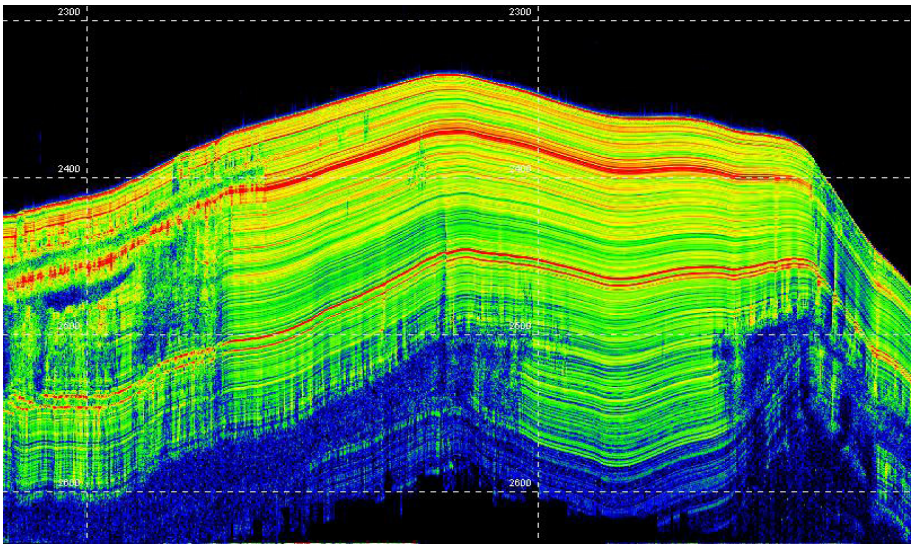
KONGSBERG

SBP 29

Sub-bottom profiler

Installation Manual



451253/A

Document information

- **Product**: Kongsberg SBP 29
- **Document**: Installation Manual
- **Document part number**: 451253
- **Revision**: A
- **Date of issue**: 26 November 2019

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Warning

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

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

Disclaimer

Kongsberg Maritime AS endeavours to ensure that all information in this document is correct and fairly stated, but does not accept liability for any errors or omissions.

Support information

If you require maintenance or repair, contact Kongsberg Maritime's support organisation. You can also contact us using the following address: km.hydrographic.support@kongsberg.com. If you need information about our other products, visit https://www.kongsberg.com/maritime.

Table of contents

About this manual

The purpose of this manual is to present the descriptions and drawings required to install the SBP 29 Sub-bottom profiler.

Target audience

The manual is intended for technical personnel; such as skilled shipyard workers, electricians, qualified engineers and naval architects. It is assumed that you understand the general principles of maritime electronic equipment. You must also be familiar with computer hardware, interface technology and installation of electronic and mechanical products.

We assume that you are familiar with the basic acoustic principles of sound in water. We also expect that you have some experience with multibeam and/or single beam echo sounders in hydrographic applications..

Online information

For information about the SBP 29 and other products from Kongsberg Maritime, visit our website.

- https://www.kongsberg.com/maritime/

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Kongsberg SBP 29

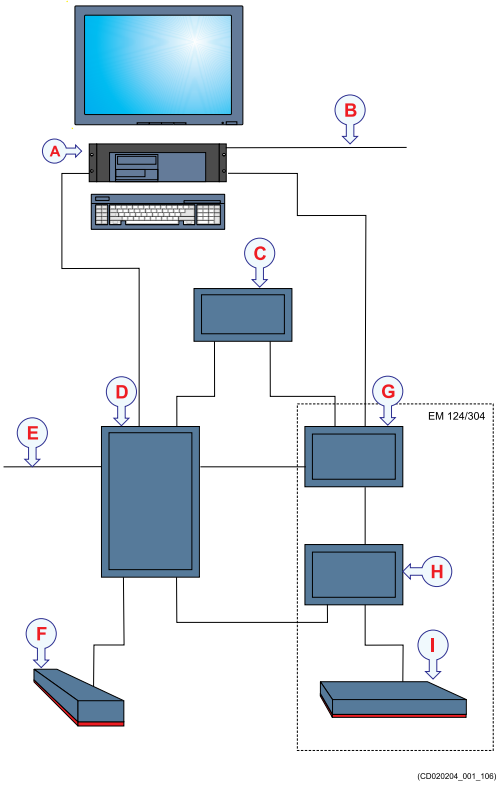
Topics

System overview

The SBP 29 Sub-bottom profiler is an optional extension to the EM 124 or EM 304 Multibeam echo sounder. The system diagram identifies the main components of a basic SBP 29 system. Only the main connections between the units are shown. Detailed interface capabilities and power cables are not shown.

The operating principle of the SBP 29 is the same as that of the EM 124 or EM 304 Multibeam echo sounder. However, the operating frequency is lower in order to penetrate the sea bottom.

The acoustic transmissions are made using a dedicated transducer array. Reception of the echoes are made using the same wideband transducer array as the EM 124 or EM 304. By adding the necessary hardware units the EM 124 or EM 304 can be extended to include the sub-bottom profiling capability provided by the SBP 29.



A Hydrographic Work Station

B From Hydrographic Work Station to local area network (LAN)

C Remote Control Unit

D SBP 29 Transceiver Unit

E From SBP 29 to external device(s)

F SBP 29 transmit transducer array

G EM 124 or EM 304 Processor Unit

H EM 124 or EM 304 RX Unit

I EM receive transducer array

System units

Topics

Transducer arrays

The acoustic transmissions are made using a dedicated transducer array. The physical length of the transmit transducer array depends on the beamwidth you have chosen for your system. Reception of the echoes are made using the same wideband transducer array as the EM 124 or EM 304.

The width of the transmit array is 80 cm. The depth is 35 cm. The physical length of the transmit transducer array depends on the beamwidth you have chosen for your system.

Beamwidth	Length
3º	7.5 m
6º	3.8 m
12º	1.9 m

The transmitter array is mounted in parallel with the vessel's keel. This is usually side by side with the EM 124 or EM 304 transmitter array. For a best performance, the SBP 29 system must use a three degrees transmitter array. However, it is normally inconvenient if the SBP 29 array is longer than the EM 124 or EM 304 array.

The lengths of the 0.5º, 1º and 2º EM 124 transmitter are 15.2, 7.8 and 4.0 meters, respectively.

The lengths of the 0.5º, 1º and 2º EM 304 transmitter are 6.0, 3.0 and 1.5 meters, respectively

The rows of the following table show what is expected to be the most common combinations of EM and SBP 29 system sizes. Since the two systems share receiver array there is a fixed relation between Rx opening angles. In the table are listed combinations of "best match" for the lengths of the EM and SBP transmitters.

Table 1 EM 124/304 and SBP 29

	EM	SBP 29
	TX x RX	TX x RX
EM 124	0.5° x 1°	3° x 3°
	1° x 1°	3° x 3°
	1° x 2°	3° x 6°
	2° x 2°	6° x 6°
	2° x 4°	6° x 12°
EM 304	0.5° x 1°	3° x 7°
	1° x 1°	6° x 7°
	1° x 2°	6° x 14°
	2° x 2°	12° x 14°

Cabinets and Hydrographic Work Station

The transmitter electronic circuitry required for the SBP 29 Sub-bottom profiler is housed in a separate cabinet. The EM Receiver Unit contains preamplifiers for the common receiver array and provides digitized receiver data for both the EM and the SBP 29 system. The operator interface and display system is implemented on a dedicated Hydrographic Work Station.

The system drawing shows the relation between EM 124/304 and SBP 29.

The Hydrographic Work Station is a work station whose shape and dimensions will depend upon the actual model delivered. It will usually consist of a rack mountable chassis, a monitor, a mouse and a keyboard. Additional peripherals may be included.

Scope of supply

Units

The SBP 29 Sub-bottom profiler delivery comprises the following items:

- Hydrographic Work Station
- Transceiver Unit
- Tx Transducer Array
- Necessary cables, cable connection units and mounting frames in accordance with chosen system size
- All system software
- System manuals covering installation, operation and maintenance

Options

System options available include:

- Ice protection window
- Non-standard cable lengths between the transducer and the transceiver unit
- Spare parts

Services

Kongsberg Maritime AS may assist with the required engineering services for installation. These services may include:

- Recommending the best location of the transducer arrays
- Installation sketches to fit the specific vessel
- Assistance during the installation
- Testing
- Training

Assistance from Kongsberg Maritime AS must be ordered separately, and are charged according to the contract.

Supply conditions

Equipment responsibility

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

Reception, unpacking and storage

For more information, see:

Equipment handling, page 133.

Project management

Project manager

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

Installation performed by Kongsberg Maritime

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

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

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

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

Installation, supervision and commissioning

Electrical and mechanical installation

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

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

Note

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

Pre-commissioning and acceptance tests

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

Installation tests

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

1 The initial start-up and dock-side testing period. This period is normally known as Setting-to-Work (STW).

2 Dock-side commissioning under operational conditions. This commissioning period is normally ended with a Harbour Acceptance Test (HAT).

3 Sea Acceptance Test (SAT) with final commissioning under operational conditions at sea.

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

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

HAT and SAT are performed according to Kongsberg Maritime test procedures.

Preparations

Topics

Tools, equipment and consumables required for SBP 29 installation

In order to do the SBP 29 installation, all necessary tools and equipment for mechanical work, cabinet installation and electrical wiring must be available.

It is not practical to provide a detailed list of all necessary tools and equipment. You must be equipped with a standard set of tools. This tool set must comprise the normal tools for electronic and electromechanical tasks. This includes different screwdriver types, pliers, spanners, a cable stripper, a soldering iron, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment.

However, you must make sure that the following specialized tools are available.

- All necessary tools and consumables required for welding
- All necessary tools and consumables required for physical installation of transducer frames and transducer modules
- All necessary tools and consumables required for electrical installations
- An articulated jack or similar arrangement capable of lifting the individual SBP 29 units
- Torque wrench

Note

If you need specific consumables, or if special tools and/or test instruments are required, these are identified in the relevant procedure(s).

Personnel qualifications

The installation of the SBP 29 is a demanding task. It is very important that the personnel involved in the installation tasks are competent and experienced craftsmen.

As a minimum, the following certified craftsmen must be available.

- Service engineer from Kongsberg Maritime
- Welders
- Electricians

Note

The quality of the welding is critical to the safety of the vessel. Welding must only be done by a certified welder.

If applicable, the final installation welds must be approved by the vessel's national registry, the corresponding maritime authority and/or classification society. Observe the relevant rules and regulations related to welding.

Sonar room requirements

Topics

Environmental requirements

The SBP 29 units must be installed in a dry and dust-free environment. The units are not fully protected against humidity, dust or water.

It is important that the sonar room is kept dry. The SBP 29 units must not be exposed to excessive temperatures, dust, moisture or humidity. Such conditions can cause corrosive attacks and subsequent failures to the electronic circuitry. Visit the sonar room at regular intervals to check temperature and humidity, and take the necessary actions if the environmental conditions are poor.

Avoid running large power cables trough the sonar room.

Observe the environmental specifications related to the SBP 29 units.

Size and access requirements

A well designed sonar room with a well fitted size and easy access reduces the risk of corrosion, and simplifies maintenance. This increases system reliability.

The sonar room must be large enough to house all the system units. The room must provide enough space to allow efficient maintenance. You must be able to keep all the cabinet doors fully open without undue restriction to your movements.

1 The room must not be used for any other heavy machinery.

2 The room must not be unnecessarily obstructed by girders, pipes etc, which may cause installation problems or impede maintenance.

3 The sonar room must be accessible under all conditions at sea or at a berth.

4 All doors or hatches must be designed so that the tools and equipment can be removed without being disassembled.

Requirements for insulation, heating and ventilation

The bulkheads in the sonar room should be insulated and provided with an interior wall to the deck. The room should be equipped with heater and connected to the vessel's ventilation system.

Heating requirements

Heating is an effective method for reducing humidity. The heater in the sonar room must be dimensioned to maintain the equipment within its environmental tolerances.

Observe the environmental specifications related to the SBP 29 units.

Ventilation requirements

The sonar room should be connected to the vessel's ventilation system to ensure a supply of cooling air. If a ventilation system is not available, install two 3” pipes from the sonar room to a suitable fresh air location on deck.

The fresh air should enter the room as close to the floor as possible, and should be extracted from as high as possible. A funnel shaped drip-collector must be mounted below the vent pipes to divert moisture to the bilge. On the main deck, the best ventilation is provided when the outlet pipe is at least four meters higher than the inlet pipe. To keep out sea water, rain and spray, the ventilation pipes must be fitted with goosenecks or an equivalent design.

Note

If the vessel is likely to operate in tropical conditions, a suitable air conditioning system must be installed. The air conditioning system must be able to provide an ambient temperature that does not exceed the maximum operating temperatures of the SBP 29 units that are installed in the room.

Requirements for electrical installations, cables and communication

The electrical installations in the sonar room must meet minimum requirements to provide suitable lights and supply power.

Light requirements

The sonar room must be equipped with suitable lighting to simplify the installation and to aid future maintenance.

Communication requirements

The sonar room should be equipped with a telephone, an intercom system, or any other means of oral communication between the sonar room and the bridge and/or control room(s).

Power requirements

Each unit in the sonar room should be provided with a separate circuit breaker on the mains supply.

Proper vessel ground must be provided.

A minimum number of additional electrical outlets must be provided for other equipment.

Cabling requirements

The sonar room units are connected to other SBP 29 units located in different compartments on the vessel. The units may also be connected to peripheral devices. If these cables pass through hatches or areas where they may be damaged, they must be run in conduits. Minimum 2” conduit is recommended.

Make sure that all system cables are properly connected and secured, and installed with some slack. The slack is essential to withstand vibrations, and to facilitate future maintenance and replacements.

Where to install the SBP 29

Topics

Introduction to SBP 29 location

A single answer to the question "where to install the SBP 29" cannot be given.

The physical location of the SBP 29 depends on the vessel's design and construction, how the hull is shaped, and how the water runs along the hull. There are however a number of important guidelines, and some of these are even conflicting.

Note

The information here must be considered as general advice. Each SBP 29 installation must be handled separately depending on the hull design and the other electrical and mechanical systems installed on the vessel.

Mount the SBP 29 deep

In order to achieve the best possible SBP 29 performance, mount the SBP 29 as deep as possible under the vessel’s hull.

There are several reasons for this recommendation.

Flow noise

Consider the situations when the vessel is unloaded, and pitching in heavy seas. The vessel is riding high, and the bow may even be lifted out of the water. This will cause a lot of air to follow the shape of the hull.

The upper water layers of the sea contain a myriad of small air bubbles created by the breaking waves. In heavy seas the upper 5 to 10 metres may be filled with air, and the highest concentrations will be near the surface. Air bubbles absorb and reflect the sound energy, and they may in worst cases block the sound transmission altogether.

Cavitation

Cavitation is the formation of small air bubbles close to the SBP 29 face. The bubbles appear because the local pressure becomes negative during parts of the acoustic pressure cycles. The cavitation threshold increases with the hydrostatic pressure. The noise is made when the bubbles implode.

Transmitting in air

The SBP 29 must never be lifted free of the water surface. If the SBP 29 is activated when out of the water it may be damaged beyond repair. Mounting the SBP 29 at a deep position on the hull will in normally prevent this.

Slamming

Slamming happens if the vessel hull climbs out of the water in heavy seas. The force of the water when the hull falls down may push the SBP 29 up, and may cause damage both to the SBP 29 and to its mounting. This is especially important for low frequency SBP 29 with large faces. The effect of slamming can be reduced by mounting the SBP 29 as deep as possible on the hull.

Note

Kongsberg Maritime AS takes no responsibility for any damages to the SBP 29, the cable or the mounting arrangement, caused by slamming.

Avoid protruding objects near the SBP 29

Objects protruding from the hull will generate turbulence and flow noise. This will reduce the SBP 29 performance.

Protruding objects may be zinc anodes, transducers or even the vessel's keel. Holes and pipe outlets are also important noise sources, as well as rough surfaces caused by bad welding. Even traces of sealing compound, sharp edges, bolts or empty bolt holes will create noise. All these protruding objects may act as resonant cavities amplifying the flow noise at certain frequencies.

Do not place a SBP 29 in the vicinity of protruding objects, and especially not close behind them. Make sure that the surface of the SBP 29 face, the hull plating and putty around the SBP 29 is as even and smooth as possible. Mounting screws or bolts must not be extruding from the SBP 29, the installation hardware or the hull plating. If necessary, grind and polish all surfaces.

Keep the SBP 29 far away from the propellers

The propulsion propellers is the dominant noise source on most vessels. The noise is easily transmitted through the water. This noise may often reduce the overall performance of your SBP 29.

The SBP 29 must be installed as far away from the propellers as possible. The best positions are therefore on the fore part of the hull. Positions outside the direct line of sight from the propellers are best.

On small vessels we recommend mounting the SBP 29 on that side of the keel where the propeller blades move *upwards*. This is because the propeller cavitation is weakest on that side. The cavitation starts when the water flows in the same direction as the propeller blades. This is where the propeller blades move downwards.

Mount the transducer at a safe distance from bow thruster(s)

Bow thruster propellers are extremely noisy. When you decide where to place the SBP 29, you must consider the noise created by most bow thrusters.

When in operation, the noise and cavitation bubbles created by the thruster may make your SBP 29 Sub-bottom profiler useless, almost no matter where the SBP 29 is installed. When the bow thrusters are *not* in operation, the tunnel creates turbulence. If your vessel is pitching, the tunnel may be filled with air or aerated water in the upper position and release this in the lower position.

In general, the SBP 29 should therefore be placed well away from the bow thruster(s).

However, this is not an invariable rule. Certain thruster designs - combined with their physical locations on the hull - may still offer a suitable location for the SBP 29, even close to the thruster. If you are in doubt, consult a naval architect.

Summary and general recommendations

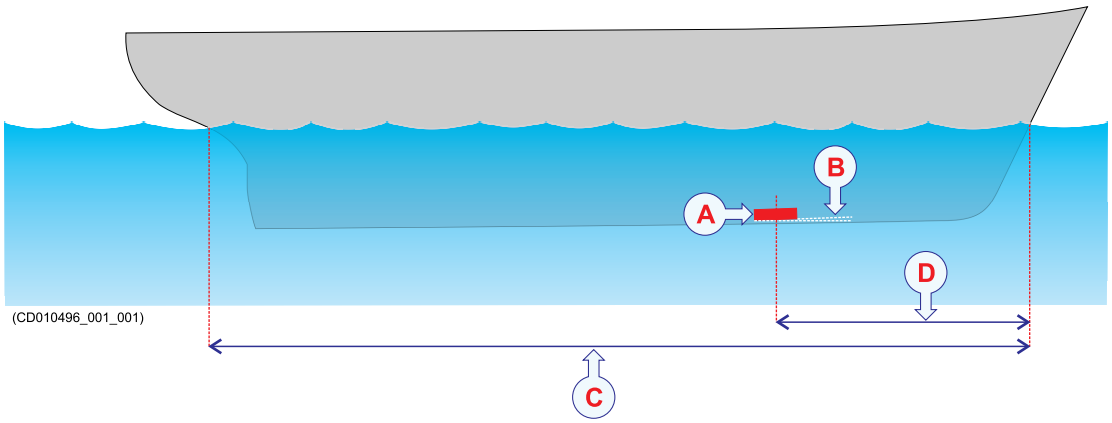
Some of the installation guidelines provided for SBP 29 location may be conflicting. For this reason, each vessel must be treated individually in order to find the best compromise.

In general, the most important factor is to avoid air bubbles in front of the SBP 29 face. For this reason, the recommended SBP 29 location is normally in the fore part of the hull, well ahead of the noise created by the bow wave.

The maximum distance from the bow is normally equal to one third of the total water line length of the hull.

Note

Mounting the transducer more than 10–15 meters from the bow may cause problems with the turbulent flow.



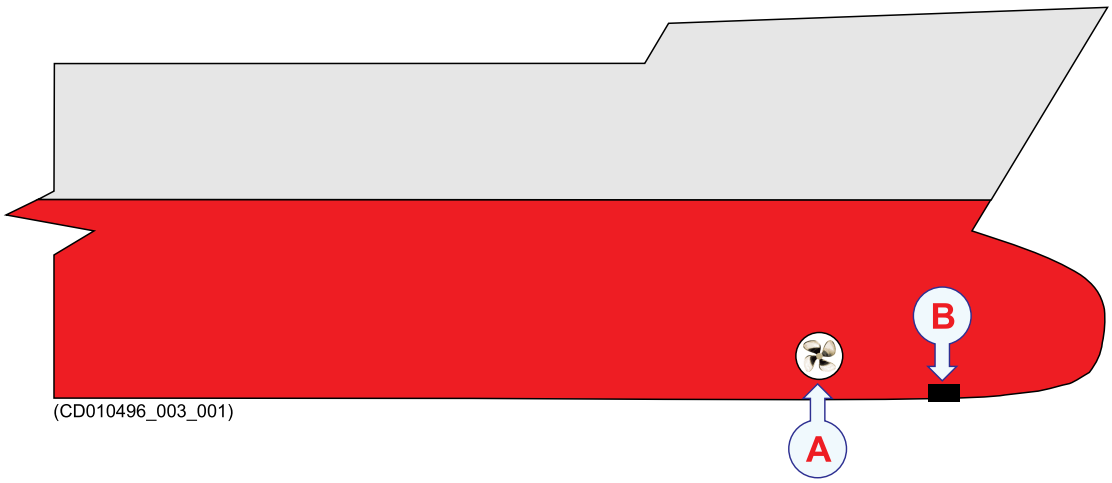
A *Transducer*

B *Inclination angle*

C *Hull length at water line*

D *Maximum 1/3 of the hull length at water line (C)*

If the vessel hull has a bulbous bow, this may well be a good SBP 29 location, but also in this case the flow pattern of the aerated water must be taken into consideration. The foremost part of the bulb is often a good location.



A *Thruster*

B *Transducer location*

This applies to the vessel in normal trim and speed.

Important

The SBP 29 must not have a negative inclination angle compared to water flow.

Do not place a SBP 29 in the vicinity of protruding objects, and especially not close behind them.

Make sure that the surface of the resulting installation is as smooth and streamlined as possible.

Acoustic and electric noise

To achieve SBP 29 data of the best quality, it important that the noise levels are as low as possible. Noise will limit the systems capability to achieve high penetration, so it is important to address the noise challenge during planning of the SBP 29 installation.

Topics

Contributing factors

Several factors are contributing to the performance of the hydroacoustic equipment used on board a vessel.

Factors contributing to the performance of the hydroacoustic equipment used on board a vessel are:

- The quality and properties of the transmitted signal
- The quality of the receiving system
- The operational settings made during operation
- The properties of the target(s)
- The signal-to-noise ratio

The majority of these factors can neither be controlled nor improved by means of installation methods or SBP 29 locations. The quality and properties of the transmitting and receiving systems are key factors during our product development, while our end user documentation aims to help the user to make the right filter settings during operation. As for the target properties, there is nothing any of us can do with those.

The *signal-to-noise ratio*, however, can be improved by making the correct choices during installation.

> Signal-to-noise ratio (often abbreviated SNR or S/N) is a measure used in science and engineering that compares the level of a desired signal to the level of background noise. It is defined as the ratio of signal power to the noise power, often expressed in decibels. A ratio higher than 1:1 (greater than 0 dB) indicates more signal than noise. While SNR is commonly quoted for electrical signals, it can be applied to any form of signal [...].
>
> *Wikipedia, Copied September 2013*

The *signal* is the echo that we want to know something about, while the *noise* is any unwanted signals or disturbances. The echo must be detected in the noise and therefore it is necessary to keep the noise level as low as possible in order to obtain high interpretation.

The noise that contributes to the signal to noise ratio may be divided into the following types of noise:

- Self noise
- Ambient noise
- Electrical noise
- Reverberation

A The SBP 29 can pick up noise from

- Biological disturbances
- Interference
- Cavitation
- Propeller noise
- Flow noise
- Acoustic noise from other hydroacoustic systems

B The SBP 29 cables are long, and may pick up electric noise from generators, pumps, cooling systems and other electric or electromechanical devices.

C The preamplifiers are very sensitive, and they can easily pick up electrical noise from internal and external power supplies. The preamplifiers are also vulnerable to analogue noise created by their own electronic circuitry. Digital noise created by the converter and processing circuitry can also create problems.

D Converters transform the analogue echoes to digital format.

E Signal processing circuitry can create digital noise.

Self noise

Any vessel equipped with a hydroacoustic system (for example echo sounder or sonar) will produce more or less self noise.

There are many sources of such self noise. We will here go into some details in order to analyse the different sources of self noise on a vessel and how they may influence upon the noise level of the hydroacoustic instruments.

Machinery noise

The main contributor to machinery noise is usually the main engine on board the vessel. The contribution from auxiliary machinery may, however, be considerable, especially if it is in poor shape. The machinery noise can be transmitted to the SBP 29 as:

- Structure-borne noise through the ship structure and the SBP 29 mountings
- Water-borne noise through the hull into the water to the SBP 29

Electrical noise

Modern vessels are normally equipped with a lot of electric instruments such as hydroacoustic systems, radars, navigation systems, and communication equipment. Any electric instruments may in some cases cause electrical interference and noise. International regulations and certifications are used to control and reduce this, but even these are limited if the electrical systems are poorly installed and/or maintained.

Propeller noise

Propeller noise is often the main source of noise at higher vessel speeds. Variable pitch propellers or fast moving propellers usually make more noise than fixed propellers or slow moving propellers.

Propeller noise is usually water-borne. In some cases, however, shaft vibrations or vibrations in the hull near the propeller may be structure-borne to the SBP 29. If a propeller blade is damaged, this may increase the noise considerably.

Propeller cavitation is a severe source of noise. "Singing" propellers might be a source of noise, which interferes at discrete frequencies. In some cases static discharge from the rotating propeller shaft may be quite disturbing.

Cavitation

Cavitation is the formation of small air bubbles close to the SBP 29 face. The bubbles appear because the local pressure becomes negative during parts of the acoustic pressure cycles. The cavitation threshold increases with the hydrostatic pressure. The noise is made when the bubbles implode.

Cavitation noise may appear near extruding objects at higher speeds, but more often it is caused by the propellers. Propeller cavitation is a severe source of noise. The cavitation starts when the water flows in the same direction as the propeller blades. This is where the propeller blades move downwards.

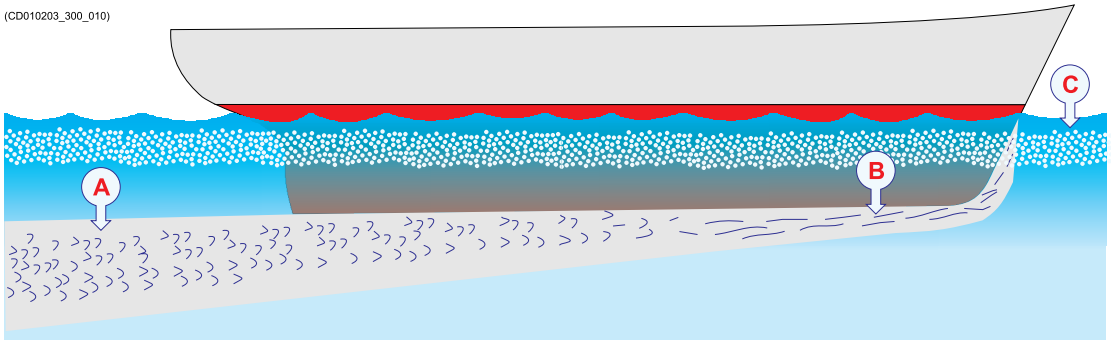
In some cases a resonant phenomenon is set up in a hole near the hull. This sound will have a discrete frequency, while all other flow noise will have a wide frequency spectrum.

(Image from U. S. Navy in the public domain.)

Flow noise

The upper water layers of the sea contain a myriad of small air bubbles created by the breaking waves. When the hull moves through water it will cause a disturbance, and this will generate friction. The friction zone is called the *flow boundary layer*. The flow in this boundary layer may be *laminar* or *turbulent*.

- The *laminar* flow is a nicely ordered, parallel movement of the water.
- The *turbulent* flow is a disorderly flow pattern, full of eddies.



A *Turbulent flow*

B *Laminar flow*

C *Air bubbles*

Air bubbles absorb and reflect the sound energy, and they may in worst cases block the sound transmission altogether.

The boundary layer increases in thickness when it becomes turbulent. The boundary layer is thin in the forward part of the vessel hull, and increases as it moves aft. The thickness depends on ships speed and on the roughness of the hull. All objects sticking out from the hull, or dents in the hull, will disturb the flow and will increase the thickness of the boundary layer. When the flow speed is high, the turbulence can be violent enough to destroy the integrity of the water. Small voids or cavities in the water will occur and this is called cavitation.

Rattle noise

Rattle noise may be caused by loose objects in the vicinity of the transducer, like fixing bolts. The rattle may also come from loose objects inside the hull.

Interference

Interference from other hydroacoustic equipment on board the same vessel may be an annoying source of disturbance. Unless the same frequency is used for more than one piece of equipment only the transmitted pulse will contribute to the interference.

> In physics, interference is the phenomenon in which two waves superpose each other to form a resultant wave of greater or lower amplitude. Interference usually refers to the interaction of waves that are correlated or coherent with each other, either because they come from the same source or because they have the same or

> nearly the same frequency. Interference effects can be observed with all types of waves, for example, light, radio, acoustic, surface water waves or matter waves.
>
> *https://en.wikipedia.org/wiki/Interference_(wave_propagation), April 2016*

Ambient noise

Ambient noise is usually not a limiting factor to the performance of sonars and echo sounders.

The ambient noise may be split up as follows:

- **Sea noise**: Air bubbles, seismic disturbances, waves, boundary turbulence, etc.
- **Biological noise**: Fish, mammals
- **Man made noise**: Other vessels, interference
- **Precipitation noise**: Heavy rain or hail

In some areas, where many vessels operate together, the engine and propeller noise from other vessels may be disturbing. Interference from hydroacoustic instruments located in other vessels may also be a limiting factor. The sea noise depends on the weather conditions. In bad weather the sea noise can be quite high due to the waves.

Electrical self noise

Electrical or electronic self noise is picked up or generated in any other part of the equipment than the SBP 29.

Hum picked up by the SBP 29 cables or picked up from the power supply is usually the most common source of electrical self noise. At higher frequencies – where rather wide bandwidths are necessary – the noise from components, transistors or other analogue electronic may be a limiting factor.

Some means to reduce acoustic noise

Several factors are contributing to the performance of the hydroacoustic equipment used on board a vessel. Careful planning of the SBP 29 installation may reduce the acoustic noise.

Unfortunately, it is impossible to simply provide a number of specific procedures to reduce the noise.

An important factor is the physical location of the SBP 29. This depends on the vessel's design and construction, how the hull is shaped, and how the water runs along the hull. Other factors deal with other equipment mounted on board, and this will also be vessel dependant. At moderate ship speeds the machinery noise is usually dominant. At medium speeds the flow noise increases more rapidly and takes over, while at higher speed the propeller noise will be the main contributor.

Note

The information here must be considered as general advice. Each SBP 29 installation must be handled separately depending on the hull design and the other electrical and mechanical systems installed on the vessel.

Reducing flow noise

- The shape of the SBP 29 (or dome around it) must be as streamlined as possible.
- The hull plating in front of the SBP 29 must be as smooth as possible.

  Important

  Be especially aware of bilge keels and zinc alloy anodes. The keel must be rounded off without sharp edges. Neither extruding objects nor abrupt transitions must be present.

Reducing machinery noise

- The main engine and relevant auxiliary engines and equipment must be fixed to rigid foundations to avoid vibrations.
- Any hull structure that may vibrate should be damped or coated to reduce the vibrations.

The use of shock absorbers or floating rafts may sometimes reduce this noise. The structure-borne noise may be reduced by isolation, for example by providing vibration clamping between the SBP 29 and the hull structure.

Reducing propeller noise

- Sufficient clearance between the propellers and the hull, the rudder and the keel must be provided.
- Place the zinc alloy anodes in places where the water flow is the least disturbed.
- Ensure that the propellers blades are correctly designed and without damages.
- The use of a baffle between the propellers and the SBP 29 may reduce noise appreciably.
- Static discharges caused by the rotating propeller shaft may be removed by proper grounding or by mounting a coal brush from the shaft to vessel ground.

Reducing rattle noise

Ensure that no parts near the SBP 29 can rattle as a result of water flow or vibrations.

Reducing interference

Interference from the transmission pulses from other hydroacoustic instruments on board the vessel is difficult to avoid. The problem may be reduced by choosing the working frequencies carefully and to some extent by separating the different transducers. On vessels with a large number of separate hydroacoustic systems installed and in

simultaneous use, a separate synchronizing system (for example the K-Sync) should be considered.

Reducing electrical noise

- Make sure that all units are properly grounded, as this is important to avoid electrical noise.
- Use shielded cables with correct grounding.
- Separate SBP 29 cables from other cables with high voltages, large currents or transients.
- Place all high voltage power cables in metal conduits.

Installing the SBP 29 Transducer array

This chapter provides a number of examples for transducer array installation. Installation procedures are also defined.

Topics

Installation principles

Basic description

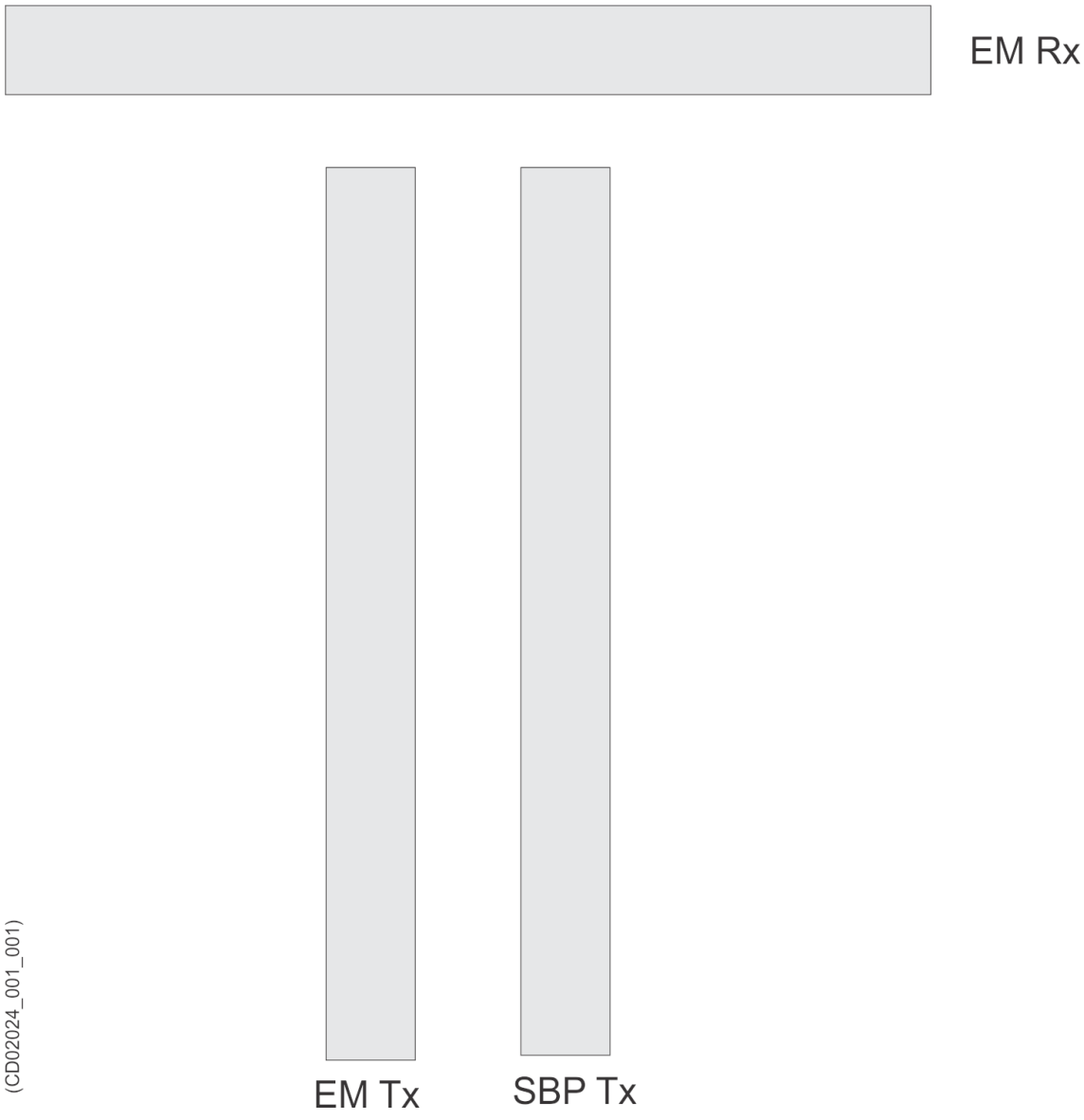
The SBP 29 has a dedicated transducer array for transmitting sound pulses. The array consists of separate transducer elements assembled in a mounting frame. This frame is normally fixed in a customized blister on the hull underneath the vessel.

The SBP 29 Tx array should normally be mounted in flush and in parallel with the EM 124 or EM 304 Tx array. Both arrays are normally mounted in parallel with the keel.

Refer to below figure showing how the arrays are mounted in relation to each other.

The number of individual Tx elements in the array depends on the chosen SBP 29 configuration.

Figure 1 EM 124 or EM 304 arrays mounted in relation to SBP 29



Installation philosophy

The SBP 29 is an optional Sub bottom profiler that can be delivered with the EM 124 or EM 304.

Note

Refer to the EM 124 or EM 304 Installation manual for more information about the multibeam echo sounder.

The transducer array must be located and installed depending on the vessel's design. A number of different factors related to the vessel's design must be taken into consideration during the installation planning.

The basic installation methods are:

- Blister
- Flush-mounted integrated into the hull
- Externally mounted with fairing(s)
- Any combination of the above

For more information, see:

Dimensional surveying and alignment, page 88.

The installation of the transducer array must thus be planned together with the installation shipyard and/or the client.

Once the installation method is defined, the installation shipyard must provide the necessary drawings. These drawings must be approved by the vessel's classification authority.

If required, Kongsberg Maritime AS can assist in the required engineering.

Installation parameters

After completing the installation, you must enter the Installation parameters into the system software. The installation parameters specifies the relative location and orientation of the sensors used to obtain the seabed image. The installation parameters must be entered prior to setting the SBP 29 into operational use.

The installation parameters are listed in the tables below. We recommend that you complete these tables for documentation of your settings.

Note

Refer to the SBP 29 Operator manual for more information about the SBP 29 user interface

Accuracy requirements for the installation is given in Ships reference point, page 88.

Table 2 Tx array SBP 29 installation parameter

Tx array SBP 29	
Position (x) [m]	
Position (y) [m]	
Position (z) [m]	
Pitch offset [deg]	
Roll offset [deg]	
Heading offset [deg]	

Table 3 Rx array EM installation parameter

Rx array EM	
Position (x) [m]	
Position (y) [m]	
Position (z) [m]	
Pitch offset [deg]	
Roll offset [deg]	
Heading offset [deg]	

Table 4 Motion sensor installation parameter

Motion sensor	
Position (x) [m]	
Position (y) [m]	
Position (z) [m]	
Pitch offset [deg]	
Roll offset [deg]	
Heading offset [deg]	

Table 5 Water line

Water line	
Position (x) [m]	

Installation steps

The following steps must be taken to install the SBP 29 transducer arrays:

1 Determine the physical location of the transducer arrays under the vessel's hull.

For more information, see:

Where to install the SBP 29, page 21

2 Design the transducer installation method.

- Several methods may be used: gondola, blister, flush mounting, external mounting with fairing(s), or any combination of these.

  The method must be chosen according to the vessel's hull design.

- On a new vessel, the transducer arrays may be incorporated into the hull for flush mounting. On older vessels, a transducer blister is usually designed to be mounted under the hull. A gondola can also be designed.

3 Prepare the transducer array installation arrangement.

- The installation arrangement must be capable of fitting the two EM transducer frames in addition to the one needed for the SBP 29 transmitter array.

4 Mount the SBP 29 mounting frame.

5 Mount the transducer elements into the frame.

For signal transmission test purpose, we suggest that you mount all elements but one. The last element can then be used as a test transducer to induce the required test signal.

For more information, see:

Signal transmission check - ringing, page 108.

Note

Remember to mount the last element when signal testing is completed.

6 Fill in the installation parameters tables in Installation parameters, page 35.

7 Pull the cables up through the steel conduits.

Manufacturing and installing the casings

The transducer mounting frames needs to be mounted into a solid base construction also called casing. The casings can be integrated in different kind of installation types like a gondola, blister or flush in the hull.

Prerequisites

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for mechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment. Depending on the tasks at hand, additional tools may be required.

Observe the relevant rules and regulations related to welding. The quality of the welding is critical to the safety of the vessel. Welding must only be done by a certified welder. The final installation welds must be approved by the vessel's national registry, the corresponding maritime authority and/or classification society.

Before you can do this task, the following prerequisites must be met:

- All relevant vessel and SBP 29 drawings must be available.
- All relevant drawings have been approved by the classification society.
- All relevant work instructions, procedures and standards must be available.
- The installation principle has been determined.
- The physical location of the SBP 29 has been determined.
- The installation angles of the SBP 29 have been defined.
- All relevant personnel (naval architects, designers) and tools must be available.

Context

The casings must be individually designed for each vessel, and it is not a part of the system delivery.

The casings must be provided (or manufactured) and installed by the installation shipyard. It is the shipyard's responsibility to get the installation approved by the classification society.

The installation must be carried out according to arrangement drawings designed for the specific vessel. Refer to the drawings included in the *Drawing File*, and the applicable drawings prepared by the installation shipyard.

Note

Follow the general safety procedures. These units are heavy.

Procedure

1 Manufacture the casings according the production drawings.

Alter the drawings and the design as required to fit the vessel and the chosen installation principle.

2 Install the casings under the hull in either the blister, the gondola or into the hull.

Designing, manufacturing and mounting the steel conduits

Steel conduits are used to protect the SBP 29 cables. They should be filled with water up to the waterline.

Prerequisites

You must be equipped with a standard set of tools. This tool set must comprise the normal tools for mechanical tasks. This includes different screwdriver types, pliers, adjustable spanners, etc. Each tool must be provided in various sizes. We recommend that all tools are demagnetized to protect your equipment. The following specific tools and items are required for this task:

- All relevant vessel and SBP 29 drawings must be available.
- All relevant work instructions, procedures and standards must be available.
- All relevant drawings have been approved by the classification society.
- The physical location of the SBP 29 has been determined.
- The installation method has been determined.
- The installation angles of the SBP 29 have been defined.
- All relevant personnel (naval architects, designers, skilled shipyard workers) and tools must be available.

Observe the relevant rules and regulations related to welding. The quality of the welding is critical to the safety of the vessel. Welding must only be done by a certified welder. The final installation welds must be approved by the vessel's national registry, the corresponding maritime authority and/or classification society.

Context

The transducer cables connect through the vessel's hull using steel conduits. The conduits are welded to the hull. The top of each conduit must be closed and sealed to preserve the watertightness. This can be done with a "Bratberger", "Roxtec" or a similar sort of sealing device.

The installation of the conduits must be properly planned. All plans and drawings must be approved by the classification authority. This is always the yard's responsibility.

The steel conduit must be designed to fit each individual ship. The quality of the materials used to manufacture the conduit, as well as the quality of the workmanship must be defined by the vessel owner and the installation shipyard.

The conduits are not included with the system delivery. They must therefore be both provided (or manufactured) and installed by the installation shipyard.

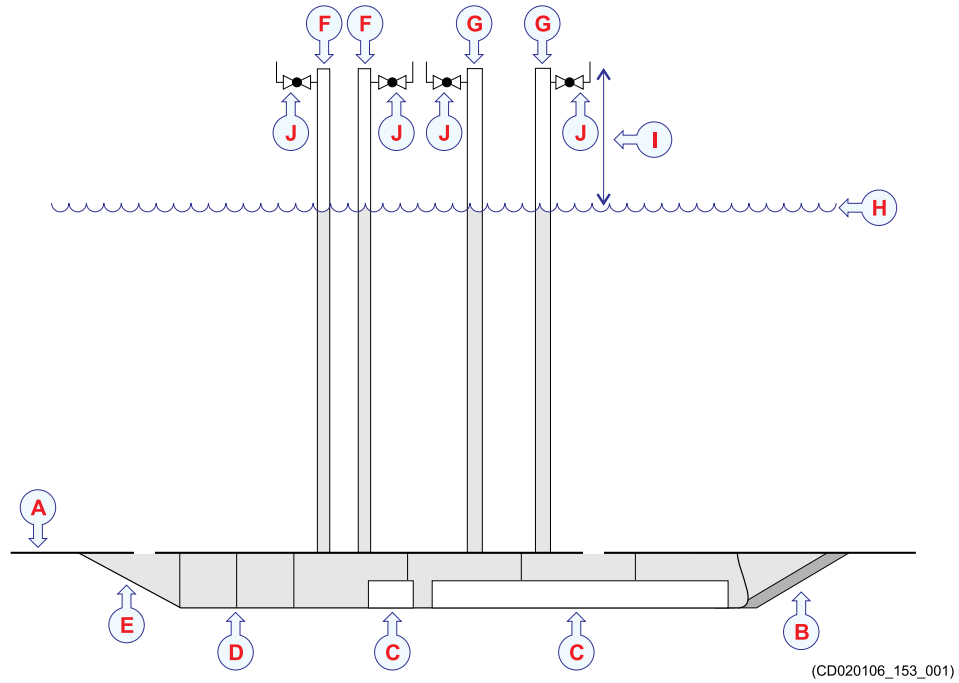
Note

Make sure that there are no spatter, sharp edges or protruding objects that can damage the SBP 29 cables.

All necessary precautions must be made to avoid damage to the cables while pulling them through the steel conduit. If water leaks into the cable, the SBP 29 module must be replaced.

The conduits should have a diameter of 6 inches (168 mm) or 8 inches (219 mm).

The number of conduits depends on the chosen system configuration and the internal diameter of the conduits.



A *Vessel's hull*

B *Ice and debris knife*

C *Casings for the transducer arrays frames and modules*

D *Support brackets inside the casing must not block for the transducer cables*

E *Water filled blister. With air outlet towards the hull*

F *One or more water filled steel conduit for the RX Transducer array*

G *One or more water filled steel conduit for the TX Transducer array*

H *Waterline*

I *Minimum 2 m above waterline. This must be verified by the classification society*

J *Separate air outlet pipes with ball valve, to above deck*

Procedure

1 Design the steel conduits with appropriate length and diameter to fit the transducer cables.

2 Manufacture the steel conduit according to the relevant production standards.

3 Mount the steel conduits from the casings and up towards the sonar room where the transmitter and receiver units are located.

The steel conduits are laid as required by the vessel structure and the location of the blister and sonar room. The conduits may be bent if required, but not more than 30 degrees. If a bend beyond 30 degrees is required a higher conduit diameter may be required. Please consult Kongsberg Maritime if this is the case.

The upper opening of the steel conduits should be minimum 2 metres above the vessel's waterline as specified by the classification society. If the openings of these conduits are under the water level, then special acceptances are needed from the classification society.

4 Mount an air outlet on top of each conduit.

Each conduit should have an air outlet on top. This can be performed by a small ball valve and a 1 " pipe routed above the deck.

5 Close the top of the steel conduits with a cable sealing system.

Kongsberg Maritime recommends the use of sealing from Roxtec, Brattberg or similar.

6 If relevant, allow the maritime authority and/or classification society to inspect and approve the design and the installation of the steel conduit.

Installing the TX mounting frames

The mounting frame have been designed to offer a reliable and maintenance friendly installation method for the SBP 29

Prerequisites

The casings should be manufactured with threaded holes for mounting of the frames. If not, access from rear side will be required.

Note

Engineers from Kongsberg Maritime must be present to install the transducer mounting frames.

- The casings have been installed and machined according to the requirements.
- All relevant vessel and SBP 29 drawings must be available.
- All relevant work instructions, procedures and standards must be available.
- All relevant personnel (skilled shipyard workers) and their tools must be available.

The following specific tools and items are required for this task:

- Torque wrench
- Loctite 242 (removable medium strength threadlocker)

- Lifting device
- Rope
- Tackles

Context

Mounting frames are designed to house the individual transducer modules. While the transducer modules are mounted into the frames, the frames require casings.

The installation must be carried out according to arrangement drawings designed for the specific vessel. Refer to the drawings included in the Drawing File, and the applicable drawings prepared by the installation shipyard.

Note

The mounting frames must be handled with care. Please observe normal safety precautions for dockyard work and welding.

Procedure

1 Mount the CCU (Cable Connection Unit) to the frame before the frame is installed. The CCU(s) should be mounted on the side of the mounting frame.

2 Mount the frame in the casings.

The mounting frames must be bolted onto the flat bars inside the casing. The number of flat bars depends on the length of the transducer array. There are three (3) holes in each flat bar.

The frames are fastened by M16 bolts. Bolts of grade A4-80 should be used.

Use a torque of 187 Nm.

3 Check that the each frame is mounted completely flat.

Important

No point on the frame may deviate from the ideal plane with more than 0.6 mm.

The maximum allowed gradient between two adjacent mounting points on the frame is 0.1 % (1 mm/m).

This can be checked by measuring the relative vertical positions of the module mounting bars on the frames. If the deviations are too large, this has to be corrected by applying shims.

When the frame is installed completely flat:

4 Remove one bolt.

5 Apply Loctite 242 to the bolt.

6 Install the bolt using a torque of 187 Nm.

7 Repeat steps 4- 6 for all the bolts.

Transducer elements

The transducer elements are identified by their unique serial numbers, which are found at the rear of the elements.

The transducer elements are assembled in the mounting frame especially designed for this purpose.

Logistics and references

Safety - Refer to the general safety procedures. Note that the individual units are heavy !

Personnel - Installation engineers from Kongsberg Maritime

Ship location - Dry dock

Special tools - Battery drill (recommended)

References - None

Note

Note that engineers from Kongsberg Maritime must be present to install the transducer elements.

Procedure

Observe normal safety precautions for dockyard work.

Caution

The transducer elements and the cables must be handled with care!

Caution

DO NOT LIFT THE ELEMENTS BY THE CABLE!

Caution

The TX elements must be installed in the positions as instructed by Kongsberg Maritime. Failure to do so may harm the transmit electronics and cause a malfunctioning system.

How to install the TX transducer elements

Note

When installing Tx transducer elements, fill in the "Location of Tx elements forms".

For more information, see:

1 Remove the baffle from the bottom part of the frame.

2 Hold the transducer close to the installation area.

3 Connect the cable from the CCU to the transducer cable.

4 Push the transducer in position.

5 Mount the transducer with four mounting bolts. Use a torque of 21 Nm and secure with Loctite 243.

   See installation drawings, .

6 When all transducers are mounted, mount the baffle. The baffle must be glued and bolted.

7 Apply one layer of antifouling to the baffle and the transducer face.

Cable Connection Unit (CCU)

The CCU connects 24 transducer elements to the Transceiver Unit. It has 24 cables, four meters each, with underwater plugs. Each cable is individually numbered and goes to it's dedicated transducer. Two long cables, 25 meters each, are used to connect the CCU to the Transceiver Unit.

Topics

Logistics and references

Safety -Refer to the general safety procedures.

Qualifications -Mechanical workers.

Ship location - Dry dock.

Special tools - None

References - None

Procedure

Safety -Refer to the general safety procedures.

Qualifications -Mechanical workers.

Ship location - Dry dock.

Special tools - None

References - None

Installing the SBP 29 topside units

This section describes the installation of the SBP 29 Transceiver Unit in the equipment or operation room, and the Hydrographic Work Station in the operation room.

Drawings showing the system and the physical dimensions are included in the text.

Note

Kongsberg Maritime strongly recommends that an Uninterruptible Power Supply (UPS) is used to power the Hydrographic Work Station.

Note

The guidelines for installation presented here must be regarded as a base for detailed vessel specific plans prepared by the installation shipyard. These plans should include drawings, instructions and procedures specific to the ship in which the equipment is to be installed. If necessary, these drawings must be approved by the relevant maritime classification society.

Topics

Transceiver unit

This chapter presents the general installation procedures for the SBP 29 Transceiver Unit.

Mains power

This section presents the requirements for mainspower to the SBP 29 transceiver unit.

The SBP 29 transceiver is designed for 3-phase input power, even though none of the components in the transceiver are using 3-phase: the 3-phase input power is simply a means to distribute the load on the electrical power system more evenly. It is the peak load when the SBP is pinging that constitute the main challenge to the electrical power distribution system. The high voltage power for the SBPs is modular, and we take advantage of this by distributing the modules (High Voltage Power Units, HVPUs) over the three phases. The number of HVPUs are 4, 2, and 1, for the 3, 6, and 12 degree systems, respectively. Since the number of HVPUs in a system is not a multiple of three, this means load sharing is not even between the three phases. As can be seen from the peak line currents listed below, 3-phase Y (Wye) 400 VAC offers the best load sharing.

Note

For 3-phase 400 VAC the neutral is mandatory, as this is required to provide 230 VAC used internally in the SBP transceiver. Only wye, not delta, can be used with 3-phase 400 VAC.

Because the smallest system (12 degree TX) has a single high voltage power unit there is very little to gain from load sharing in this case. To simplify installation of this smallest system single-phase power input is available for this model.

Mains power alternatives:	**Available for:**
3-phase wye (Y) 400 VAC	SBP 29 system
3-phase delta (Δ) 230 VAC	SBP 29 system
1-phase 230 VAC	SBP 29 with a 12 degree TX

The table below lists the peak power and the peak line currents required by the transceiver when pinging. Maximum duration of the peaks is 100 milliseconds limited by the maximum pulse length for the system. The average power requirement listed is calculated for pinging with maximum power and the maximum duty cycle of 10 per cent.

			Peak line currents			**Peak power**			**Max average power**		
	Voltage	Fre-que-ncy	TX 3°	TX 6°	TX 12°	TX 3°	TX 6°	TX 12°	TX 3°	TX 6°	TX 12°
	[VAC]	[Hz]	[A]			[kW]					
3-phase Y	385 – 415	50 – 60	33	16	16	14.7	7.5	4	1.9	1.1	0.7
3-phase Δ	220 – 240	50 – 60	44	28	17						
1-phase	220 – 240	50 – 60	-	-	18						

Detailed power/current distribution

For planning of the total power distribution on the vessel, the following detailed information may be useful:

Peak power for the individual phase pairs				
400 VAC Y (Wye)	**230 VAC Δ (Delta)**	**TX 3°**	**TX 6°**	**TX 12°**
L1-N	L1-L2	7.2 kW	3.6 kW	3.6 kW
L2-N	L1-L3	3.6 kW	3.6 kW	0 kW
L3-N	L2-L3	3.9 kW	0.3 kW	0.3 kW

Peak RMS line currents							
400 VAC Y (Wye)				**230 VAC Δ (Delta)**			
Line	TX 3°	TX 6°	TX 12°	Line	TX 3°	TX 6°	TX 12°
L1	33 A	16 A	16 A	L1	43 A	28 A	16 A
L2	16 A	16 A	0 A	L2	44 A	17 A	17 A
L3	18 A	1 A	1 A	L3	30 A	17 A	1 A
N	16 A	15 A	16 A				

Location

The SBP 29 Transceiver Unit is normally installed in the vessel's "sonar room" close to the EM receiver unit. This room must be dry and free from excessive dust and vibration. Maximum humidity of 80% is recommended. Good ventilation for the equipment cooling must be provided.

The cabinet must be mounted on a bulkhead or on mounting brackets welded to the bulkhead. Ensure that sufficient space is provided around the unit to allow the unit's doors to open fully.

Space must be provided to allow the power and interface cables to be installed, and to allow the cabinet to move on its shock absorbers.

General information

The Transceiver Unit cabinet is fitted with hinges to allow the front and middle parts to swing open, this gives you access to both the front and rear side of all the circuit boards. The unit is mounted on a support frame at the factory.

This frame is mounted on the bulkhead with four shock absorbers; two mounted on top of the frame and two at the bottom.

Logistics

Safety - Refer to the general safety procedures. Note that the unit is heavy

Personnel - Trained mechanical/electrical workers.

Ship location - Dry dock or at quay. The watertight integrity of the ship will not be affected

Special tools - Special wrenches, lifting equipment

References - None

Caution

The cabinet is heavy. Ensure that correct lifting equipment is available.

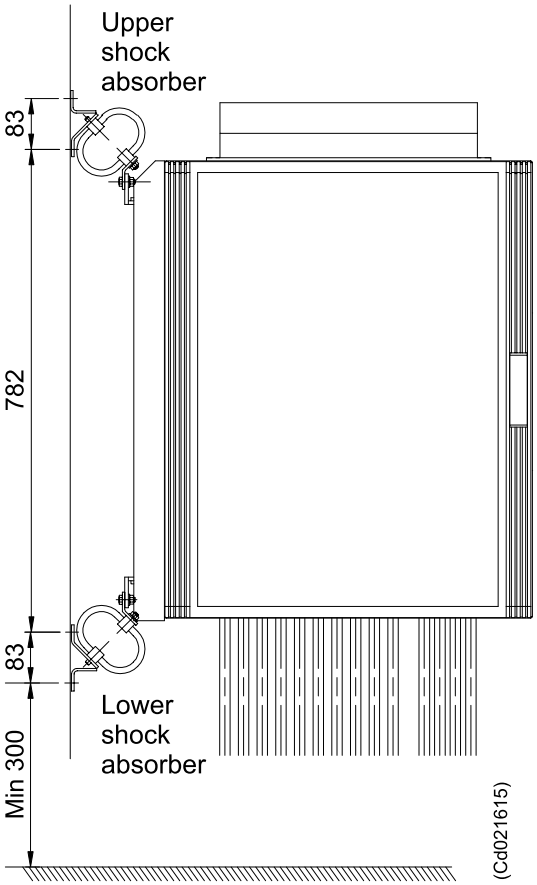
For more information, see:
Figure 24 , 430751, page 123

Procedures

Cabinet

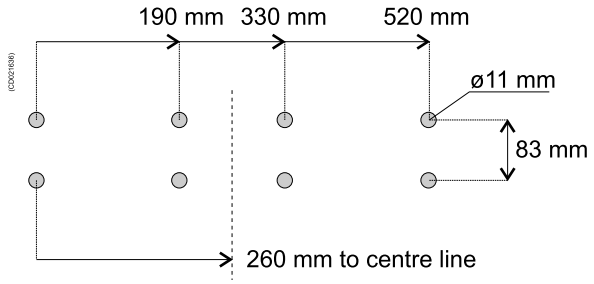
The Transceiver Unit is delivered as a complete unit with shock absorbers.

Figure 2 Wall mount transceiver unit



1 Mark the location of the holes for the upper and lower shock absorber on the bulkhead.

Figure 3 Fixing holes for one shock absorber



Shown in Figure 24 , 430751, page 123

2 Drill 11 mm holes, eight (8) for each shock absorber.

Caution

Always check on the other side of the bulkhead before drilling holes !

3 Mount the unit to the bulkhead with M10 bolts. These bolts must be supplied by the shipyard.

- As the Transceiver Unit is heavy, a lifting arrangement (articulated jack or similar) must be used.
- The foundation onto which the Transceiver Unit is mounted will determine the correct torque to be applied to the bolts. Use maximum torque 64 Nm.

4 Alternatively, the shock absorbers can be mounted to a pair of specially designed support brackets.

Shown in Figure 25 , 871–212984, page 124

Interconnection cables and interfaces

1 Prepare the support bracket to receive the transducer array cables on the lower frame Refer to Interconnection cables support bracket for the cable entries.

The cabling layout and interconnections are described in Cable layout and interconnections.

For more information, see:

Figure 27 , 448231_1A, page 126

2 Mount the cables according to the cable plan.

Make sure that the cable tables are filled in correctly.

Shown in Table 13 CCU1 cable labelling, page 70

3 Close and secure support bracket to secure the cables.

4 Secure the interface cables by strapping them to the transducer cables.

Surface preservation

All metal surfaces which are likely to corrode should be painted. This includes welds, base frames and support brackets. Make appropriate cautions to avoid spilling paint on the cabinet.

Hydrographic Work Station

This section describes the installation of the SBP 29 Hydrographic Work Station in the operation room.

Description

The SBP 29 has one Hydrographic Work Station.

Generally, this unit is a commercial work station. The Hydrographic Work Station includes display monitor, keyboard and mouse or trackball.

Location

It is recommended to place the unit in a room with environmental conditions similar to those required for extended human occupation.

The unit is usually mounted in a rack, alternatively on a desk in the operation room and suitably tied down.

Installation

No specific installation procedures exist for the unit. However, it must be installed so that it is properly physically supported and protected for shock and vibration due to sea conditions.

A dedicated installation kit is available for 19” rack installation, the order number is 371591. The kit comprises a shelf for positioning and securing the computer, and all relevant mounting materials.

Cable layout and interconnections

Topics

General requirements for cable installations

Certain general requirements apply for all cable installations.

1 Refer to the cable plans and the list of cables.

2 Detailed information about cable specifications, termination and connectors are provided in the relevant cable drawings.

3 Unless otherwise specified, all cables are supplied with the SBP 29 delivery.

4 In order to ease the access for maintenance purposes, and to allow for vibration, make sure that some slack is provided for each cable.

5 Before you start the installation of the SBP 29 cables, ensure that the mains circuit breaker for the system is switched off.

6 Observe the basic cable requirements.

Shipyard and system cables

General

Each drawing provides additional information, and may, when applicable, include minimum specifications, connector terminations and the required number of cores.

Drawings are generally not provided for standard commercial cables.

Cables fall into two categories.

1 **System cables**: These cables are provided by Kongsberg Maritime as a part of the SBP 29 delivery.

2 **Shipyard cables**: These cables must be provided by the shipyard performing the installation, or the shipowner. It is very important that the cables used meet the minimum specifications provided in this manual.

Note

It is very important that all cables are properly installed and correctly terminated. Observe the relevant regulations and work standards. Always leave enough cable slack close to system units and cabinets to allow for maintenance.

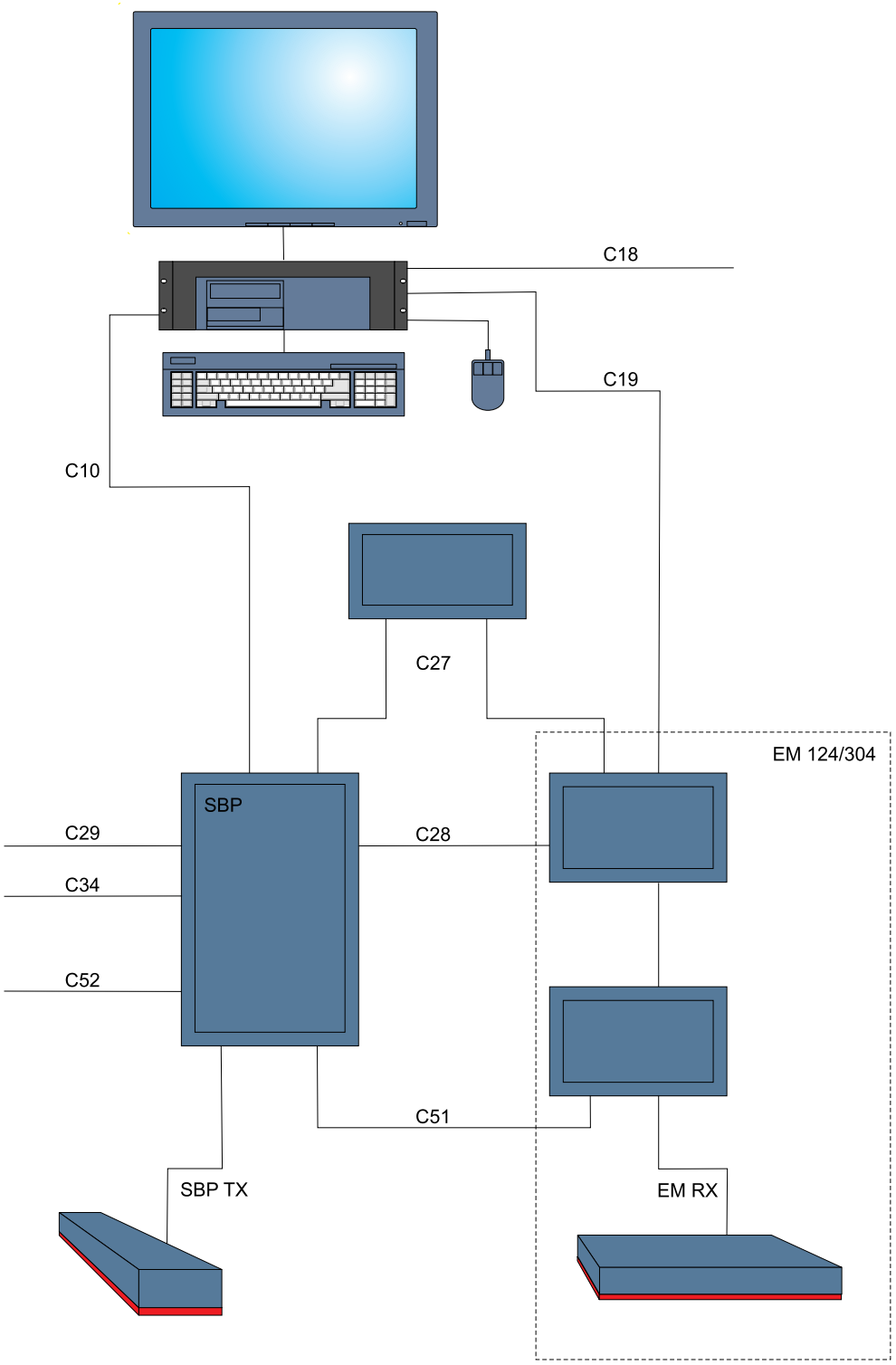
Kongsberg Maritime accepts no responsibility for damage to the system, or reduced operational performance, when this is caused by improper wiring.

Cable plans

Topics

Cable plan overview

Overview of the SBP 29 cable plan.



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List of SBP 29 cables

A set of cables is required to connect the SBP 29 units to each other, to the EM 124 or EM 304, to external devices and power source.

Cable	Type	From/To	Minimum requirements
C1	Video cable	From Hydrographic Work Station to display	
C3	Computer cable	From Hydrographic Work Station to keyboard	
C4	Computer cable	From Hydrographic Work Station to mouse (or another similar device)	
C5	AC power cable	From display to AC power outlet	
C7	AC power cable	From Hydrographic Work Station to AC power outlet	
C8	Ground cable	From Hydrographic Work Station to vessel ground	
C10	Ethernet cable	From Hydrographic Work Station to SBP 29 CPU RIO.	CAT-6A Quality or better.
C18	Ethernet cable	From Hydrographic Work Station to local area network (LAN)	CAT-6A Quality or better.
C19	Ethernet cable	From Hydrographic Work Station to EM Processing Unit.	CAT-6A Quality or better.
C27	Control cable	From HV Control RIO to remote control unit.	See Remote control, page 85
	For remote on/off.		
C28	Control cable	From SBP 29 CPU RIO to EM Processing Unit.	See EM 124 or EM 304 Synchronization, page 83
C29	Serial cable	From SBP 29 CPU RIO to Attitude sensor.	See RS-232 serial line connection using three wires, page 80 RS-422 serial line using two wires, page 81
C34	Coax cable	From SBP 29 CPU RIO to the global positioning system (GNSS)	See Clock synchronization (1PPS) using a coax cable, page 82
	For the 1PPS signal.		
C51	Fibre optic cable	From SBP 29 SISP10 RIO to EM 124 or EM 304 Rx unit.	
	For synchronization.		

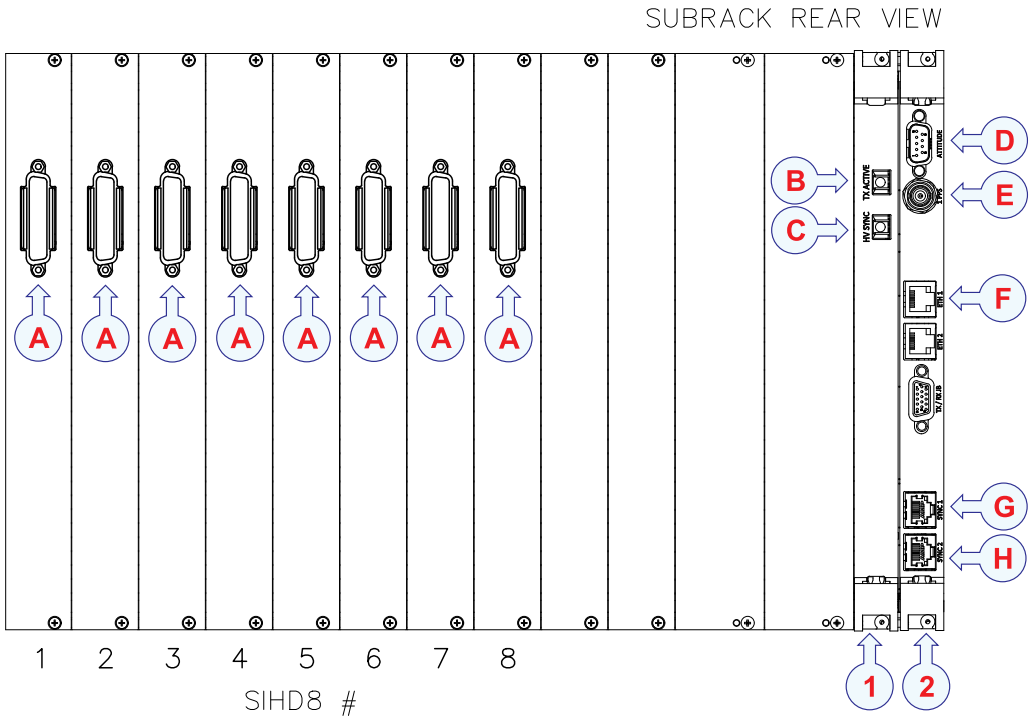
Cable	Type	From/To	Minimum requirements
C52	Control cable	From SBP 29 CPU RIO to the external synchronization unit.	See External synchronization, page 84
	For external synchronization.		
C53	Fibre optic cable	From SBP 29 SISP 10 RIO to the High Voltage Unit RIO.	

Cable plan SBP 29 Transceiver Unit

Cable plan transceiver subrack

This illustration shows the rear view of the upper subrack in the transceiver.

Figure 4 Transceiver Subrack, rear view



(CD020204_001_117)

Table 6 SISP10 RIO connection (1)

Connector	Type	To	Cable id
B	Fiber optic connector	Connected to EM RX Unit.	C51
C	Fiber optic connector	Connected to HV Control RIO.	C53

Table 7 CPU RIO3 connections (2)

Connector	Type	To	Cable id
D	9-pin D-sub	Connected to external motion sensor. Default setting is RS-232.	C29
E	BNC	Connected to external time synchronization device. (Optional)	C34
F	RJ45	Connected to Hydrographic Work Station.	C10
G	RJ45	Connected to External trigger (K-Sync).	C52
H	RJ45	Connected to EM 124 or EM 304 processing unit.	C28

Connector D (9-pin D-sub) to external motion sensor.

On the CPU RIO3 (**2**), a jumper on P5 will change the connector **D** (9-pin D-sub) from RS-232 to RS-422.

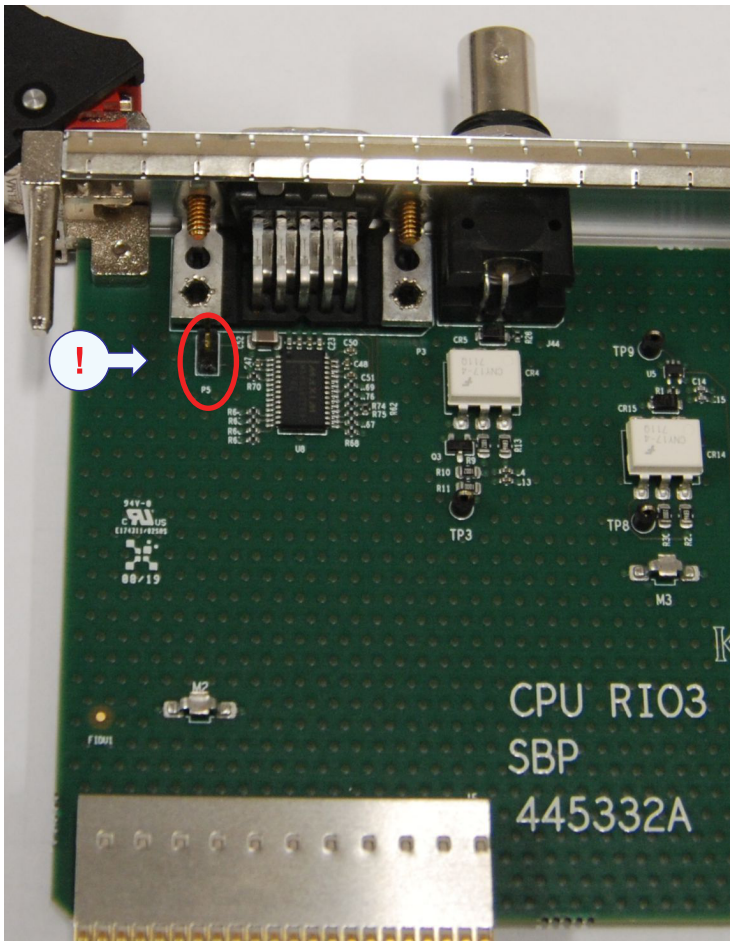
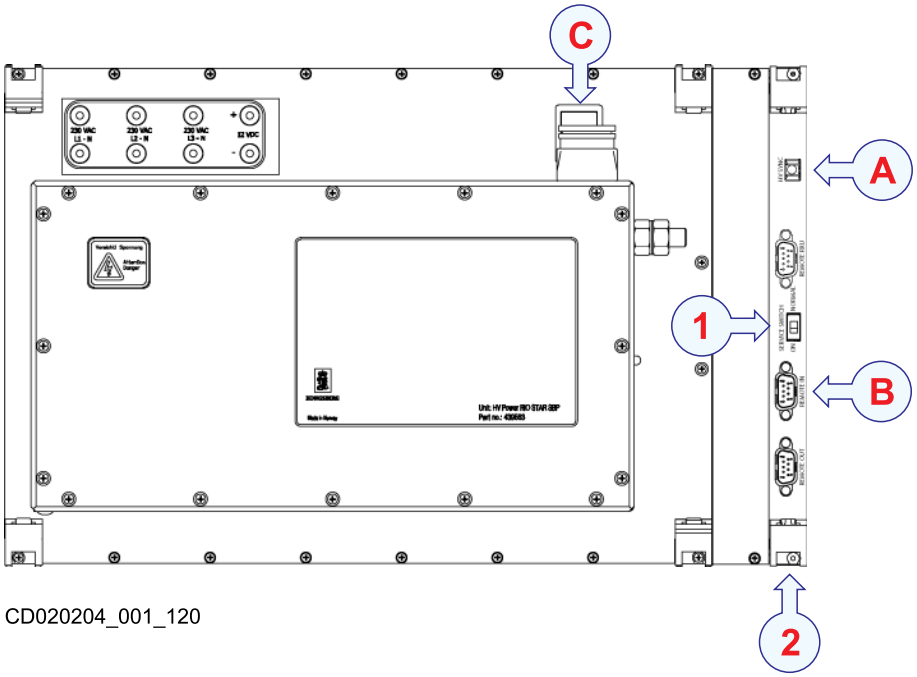


Table 8 SIHD8 RIO connections

Connector	Type	To	Cable id
A	Transducer cables	Connected to the Cable Connection Units.	

Cable plan high voltage subrack

Figure 5 High Voltage subrack, rear view



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Id	Item	
1	Service Switch Normal/On	“Normal” for remote control on/off “On” when the transceiver unit will start and stay on regardless of remote on/off signal
2	HV Control RIO	

Table 9 HV Control RIO connections

Connector id	Type	To	Cable
A	Fiber optic connector	From HV Control RIO to SISP10 RIO	C53
B	9 pin D-SUB	To Remote Control Unit.	C27

Table 10 HV Power RIO connections

Connector id	Type	To	Cable
C	Power cable	AC mains power This cable is supplied with the SBP 29 delivery.	

Note

Details of the HV Power RIO modul are dependent on type of mains power.

For circuit diagrams of the different versions, see

3-phase wye (Y) 400 VAC, see Figure 28 , 427512, page 127.

3-phase delta (Δ) 230 VAC, see Figure 29 , 435680, page 128.

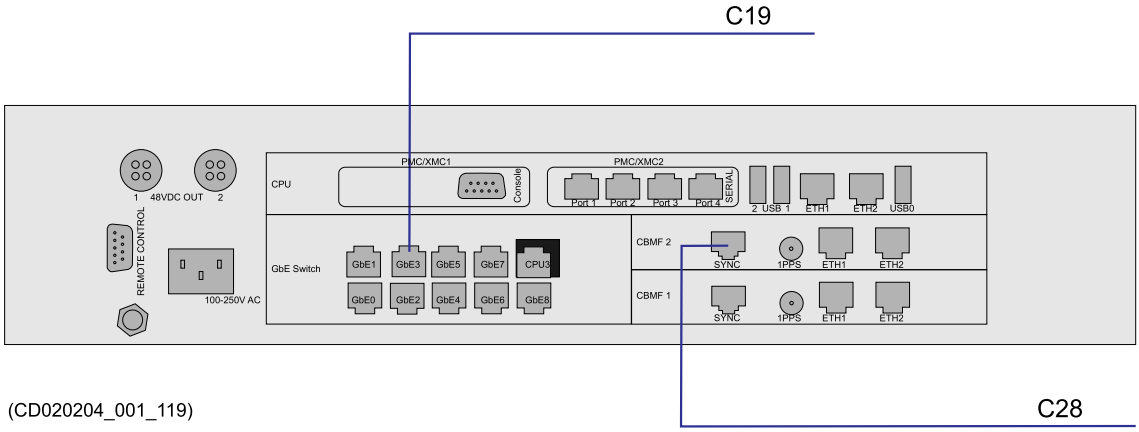
1-phase 230 VAC, see Figure 30 , 444783, page 129.

For details about the supplied input power cable, see Input power cable , page 87

Cable plan EM 124 or EM 304 Processor Unit

The EM processing unit cable plan is described in the pertinent EM installation manual. For connection with the SBP 29, note the following in below sketch

Figure 6 EM Processing Unit, rear view



Cable	Type	From/To
C19	Ethernet cable	RX data to Hydrographic Work Station
C28	Control cable	EM sync with the SBP 29 transceiver unit

Cable plan EM 124 or EM 304 RX Unit

The EM receiver unit cable plan is described in the pertinent EM installation manual. For connection with the SBP 29 note the following on below sketch:

Figure 7 EM 124 or EM 304 RX Unit Cable plan

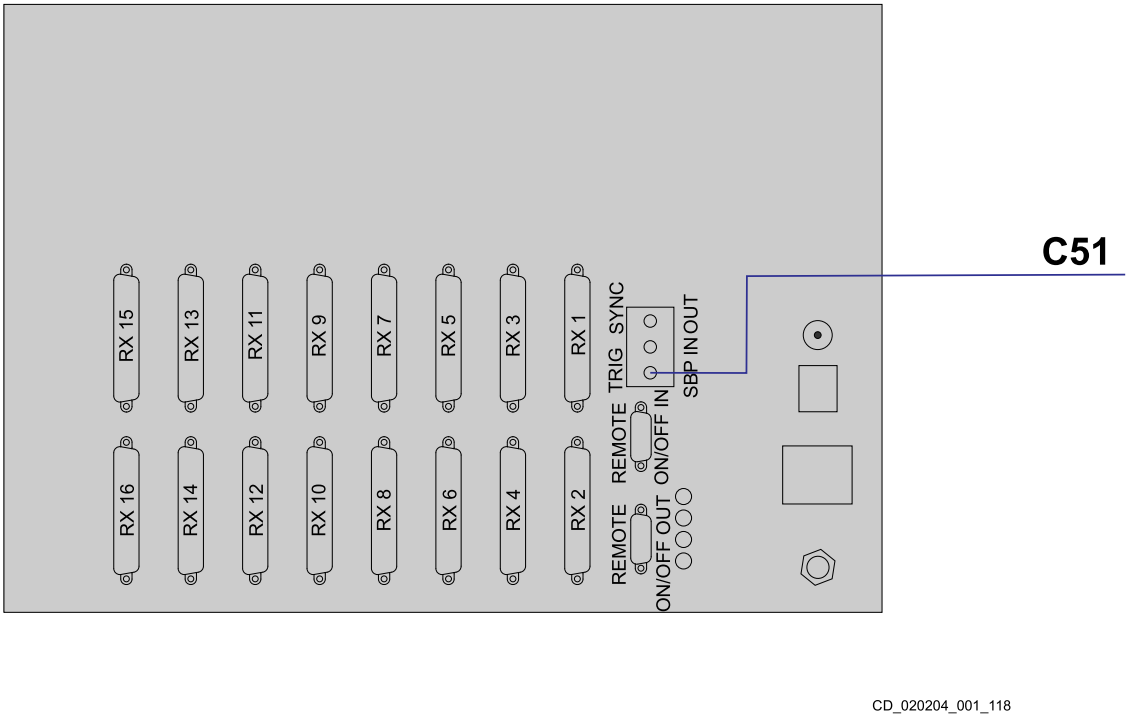
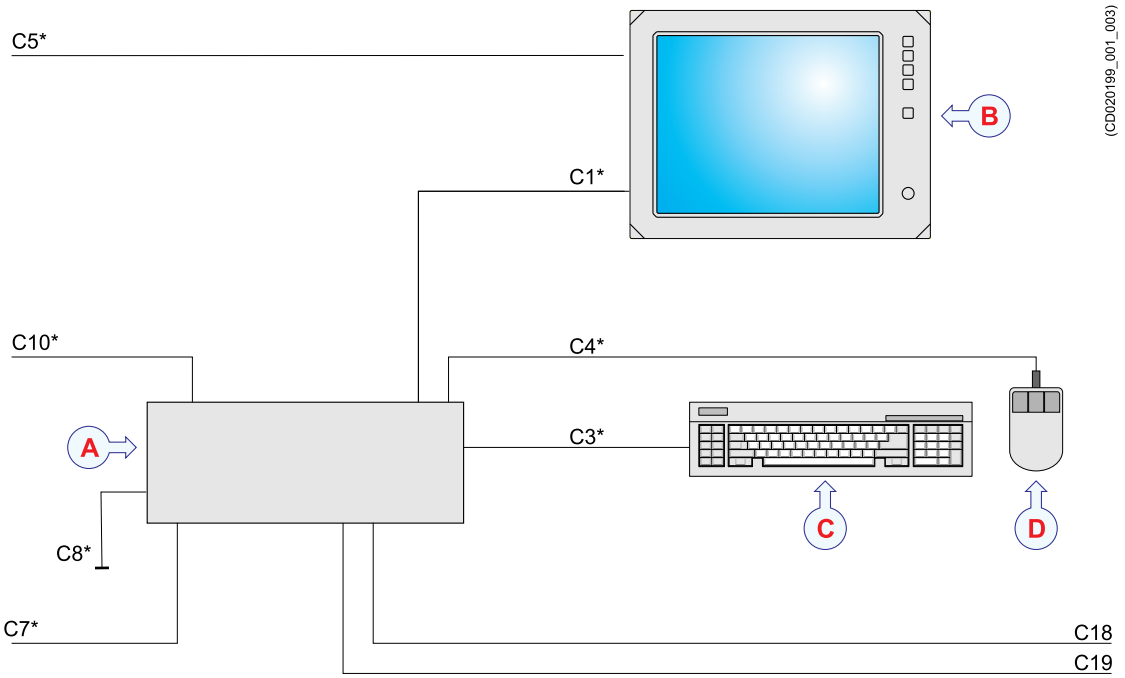


Table 11 EM 124 or EM 304 RX Unit connection

Cable id	Type	From/To
C51	Fiber optic connector	From SISP10 RIO in the SBP 29 transceiver unit TX Active synchronization signal

Cable plan, Hydrographic Work Station

The topside/bridge cables include those used to connect the SBP 29 Hydrographic Work Station and the display to each other, to AC mains power, and to external devices.



A *Hydrographic Work Station*

B *Display*

The Hydrographic Work Station supports up to three displays.

C *Computer keyboard*

D *Computer mouse or trackball*

Cables identified with an asterisk (*) are system or commercial cables. These cables are supplied with the SBP 29 delivery.

Transducer cables

The following cable information is available both in the SBP 29 installation and maintenance manuals. The cable markings are normally recorded in the installation manual first, and it is recommended to copy these records to the maintenance manual later.

The following transducer cables are all supplied by Kongsberg Maritime with the SBP 29 system.

The physical number of cables depends on the chosen system beamwidth as shown in the following tables.

Table 12 Tx transducer cables

Tx transducer cables			
System beamwith	Number of CCUs*	Number of cables from CCUs* to Tx elements	Number of cables from CCUs* to SBP 29
3 degrees	4	96	8
6 degrees	2	48	4
12 degrees	1	24	2

All Tx cables are moulded to the Cable Connection Units.

Note

** CCU = Cable Connection Unit*

Transmit array cable markings

Caution

The TX elements must be installed in the positions as instructed by Kongsberg Maritime. Failure to do so may harm the transmit electronics and cause a malfunctioning system.

The TX elements are identified by individual serial numbers, and the characteristics of each element has been measured by the manufacturer. These measurements are used by Kongsberg Maritime to determine in what position of the array to install each element. Kongsberg Maritime shall provide the information about in what position to install every single element.

In addition to installing the elements in the positions as instructed, the information about the element positions must be documented by completing the tables. In this way you can later identify which element is in which position.

For more information, see: Table 13 CCU1 cable labelling, page 70

The Tx transducer array is physically positioned in the fore-and-aft direction under the hull.

The Tx-elements are connected to the SBP 29 Transceiver Unit via Cable Connection Units (CCUs). Like the Tx-elements, each CCU has an individual serial number, and you can select any CCU you wish and place them in random order in the frame. Each CCU has 24 cables numbered from 1 to 24 towards the Tx-elements, and 2 cables marked with CCU<S/N> cable 1 and CCU<S/N> cable 2. These cables are moulded into the CCU, and the two cables towards the SBP 29 Transceiver Unit are terminated with 25-pins male D-sub connectors.

During installation, CCU cable 1 of the most forward CCU is marked M1-1, while CCU cable 2 is marked M1-2. The cables from the second CCU (counted from bow to aft) are marked M2-1 and M2-2 and so on.

Cables between CCU and SBP 29		
CCU number	Marking of cables	Sockets SBP 29
1	M1-1 M1-2	SIHD8 #1 SIHD8 #2
2	M2-1 M2-2	SIHD8 #3 SIHD8 #4
3	M3-1 M3-2	SIHD8 #5 SIHD8 #6
4	M4-1 M4-2	SIHD8 #7 SIHD8 #8

Transducer elements number 1, 2 and 3 are the most forward elements. Element number 1 is on the port side, element number 2 is in the middle and element number 3 is on the starboard side. They are connected to transducer cables 1, 2 and 3 of the most forward CCU, respectively. The elements of the second row are numbered 4, 5 and 6 from port to starboard, and are connected to cables 4, 5 and 6 of the CCU. This continues up to element 25, which then must be connected to cable 1 of the next CCU.

We recommend installation of 24 Tx elements and a single CCU at a time, starting forward and proceeding towards the back. Always mark cables in the technical room (M<n>-1 / M<n>-2) and write down the serial number of the CCU before continuing with the next group of 24 Tx elements.

Note

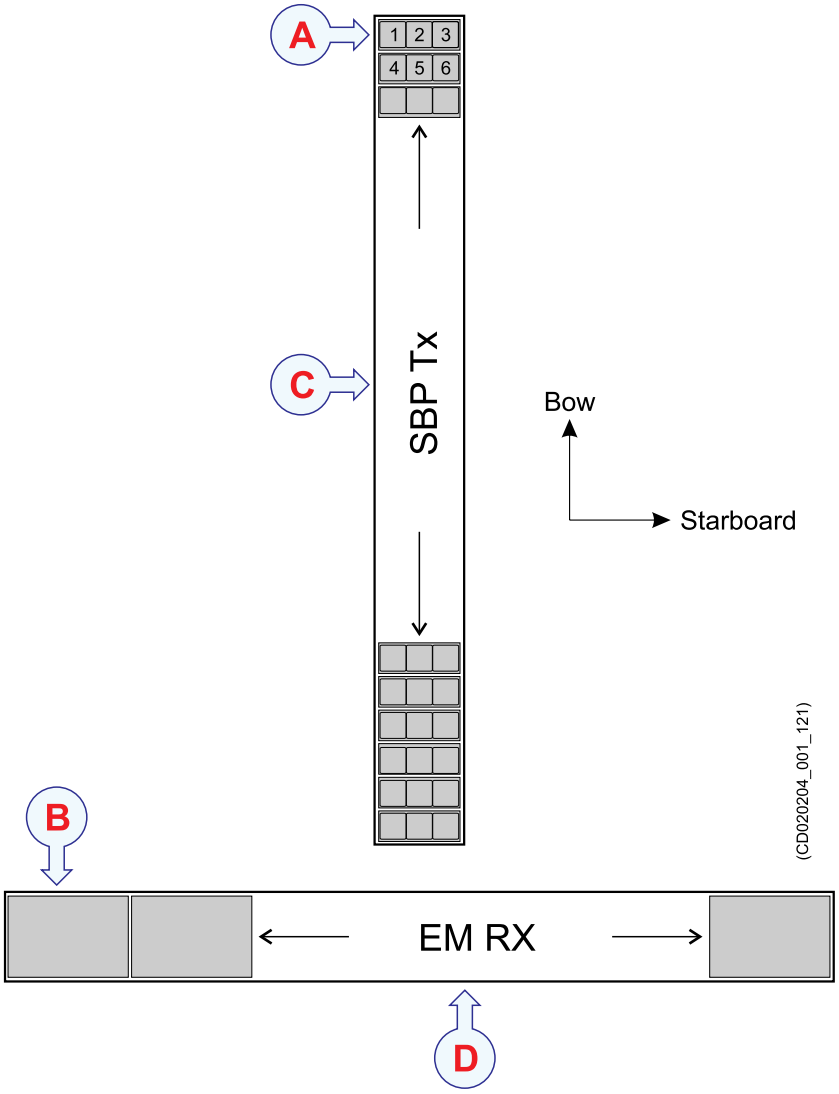
Remember to always make a note of the CCU and the Tx element serial numbers in the tables in CCU cable labelling.

Note

Remember to always make a note of the CCU and the Tx element serial numbers in the tables in CCU cable labelling .

A system with 6 degrees will only have CCU1 and CCU2, whereas a system with 12 degrees will have one single CCU (CCU1).

Figure 8 Top view of the first transducer element / module in each array



Note

The illustration is top view

A Element no. 1.

B Module no. 1.

C SBP 29 Tx array. Number of elements depends on system beamwidth.

D EM 124 or EM 304 Rx array Number of modules depends on system beamwidth.

CCU cable labelling

Table 13 CCU1 cable labelling

CCU1 serial number:			
Location of Tx elements			
Physical position (Element)	Element serial number:	Cable identification	Cable C-number
1 (forward port)		1	
2 (Cable C-number middle)		2	
3 (Cable C-number starboard)		3	
4 (port)		4	
5 (middle)		5	
6 (starboard)		6	
7 (continuing)		7	
8		8	
9		9	
10		10	
11		11	
12		12	
13		13	
14		14	
15		15	
16		16	
17		17	
18		18	
19		19	
20		20	
21		21	
22 (port)		22	
23 (middle)		23	
24 (starboard)		24	

Table 14 CCU2 cable labelling

CCU2 serial number:			
Location of Tx elements			
Physical position (Element)	Element serial number:	Cable identification	Cable C-number
25 (port)		1	
26 (middle)		2	
27 (starboard)		3	
28		4	
29		5	
30		6	
31		7	
32		8	
33		9	
34		10	
35		11	
36		12	
37		13	
38		14	
39		15	
40		16	
41		17	
42		18	
43		19	
44		20	
45		21	
46		22	
47		23	
48		24	

Table 15 CCU3 cable labelling

CCU3 serial number:			
Location of Tx elements			
Physical position (Element)	Element serial number:	Cable identification	Cable C-number
49 (port)		1	
50 (middle)		2	
51 (starboard)		3	
52		4	
53		5	
54		6	
55		7	
56		8	
57		9	
58		10	
59		11	
60		12	
61		13	
62		14	
63		15	
64		16	
65		17	
66		18	
67		19	
68		20	
69		21	
70		22	
71		23	
72		24	

Table 16 CCU4 cable labelling

CCU4serial number:			
Location of Tx elements			
Physical position (Element)	Element serial number:	Cable identification	Cable C-number
73 (port)		1	
74 (middle)		2	
75 (starboard)		3	
76		4	
77		5	
78		6	
79		7	
80		8	
81		9	
82		10	
83		11	
84		12	
85		13	
86		14	
87		15	
88		16	
89		17	
90		18	
91		19	
92		20	
93		21	
94		22	
95		23	
96		24	

Clock synchronization (1PPS)

The SBP 29 has a 1PPS (one pulse per second) input for clock synchronization.

The 1PPS signal is connected to the coax connector on the CPU RIO. This connection is marked **1PPS**.

The 1PPS signal must be minimum 1 microsecond long.

The CPU RIO board is equipped with an optocoupler at this input. The input series resistor is tuned for a TTL signal (Low level<0.6 V, High level>3.2 V).

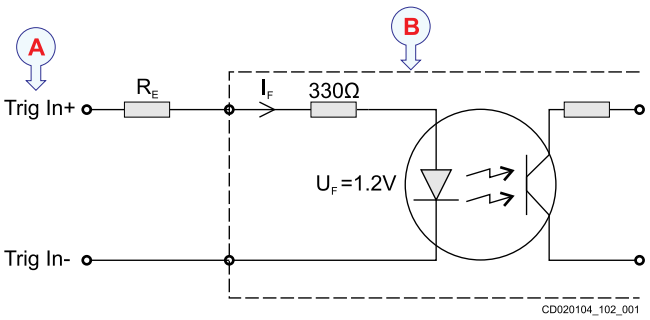
Optically isolated input signals

Note

The input signals must not be negative, that is no RS-232 signals can be used for these inputs.

A *Input from external system*

B *CPU RIO input circuitry*



The input current must be approximately 10 mA. Depending on your input signal additional resistance must be applied to achieve the required input current.

Two examples are shown to clarify.

- $$I_F = \frac{4.5V - 1.2V(U_F)}{330\Omega} \approx 10mA$$

  Using +4.5 V input signal the input current will be as required (~10 mA). No additional resistance required.

- $$R_{TOT} = \frac{12V - 1.2V(U_F)}{10mA} = \frac{10.8}{0.010} = 1080\Omega$$

  $$R_E = 1080 - 330 = 750\Omega$$

  An added resistor of 750 Ω and minimum 0.1 W must be used.

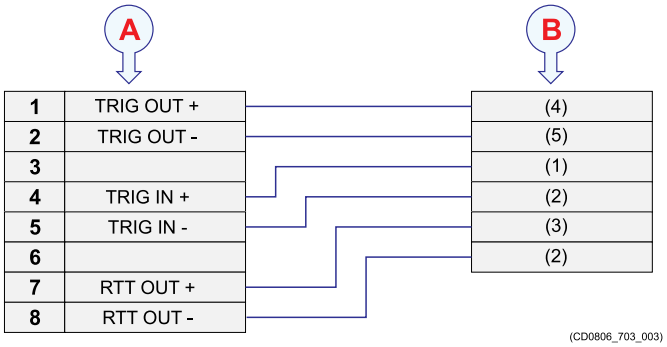
External synchronization

The SBP 29 CPU RIO have two connections for external synchronization.

One connection is dedicated for synchronization with the EM 124 or EM 304, and the other is for interface to an external synchronization system, for example K-Sync. An external synchronization system is used when multiple echo sounders are employed on the same vessel.

This is an optically isolated connection that requires ~10mA current. Input power and resistor value must be adjusted accordingly. The connector is RJ45 type.

RJ45 connector pin layout



External synchronization signal characteristics

Signal	Description	Type	Active
RTT	Rready To Transmit - Output from SBP 29 when it is ready for the next trigger pulse	Open collector output from isolation unit	High
TRIG OUT	Trigger out - Output to external synchronization system, active while the SBP 29 is transmitting	Open collector output from isolation unit	Low
TRIG IN	Trigger in - Input to SBP 29 enabling it to transmit	Optical isolated input	High

Note

To avoid ground loops and damage of the electronics caused by external connections, all connections are optically isolated.

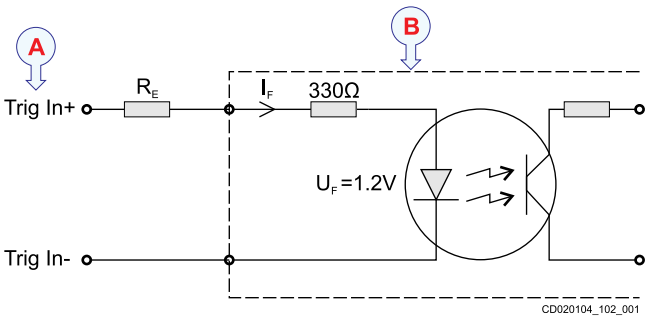
Optically isolated input signals

Note

The input signals must not be negative, that is no RS-232 signals can be used for these inputs.

A *Input from external system*

B *Processing Unit input circuitry*



The input current must be approximately 10 mA. Depending on your input signal additional resistance must be applied to achieve the required input current.

Two examples are shown to clarify.

•

$$I_F = \frac{4.5V - 1.2V(U_F)}{330\Omega} \approx 10mA$$

Using +4.5 V input signal the input current will be as required (~10 mA). No additional resistance required.

•

$$R_{TOT} = \frac{12V - 1.2V(U_F)}{10mA} = \frac{10.8}{0.010} = 1080\Omega$$

$$R_E = 1080 - 330 = 750\Omega$$

An added resistor of 750 Ω and minimum 0.1 W must be used.

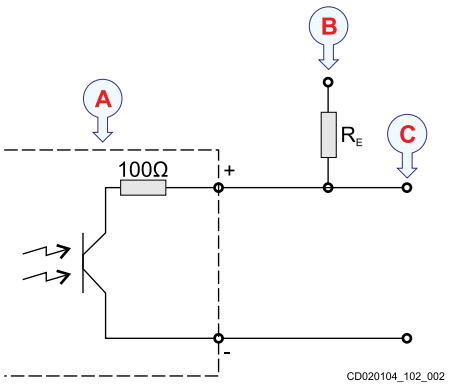
Optically isolated output signals

A *Processing Unit output circuitry*

B *External power*

C *Input to external system*

The collector current must be approximately 10 mA. A resistor must be used to tune the collector current depending on your voltage.



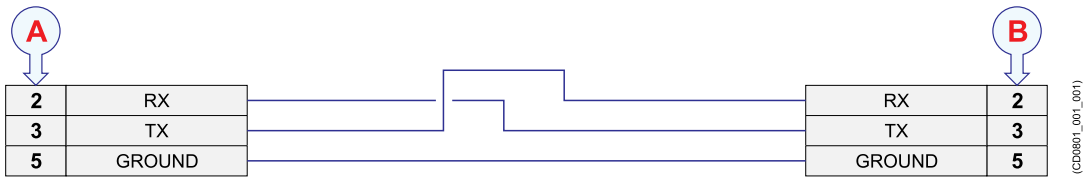
Power	Resistor value	Minimum effect
5 V	0.38 kΩ	0.1 W
12 V	1.08 kΩ	0.15 W
24 V	2.28 kΩ	0.25 W

Cable drawings and specifications

Topics

RS-232 serial line connection using three wires

An RS-232 serial line connection using three (3) wires and NMEA datagrams is a common way to connect the SBP 29 to external devices.

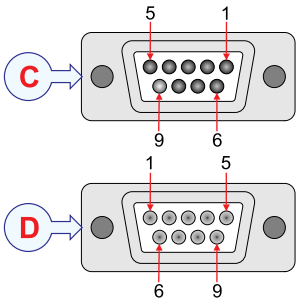


A *Local connection*

B *Connection on remote device*

C *Female 9-pin D-Subminiature connector*

D *Male 9-pin D-Subminiature connector*



Unless otherwise specified, this cable must be provided by the installation shipyard. Note that this cable does not support all the signals in the standard RS-232 specification.

Minimum cable requirements

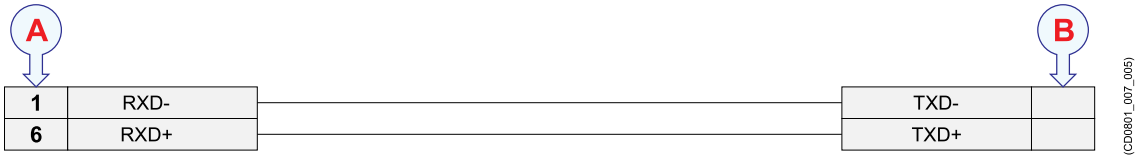
- **Conductors**: 2 x 2 x 0.2 mm^2
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

Use a cable with twisted pairs. If you need to install a very long cable, increase the cross section.

We recommend using a shielded CAT-6A quality or better cable.

RS-422 serial line using two wires

CPU RIO3 is capable of receiving attitude data using RS-422. Only reception is supported, so only one pair of wires is used. The advantage of RS-422 over RS-232 is that communication is reliable over much longer cables.

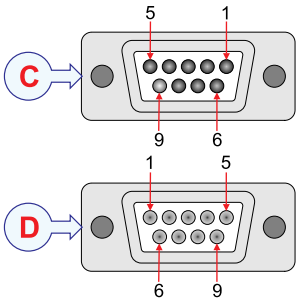


A *Local connection*

B *Connection on remote device*

C *Female 9-pin D-Subminiature connector*

D *Male 9-pin D-Subminiature connector*



Unless otherwise specified, this cable must be provided by the installation shipyard.

Minimum cable requirements

- **Conductors**: 2 x 0.2 mm^2
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

Use a cable with twisted pairs. If you need to install a very long cable, increase the cross section.

We recommend using a shielded CAT-6A quality or better cable.

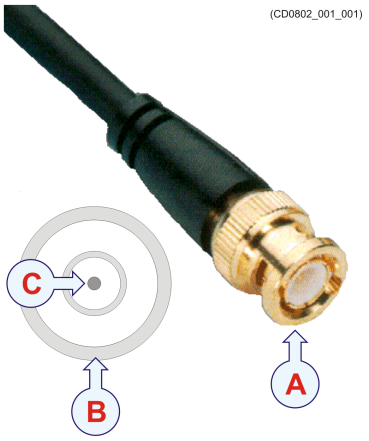
Clock synchronization (1PPS) using a coax cable

The SBP 29 is equipped with a 1PPS signal input for clock synchronization.

A *Male BNC connector*

B *Ground*

C *1PPS signal*



This cable must be provided by the installation shipyard.

The 1PPS (one pulse per second) signal is normally provided by a positioning system.

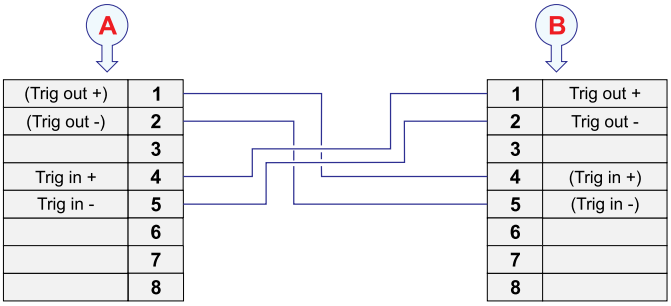
EM 124 or EM 304 Synchronization

The SBP 29 synchronizes EM 124 or EM 304 so it is ready to receive data.

For EM 124 or EM 304, the signal "trig out" is available on SYNC the second CBMF card

Connecting SBP 29

Use the lower SYNC plug on the CPU-RIO3 (Sync2). This is the one used when selecting "EM trigger" in operator software.



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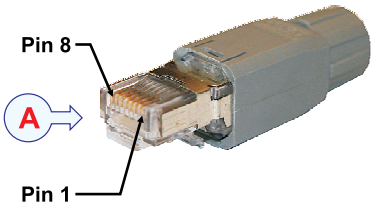
Notice

The pair in parentheses can be skipped. We recommend using twisted pairs.



(CD0804_001_004)

A *Local connection The connector is RJ45 type.*

B *Connection on EM. The connector is RJ45 type.*

Unless otherwise specified, this cable must be provided by the installation shipyard.

Minimum cable requirements

- **Conductors**: 2 x 2 x 0.2 mm^2
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

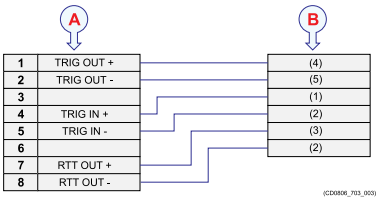
Use a cable with twisted pairs. If you need to install a very long cable, increase the cross section.

We recommend using a shielded CAT-6A quality or better cable.

External synchronization

The SBP 29 CPU RIO is equipped with a connection for interface to an external synchronization system.

This connection is for interface to an external synchronization system, for example K-Sync. The connector is RJ45 type.



A *Local connection The connector is RJ45 type.*

Note

Pin 3 and 6 are not used for SBP 29.

B *Connection on remote device.*

Pinout for K-sync shown in parentheses.

Unless otherwise specified, this cable must be provided by the installation shipyard.

Minimum cable requirements

- **Conductors**: 2 x 3 x 0.2 mm²
- **Screen**: Overall braided
- **Voltage**: 30 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

We recommend using a shielded CAT-6A quality or better cable.

Remote control

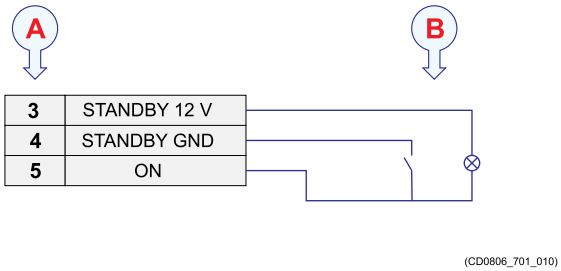
The SBP 29 can be switched on/off with a remote switch. This switch is connected to a 9–pin D-connector on the HV control RIO.

A *Local connection, male 9–pin D-connector*

B *Connection to remote lamp and on/off switch*

C *Female 9–pin D-connector*

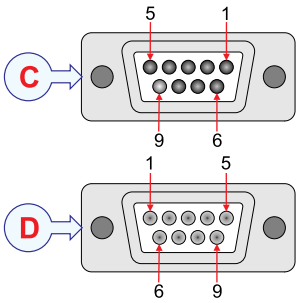
D *Male 9–pin D-connector*



Minimum cable requirements

- **Conductors**: 3 x 0.5 mm²
- **Screen**: Overall braided
- **Voltage**: 60 V
- **Maximum outer diameter**: Defined by the plugs and/or the cable gland

This cable must be provided by the installation shipyard.



Transmit Transducer cable

The following transducer cables are all supplied by Kongsberg Maritime with the SBP 29 system.

Tx transducer cables		
System beamwidth	Number of CCUs*	Number of cables from CCUs* to Tx elements
3 degrees	4	8
6 degrees	2	4
12 degrees	1	2

All Tx cables are moulded to the Cable Connection Units.

Note

** CCU = Cable Connection Unit*

The length of the cables are fixed. The cables can not be extended or shortened during installation.

Cable specifications

- Cable length: 25 m
- Maximum outer diameter: 12.95 +/– 0.5 mm
- Minimum bending radius: 77.5 mm
- Connector: 25-pin D-Sub connector

Input power cable

The SBP transceivers are delivered with a flexible rubber cable of length 5 meters suitable for connecting the transceiver to a wall-mount socket/outlet close to the transceiver. This cable should be cut to the desired length.

Cable for 3-phase input

- Diameter 17 mm
- Minimum static (dynamic) bending radius 7 (14) cm
- Five wires of cross-section 4 mm^2
- Wire colours are green/yellow, blue, brown, black and grey
  - Green/yellow is used for ground
  - Blue wire is unused for 230/Δ VAC (delta connection)
  - Blue wire is Neutral for 400/Y VAC (star connection)

Cable for 1-phase input

- Diameter 14.2 mm
- Minimum static (dynamic) bending radius 6 (12) cm
- Three wires of cross-section 10 mm^2

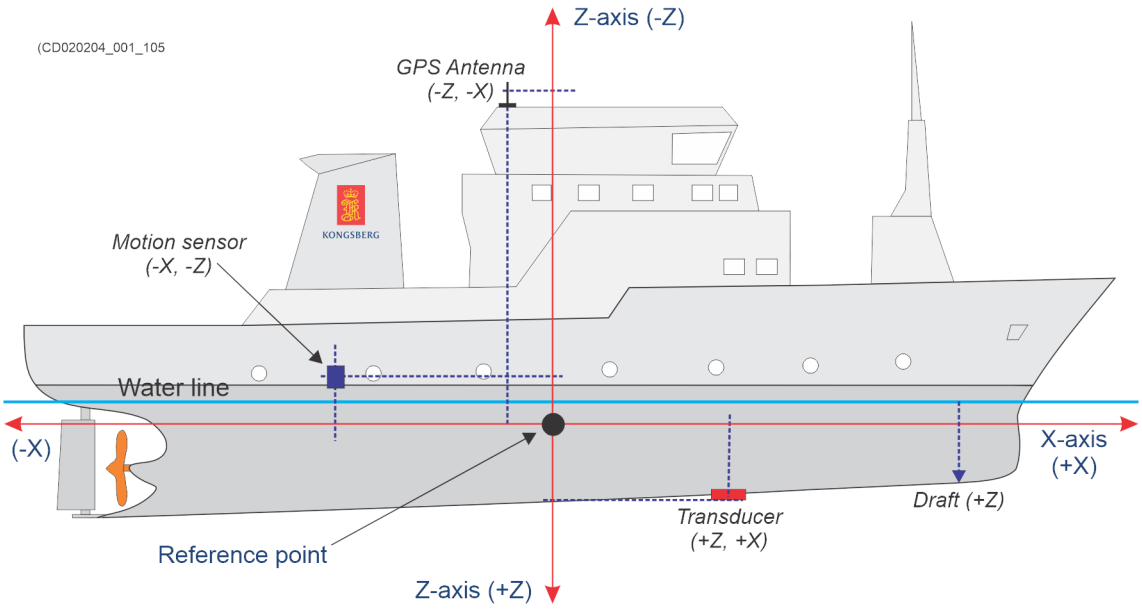
Note

For feeding power to the wall-mount socket select a cable that is suitable for the maximum current. You must also consider the voltage drop introduced at maximum current. The voltage available at the transceiver should not drop below 220 V (Δ)/385 V(Y) when the current is maximum.

Dimensional surveying and alignment

Ships reference point

Figure 9 Reference points



The SBP 29 is a precision instrument for sub-bottom investigation. To be able to produce data that are both detailed and correct, it is necessary to calibrate the survey vessel very well, and perhaps better than what may have been standard practice earlier.

The required measurement consists of:

- measurement of where sensors and transducers are located
- measurement of how sensors and transducers are oriented
- measurement of the water line vertical location
- alignment of angular measurement sensors

- determination of any offsets in sensor data
- determination of any time delays in sensor data

The results, with all sensor locations and alignments referred to a common vessel coordinate system, are to be entered in the SBP 29 Hydrographic Work Station.

Note

The measurement and calibration of these parameters are all to be done for the EM 124 and EM 304 with sufficient accuracy for the SBP 29. Please see the EM 124 and EM 304 Installation manual for a further description. The only specific measurements for the SBP 29 is the location and orientation of the SBP 29 transmit transducer. This is described below.

Note

If the SBP 29 is acquired as a standalone system, without the EM 124 and EM 304, please contact Kongsberg Maritime for assistance.

Summary

The minimum requirements for alignment accuracy are given for the various sensors in the following tables

TX array	Measurement accuracy
Position (x, y, z) [m]	± 0.05
Pitch, roll, heading [deg]	± 0.50

Motion sensor	Measurement accuracy
Position (x, y) [m]	± 0.05
Position (z) [m]	± 0.10
Pitch, roll[deg]	± 0.05
Heading [deg]	± 0.10

Heading sensor	Measurement accuracy
Heading [deg]	± 0.10

Positioning system (antenna)	Measurement accuracy
Position (x, y) [m]	± 0.10
Position (z) [m]	± 0.05

Water line	Measurement accuracy
Position (z) [m]	± 0.05

Note

All distance measurements are to be done to an accuracy of 5 cm both horizontally and vertically. (2 cm for transducers or better)

The procedures and requirements made by the manufacturers of the external sensors connected to the SBP 29 must also be taken into account.

The measurements

Topics

Objectives

The measurements to be made after installation are:

- the horizontal and vertical positions of the transmit transducer array
- the angular orientation of the transmit transducer array

The measurements on the transducer array must be made with the vessel in dry dock.

Any changes of these values and/or sensor offset values measured for the EM must be entered in the SBP 29 menu.

Vessel coordinate system

The Cartesian coordinate system used for the EM is also to be used with the SBP 29.

Measurement accuracy

Measure transducer location to an accuracy of 5 cm in all three axes and angular orientation (roll, pitch and heave) to 0.5°.

Measurement of the transducer orientation

The heading of the transducers is measured as the average heading of the two fore-and-aft oriented sides of each transducer in the horizontal plane of the vessel coordinate system. Thus, the heading of the transmit transducer is the heading of the long sides, while the heading of the receiver array is the heading of the short sides. As the latter may be difficult to measure accurately, it may be better to measure the heading of the long sides, and then subtract 90° to achieve the correct value.

Roll and pitch measurements are made according to standard conventions with positivepitch angle if the transmitter array's forward end is above the aft end (tilts up), andpositive roll if the starboard side of the receiver array is lower than the port side.

The actual measurement of the installation angles may be done by two different methods.

- The most accurate method is to use land surveying techniques, establish a horizontal plane and do distance measurements to and in this plane.
- The second method is to use an inclinometer to measure roll and pitch angles combined with the distance measurements in the horizontal plane for heading. This method is simpler, but will require a sufficiently accurate inclinometer.

Note that it may be most practical to perform these measurements on the transducer mounting frames before installation of the transducer modules. This is an acceptable method.

Mounting frames and structures

No actual measurements of the orientation or location of the transducer mounting structures are required. However, the mounting structures must not deviate from a flat surface by more than 2.5 mm This can be checked by placing a ruler along the long side of the transducer array, and check the opening between the side and the ruler.

Technical specifications

Topics

System performance, 3 degrees system

- **Frequency:** 2 to 9 kHz
- **Number of beams per ping:**
  - Tx: 1
  - Rx: Max. 21
- **Beamwidth, 4 kHz:** (along x across)
  - Tx: 3/6/12 x 35 °
  - Rx: 80 x 3 °
- **Beam spacing:** ≤ 15°
- **Fan width:** ≤30°
- **Transmit beam steering:** ±20°(along, Pitch ≤10°, bottom slope ≤10°)
- **Receive beam steering:** ±25°(across, Roll ±15°, bottom slope ±10°)
- **Range resolution:** 0.2 ms (theoretically 0.15 ms)

- **Pulse length:** From 2 ms to 100 ms
- **Sampling rate:** 21.0 kHz

List of units

Note

Kongsberg Maritime is engaged in continuous developments of its products and reserves the right to alter specifications without prior notice.

List of units and main sub-units

- Hydrographic Work Station
  - The Operator Station may contain a number of sub-units and peripherals (for example storage units). The configuration of these will be defined by the user.
- Transceiver Unit
- Transmit Transducer Array

Interfaces

- Hydrographic Work Station
  - Network or serial line interfaces (with operator adjustable baud rate, parity, data length, and stop bit length) for:
    - Positions in either NMEA GGA and NMEA GGK formats.
    - External clock in NMEA ZDA format.
    - Input of depth, bottom slope angles and sound velocity information from EM 124 and EM 304 in a native KM datagram format or depth in NMEA DPT format.
    - Ethernet interface for output of all data logged to disk.
- Transceiver Unit
  - Serial line interface for attitude (Motion sensor) -
    - Can be configured by a jumper on CPU-RIO to either RS-232 or RS-422. Baud rate (either 19.2k or 38.4k) is configured in the operator software.
  - Ethernet to Hydrographic Work Station
  - 1PPS
  - External sync (K-Sync)
  - Tx Active to EM 124/304 Receiver Unit
  - Remote on/off

Physical specifications

A transducer is a device that converts one form of energy to another. In an echo sounder system the transducer converts between electric energy and sound.

Transmitter

- **Length:** 184 mm
- **Width:** 184 mm
- **Height:** 270 mm
- **Module weight:** 12.5 kg

Frame (3°)

- **Length:** 7450 mm
- **Width:** 800 mm
- **Height:** 353 mm (elements included)
- **Weight:** 1150 kg

Cable Connection Unit

- **Weight:** 45.0 kg
- **Weight, four units:** 180.0 kg
- **Total weight above: elements, frame and Cable Connection Unit (3°):** 2530 kg

Transceiver Unit

- **Height:** 867 mm
- **Width:** 545 mm
- **Depth:** 758 mm
- **Weight:** ~ 110 kg

Remote Control Unit

- **Height:** 43.6 mm
- **Width:** 482.6 mm
- **Depth:** 240 mm

Hydrographic Work Station

- **Height:** 100 mm
- **Width:** 338 mm
- **Depth:** 379 mm
- **Weight:** approximately 7.6 kg

Note

Dimensions and weight will depend upon choice of workstation model, thus the figures above serve as a guideline only.

A dedicated installation kit is available for 19” rack installation, the order number is 371591. The kit comprises a shelf for positioning and securing the computer, and all relevant mounting materials.

24” LCD monitor

- **Height:** 408 mm (excluding mounting brackets)
- **Width:** 601 mm (excluding mounting brackets)
- **Depth:** 68 mm (excluding mounting brackets)
- **Weight:** approximately 10.0 kg (excluding mounting brackets)

Power requirements

Operational voltage and frequency

- Transceiver Unit
  - 220 to 240 VAC (3-phase Δ, 1-phase) or 385 to 415 VAC (3-phase Y)
  - Average power consumption is 400 to 1900 Watt depending on power level and duty cycle.
  - 47 to 63 Hz
- Peak power requirements during transmission:
  - 3 deg.: ~15 kW
  - 6 deg.: ~ 8 kW
  - 12 deg.: ~4 kW
- Hydrographic Work Station
  - 100 to 240 VAC
  - < 300 W
  - 47 to 63 Hz

Acceptable transients

- **Short time (Max 2 s):** ±25 %, 42-69 Hz
- **Spikes (Max 50µs):** <1000 V

Power interrupts

For the hydrographic work station the use of an uninterruptable power supply (UPS) is highly recommended.

For the transceiver unit, clean power (using an isolating transformer) is highly recommended.

Restrictions for use – limitations

Do not ping in drydock.

Operating and storage temperature

Operating and storage temperature

- **Transceiver Units:** 0 to 45 °C
- **Hydrographic Work Station:** 0 to 40 °C
- **Storage:** -30 to + 70 °C

Surface finish

All cabinets are painted. System units exposed to salt water must be treated accordingly.

Environmental specifications

Vibration and shock

- **Vibration during storage and transport**
  - **Frequency range:** 5 to 500 Hz
  - **Excitation level:** ±0.7 g
    Reference document: IEC publication 68-2-6
- **Vibration during operation (locations 1, 2, 3 and 4)**
  - **Frequency range:** 5 to 500 Hz
  - **Excitation level:**
    5 to 13.2 Hz: ±1.5 mm
    13.2 to 100 Hz: 1 g
  - **Sweep rate:** 1 oct/min

  - **Duration:** 10 sweeps 5-100-5 Hz
    Reference document: IEC publication 68-2-6 (Test Fc)
- **Shock during storage and transport, free fall:**
  - **> 500 kg gross weight:** max 25 mm fall

System tests

Topics

Scope

After the installation has been performed and before the SBP 29 system is brought into operation for the first time, a series of test procedures must be carried out to confirm a correct installation.

Some of the tests can be carried out on individual units once that particular unit has been installed. However, in the interests of safety and to avoid possible mistakes, it is recommended to set aside a period of time at the end of the installation phase specifically for the checks and tests. The entire set of tests can then be performed in sequence to ensure the entire system is comprehensively checked.

Note

If the test engineer is not satisfied with the quality of any part of the installation, he/she must contact the customer to have the work rectified and brought up to the required quality standards.

Which specific tests that are to be conducted are normally specified in the contract. In most cases, the following tests are performed

- Installation tests
  - These tests are performed during the installation work. The general procedures are given in this chapter. These tests take place before power is applied to the system.
- Setting To Work (STW)

  - This work is performed by the installation personnel from Kongsberg Maritime. All specific hardware and software units are checked, and the cabling is controlled.
- Harbour Acceptance Test (HAT)
  - This test is performed by the installation personnel from Kongsberg Maritime together with representatives from the customer and in some cases the installation shipyard.
- Sea Acceptance Test (SAT)
  - This test takes place with the vessel in open sea. It is performed by the installation personnel from Kongsberg Maritime together with representatives from the customer and in some cases the installation shipyard. The purpose of the test is to check the functional specifications of the system during normal working conditions.

Visual inspection of units

Scope

WARNING

These checks must be completed before any power is switched onto the system.

After the physical installation has been carried out, all the system units must be visually checked to ensure that the SBP 29units have been installed correctly. You must ensure that the units have been mounted in the correct locations, correctly orientated (e.g. the right way up) and are correctly secured.

Operator Unit

Perform a close visual inspection of the unit according to the following procedure

1 Check that the unit is installed properly, secured, and that it is suitably orientated to enable easy operation.

2 Check that the unit is not damaged.

3 Make sure that appropriate slack has been applied to the cables.

4 Check that the air vents are not blocked.

5 Check the immediate environment around the unit. The operator should have easy access to a communication system, and it must be possible to dim and/or switch off the deckhead lights.

6 Checked (date/sign):_____

Transceiver Unit

Perform a close visual inspection of the SBP 29 Transceiver Unit cabinet.

1 Check that the unit is installed in the correct location, and is suitably orientated to enable easy maintenance.

2 Check that the proper mounting bolts have been used, and that proper torque has been applied.

3 Check that the unit is not damaged.

4 Make sure that you have access to the internal part of the cabinet and that appropriate slack has been applied to the cables.

5 Check that the air vents are not blocked.

6 Check that the sonar room is equipped with proper light for maintenance work.

7 Check that the sonar room is equipped with the ventilation facilities required for continuous operation.

8 Checked (date/sign):_____

Electrical checks

This section of the manual contains the test procedures for the SBP 29 system's power and signal interface cables.

WARNING

These checks must be completed before any power is switched onto the system

Cabling

Visual inspection

Refer to the cable plans and interconnection diagrams, and check all power and interconnection cables. Any locally fitted plugs and connectors should also be checked to ensure that the correct types have been used for the specific locations. (Sealed or spark-proof connectors in areas where flammable gasses may accumulate, etc.)

Ensure that all cable connections have been made according to the cable plan, and that all connections are tight and secure. Ensure that all cables are correctly laid in conduits, or are otherwise protected according to the regulations and recommendations laid down by the vessel's registering authority. Ensure all protective covers are fastened correctly.

Cable connections and continuity

After the cable connections have been completed and the visual inspection has been carried out, all the cable cores must be checked for correct connection and continuity. Refer to the cable plans and interconnection diagrams, and check all interconnection cables. Any locally fitted plugs and connectors must be checked for shorts or open circuits. Ensure all cable connections have been made according to the cable plan, and that all connections are tight and secure.

The check procedure will require two engineers equipped with two-way communication devices; one will require continuity test equipment, while the other will require a suitable shorting strap.

Follow the check procedure below for each cable core

1 Position yourselves one at each end of the cable to be checked. Good communications must be established between you and your assistant.

2 Ensure that the cable to be tested is not connected to any power source.

- If a cable terminates in a plug at the unit, the test will be more easily conducted if the plug is disconnected.

3 Select one pair of cable cores, and check that the cores are connected to the correct terminals in the unit.

4 Connect your continuity tester to the two terminals in question and check the continuity.

- If a low resistance exists between the two cores, this may indicate the cores are connected to circuits or units with low internal resistance. If this is the case, disconnect the cores from the terminal block and test again.
- The resistance should be nearing ∞ ohms.

5 Tell your assistant to short the two cores together. Repeat the previous test.
- The resistance should be 0 (zero) ohms.

6 Tell your assistant to remove the shorting strap.
- Check that the resistance reaches ∞ ohms again.

7 Check each core's resistance to ground, and each core's resistance to all the other cores in the cable.
- All results should be close to ∞ ohms.

8 Assuming the test results are correct, the cores must be reconnected to the terminal block (if they had been removed), and the terminals checked to ensure they are tight.

9 On completion, move on to the next pair of cores and repeat the tests until the entire cable has been checked.

Operational voltages

Check that the operational voltages on the equipment match the power available on the vessel.

Applying mains power to the transceiver

We recommend to turn the transceiver mains switch OFF before applying power.

WARNING

Too high input voltage(s) may cause serious damages to many components in the cabinet.

Caution

Always turn the transceiver mains switch OFF before applying power. Before turning the mains switch on, make sure the input voltages at the test points are within specifications 220-240 VAC.

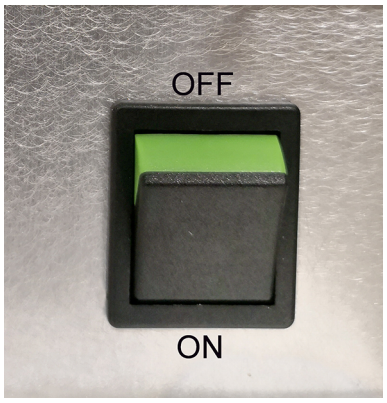
Caution

Only when all 230 VAC input voltages are verified to be within specifications, the main switch can be turned ON.

Note

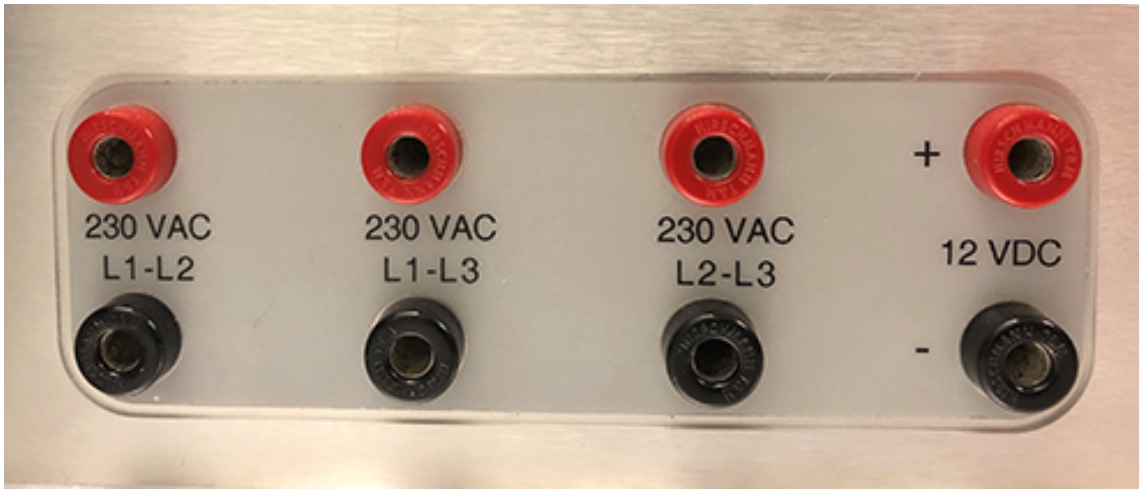
This requirement also applies to transceivers powered by 3-phase 400 VAC.

Figure 10 Mains switch



The above picture shows the position of the mains switch in the ON position. Make sure it is in the OFF position before applying mains power to the transceiver.

Figure 11 Mains test points



From left to right there are three pairs of test points for measuring the mains input voltage to the three different phase pairs.

For single-phase input power only test points L1-L2 are in use.

Note

If power is applied to the transceiver and yet no voltages are measured at the test points, a likely reason is that fuses F1 are off. In that case, the HV Power RIO module must be ejected from the cabinet and the fuses must be switched back ON.

Fuse F1 is found in the circuit diagrams:

3-phase wye (Y) 400 VAC Figure 28 , 427512, page 127

3-phase delta (Δ) 230 VAC Figure 29 , 435680, page 128

1-phase 230 VAC Figure 30 , 444783, page 129

Only when all 230 VAC input voltages are verified to be within specifications, the main switch can be turned ON.

After the mains switch is turned ON, the 12 VDC power supply part of HV Power RIO will be powered and 12 VDC will be present at the test points to the right.

For the transceiver to start when the mains switch is turned ON, either

- the service switch on HV Control RIO must be in the ON position in which case the transceiver will start regardless of the presence and state of a remote ON/OFF signal, or
- the remote ON/OFF signal must be connected and switched ON.

Signal transmission check - ringing

To verify correct signal transmission from the SBP transceiver to the TX transducer elements a signal transmission check, often referred to as ringing, can be done. The principle is to use a test transducer and a signal generator to induce a signal from each of the transducer elements and verify the reception at the transceiver.

Note

The test transducer element may be any unit that by using a signal generator transmits at the relevant frequency.

The SBP 29 TX elements can be used for this purpose. We suggest that you mount all TX elements but one, use the last element for the signal check, and mount it when test is completed.

How to verify the signal transmission

1 Position the test transducer element against one the transducer element to induce a signal

2 Determine from illustration referred below, what channels (pins) at the transceiver cable connector

3 Observe the received signal at the transceiver cable connector using a oscilloscope

4 Verify that the signal is received at the correct channels (pins) at the correct transceiver cable connector

5 Repeat for each TX element

The signal path to verify is shown in the following illustration Figure 27 , 448231_1A, page 126.

Final installation checks

After installation - but before un-docking - a number of verification must be done to check that the mechanical end electrical installation has been performed correctly.

Procedure

1 Check that the measured positions of the transducers, motion sensor and positioning system antenna are reasonable by comparing them with those estimated from the vessel drawings.

2 Check that the measured installation angles of the transducers is reasonable by comparing them with measurements done with a simple inclinometer.

3 Check that the specified sacrificial anodes have been mounted, and that any specified anti-fouling paint has been applied correctly.

4 Check that all system units have been fastened properly and that all nuts and bolts have been tightened properly.

5 Check that the data from the motion sensor, the heading sensor and the positioning system are correctly read by the SBP 29 and that the values are reasonable before un-docking.

The steps in this procedure may be incorporated in the “Harbour Acceptance Test” carried out as a final check to test both the installation and the main functions of the system.

Drawing files

This chapter lists most relevant drawings required for installation. For further drawings, or details releated to the drawings, please contact Kongsberg Maritime with your request.

If required, certain drawings may be supplied on AutoCad or PDF format. To order, contact Kongsberg Maritime and refer to the drawing number in the bottom right corner of the frame.

Note

The mechanical drawings are for information and guidance only. They are not in scale. All dimensions are in mm unless otherwise is noted.

Drawing no	Description
Figure 12 , 862-216859, page 111	TX mounting frame, 3 degrees
Figure 13 , 307904, page 112	TX mounting frame, 6 degrees
Figure 14 , 862–218001, page 113	TX mounting frame,12 degrees
Figure 15 , 871-219193, page 114	TX cover plate casing, 3 degrees
Figure 16 , 871-219201, page 115	TX cover plate casing, 6 degrees
Figure 17 , 388168, page 116	TX cover plate casing, 12 degrees
Figure 18 , 871–219187, page 117	Casing with mounting frame, 3 degrees
Figure 19 , 821–219199, page 118	Casing with mounting frame, 6 degrees
Figure 20 , 388235, page 119	Casing with mounting frame, 12 degrees
Figure 21 , 871–219198, page 120	Casing mounting frame, 6 degrees
Figure 22 , 388148, page 121	Casing mounting frame, 12 degrees
Figure 23 , 315550, page 122	Cable connection unit, outline dimensions
Figure 24 , 430751, page 123	Transceiver unit
Figure 25 , 871–212984, page 124	Mounting bracket
Figure 26 , 407070, page 125	Interconnection diagram Tranceiver Unit
Figure 27 , 448231_1A, page 126	Cable layout SBP 29
Figure 28 , 427512, page 127	3-phase wye (Y) 400 VAC
Figure 29 , 435680, page 128	3-phase delta (Δ) 230 VAC
Figure 30 , 444783, page 129	1-phase 230 VAC

Figure 12 , 862-216859

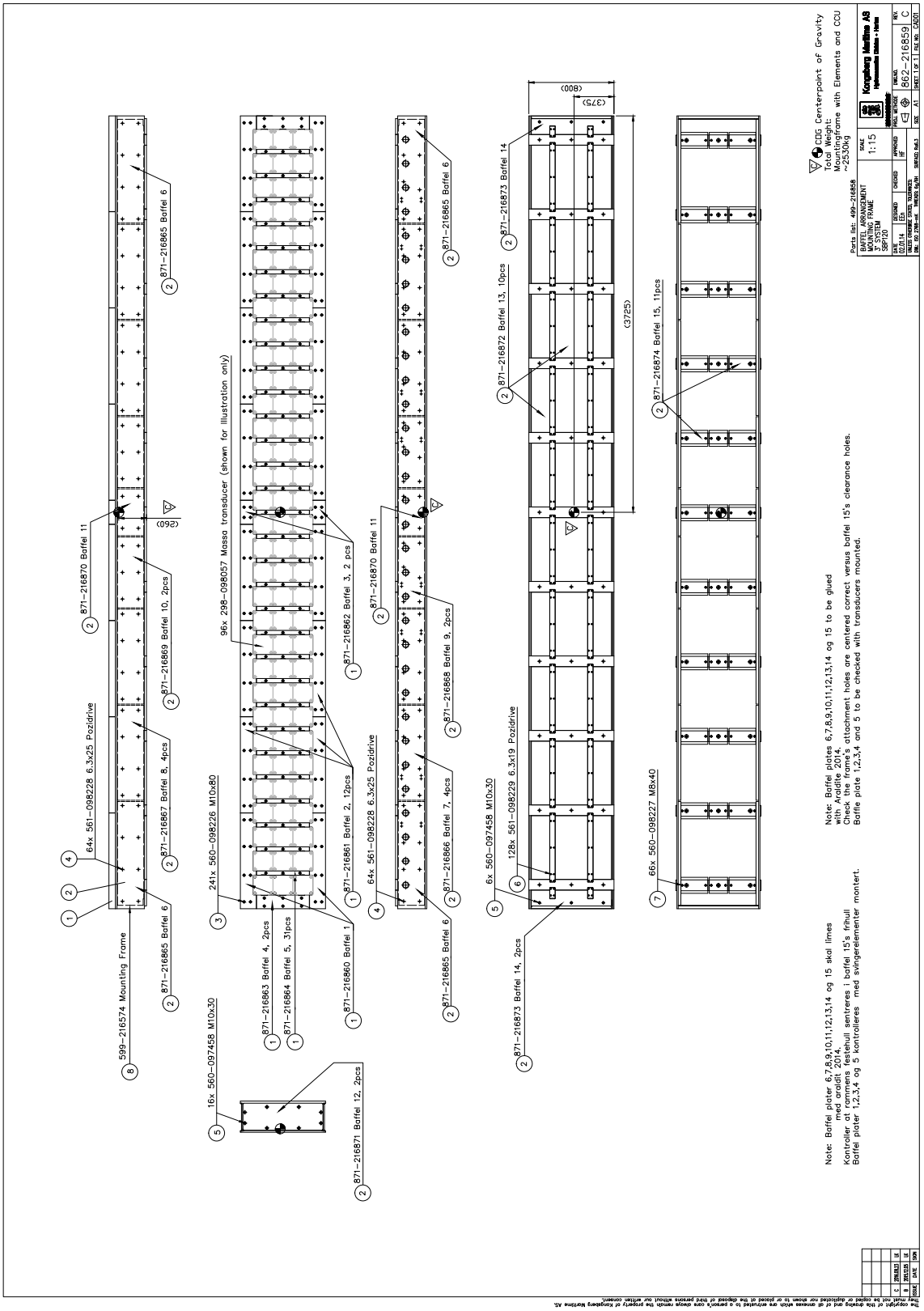


Figure 13 , 307904

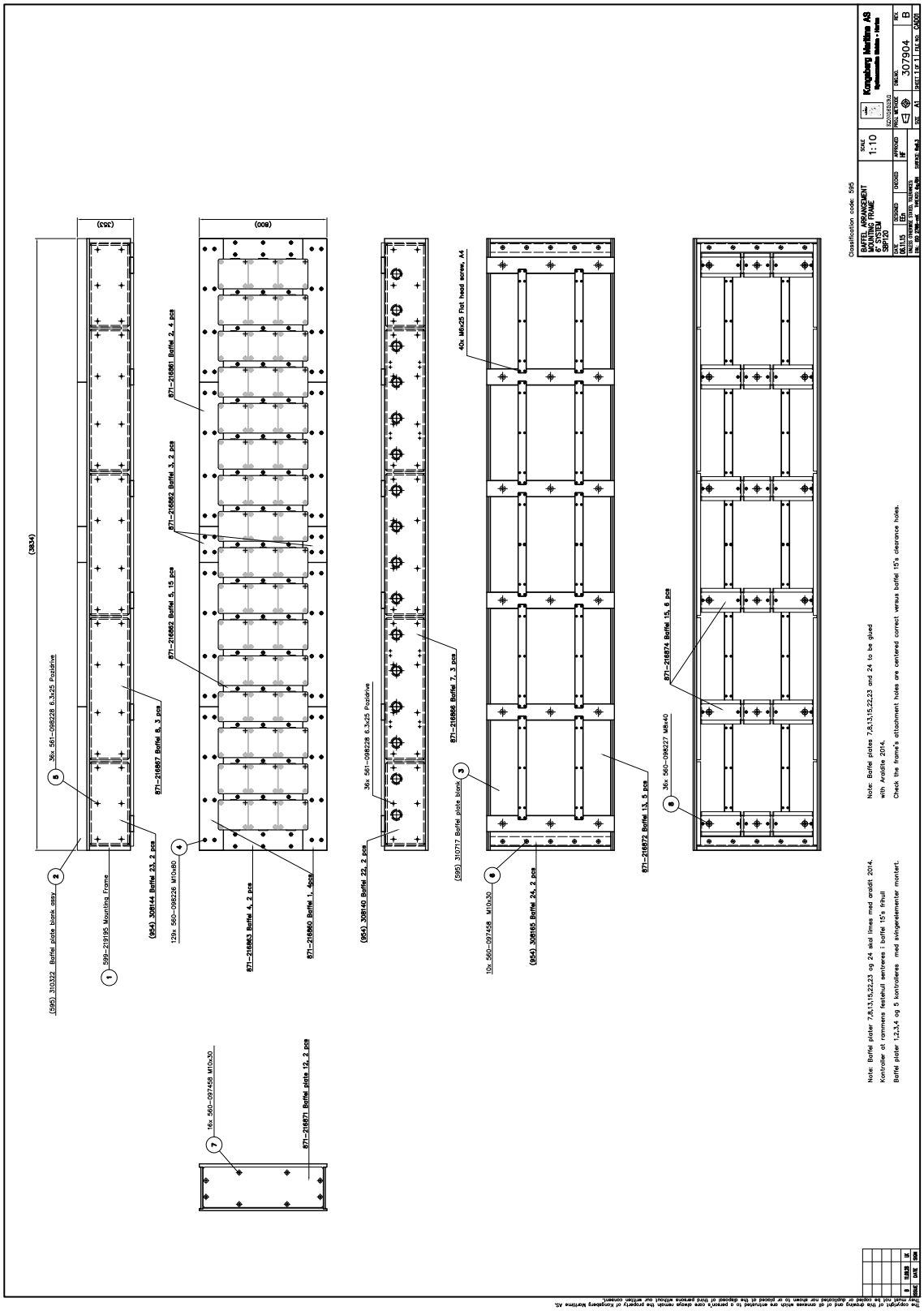


Figure 14 , 862–218001

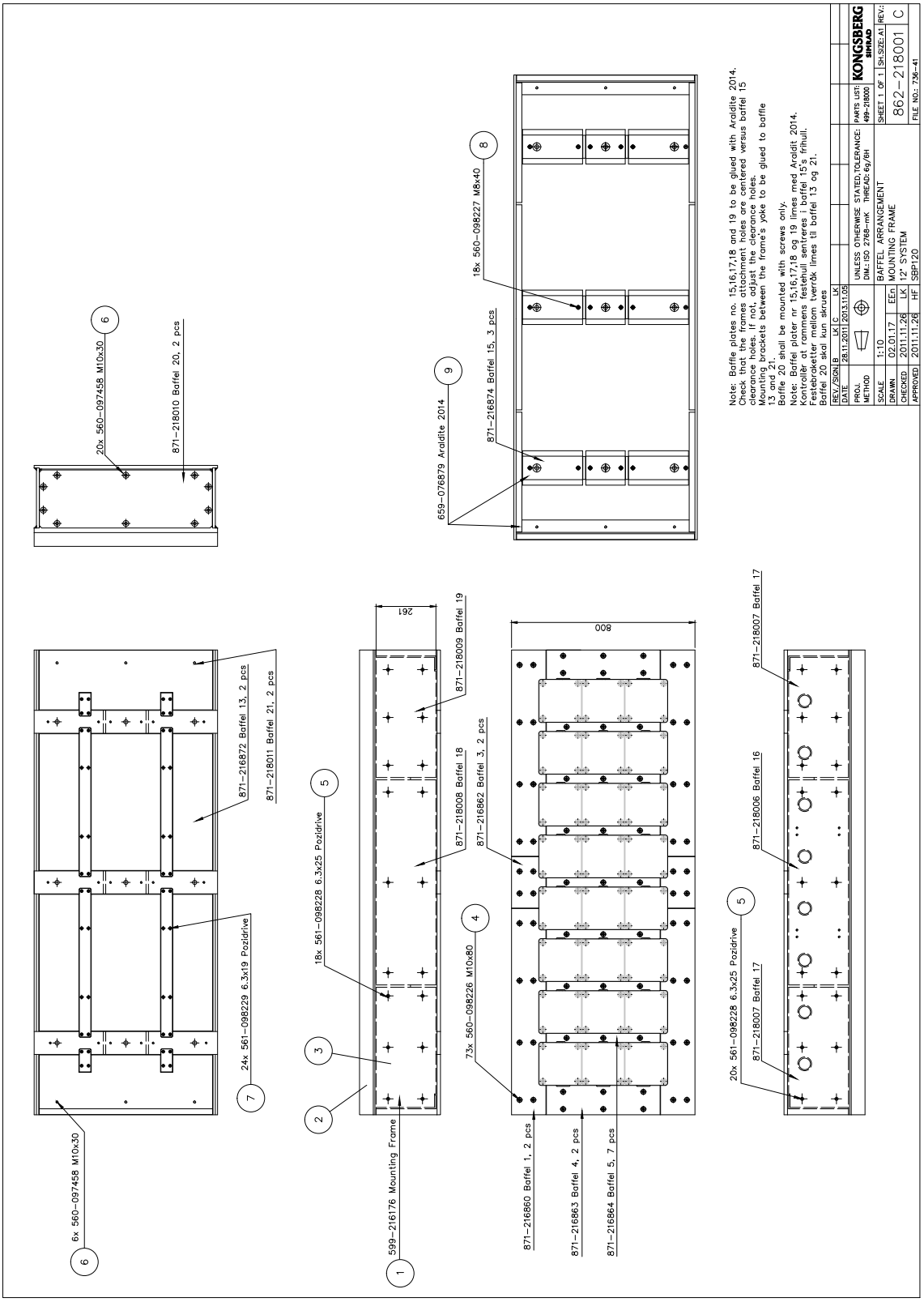


Figure 15 , 871-219193

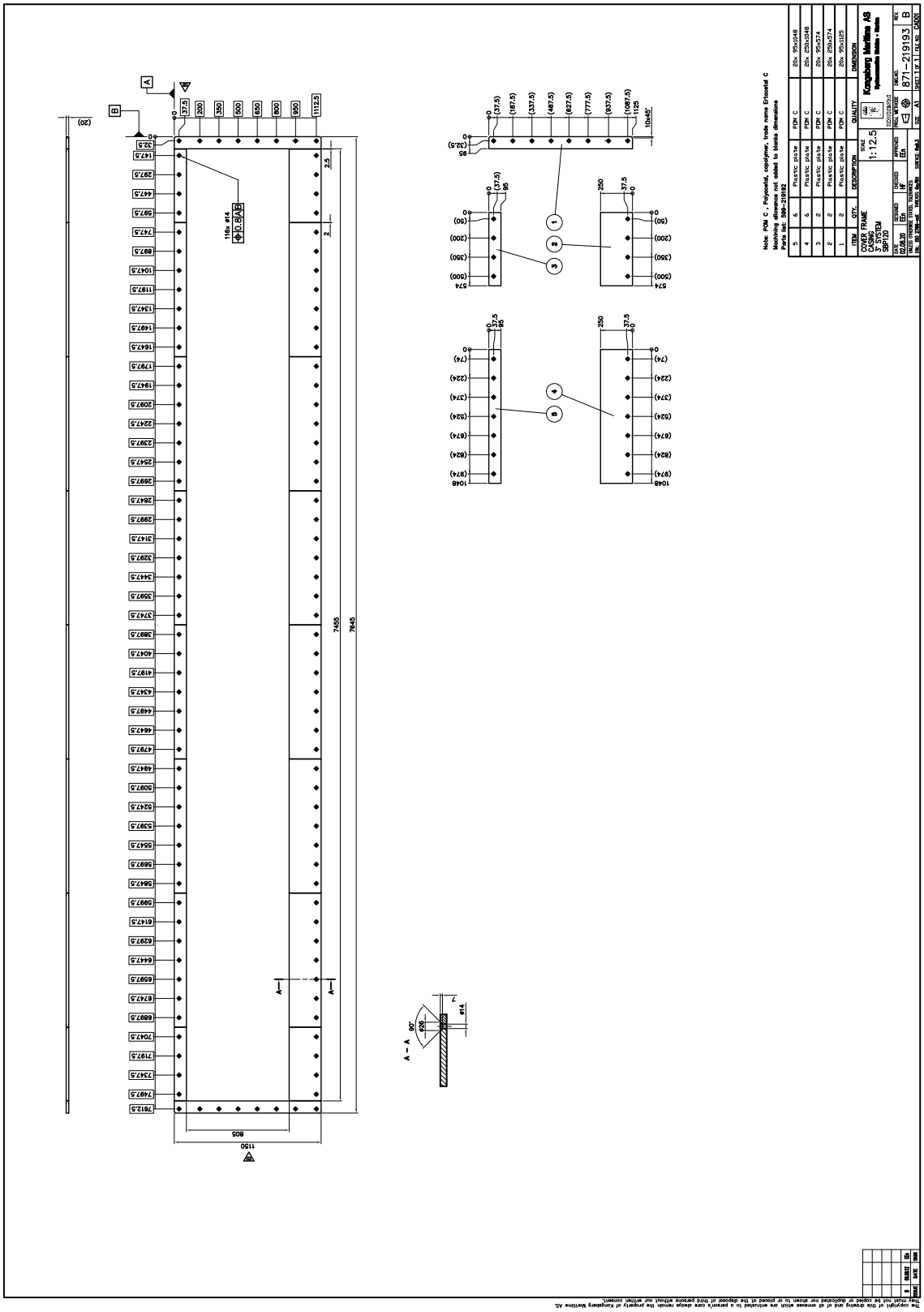


Figure 16 , 871-219201

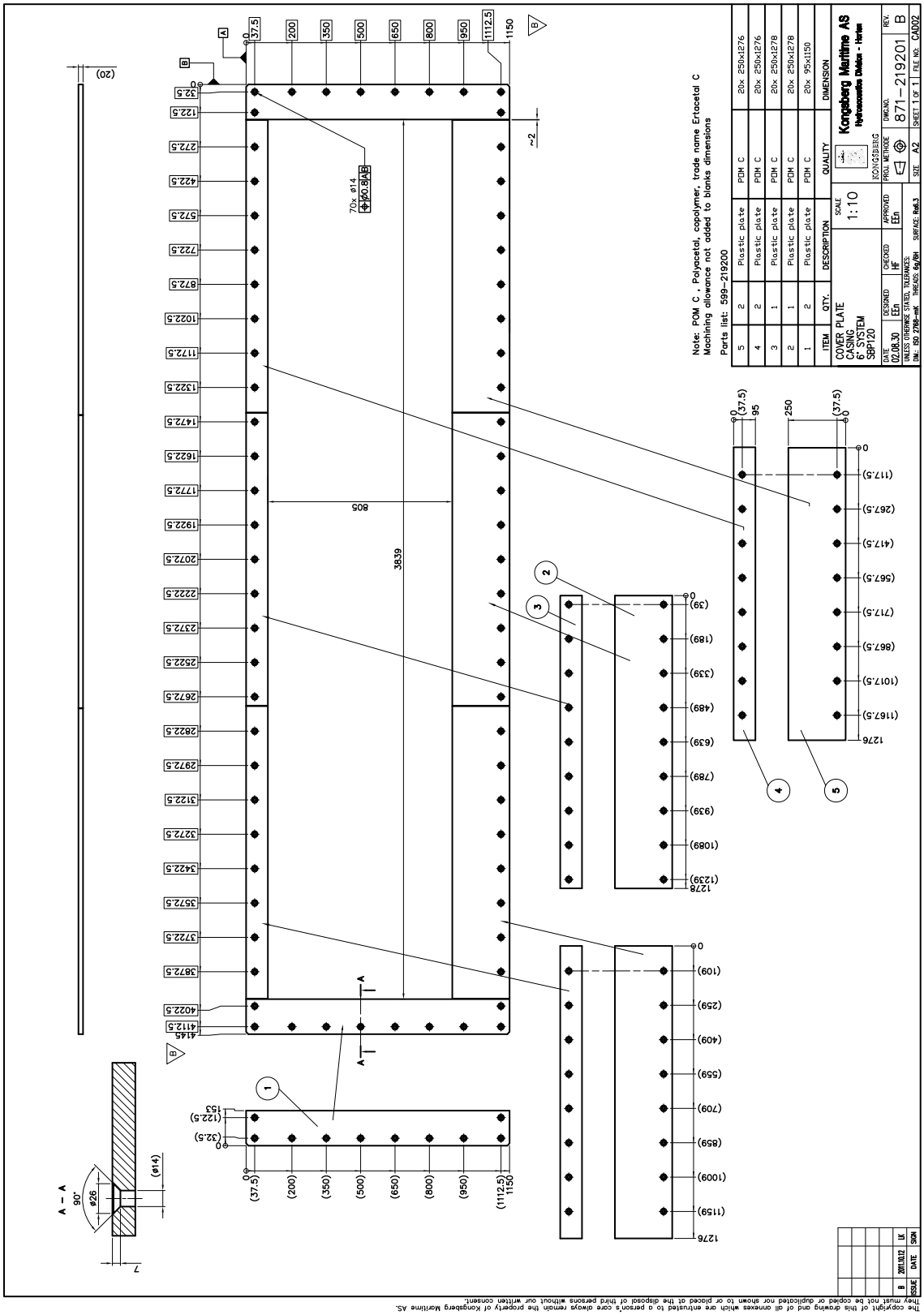


Figure 17 , 388168

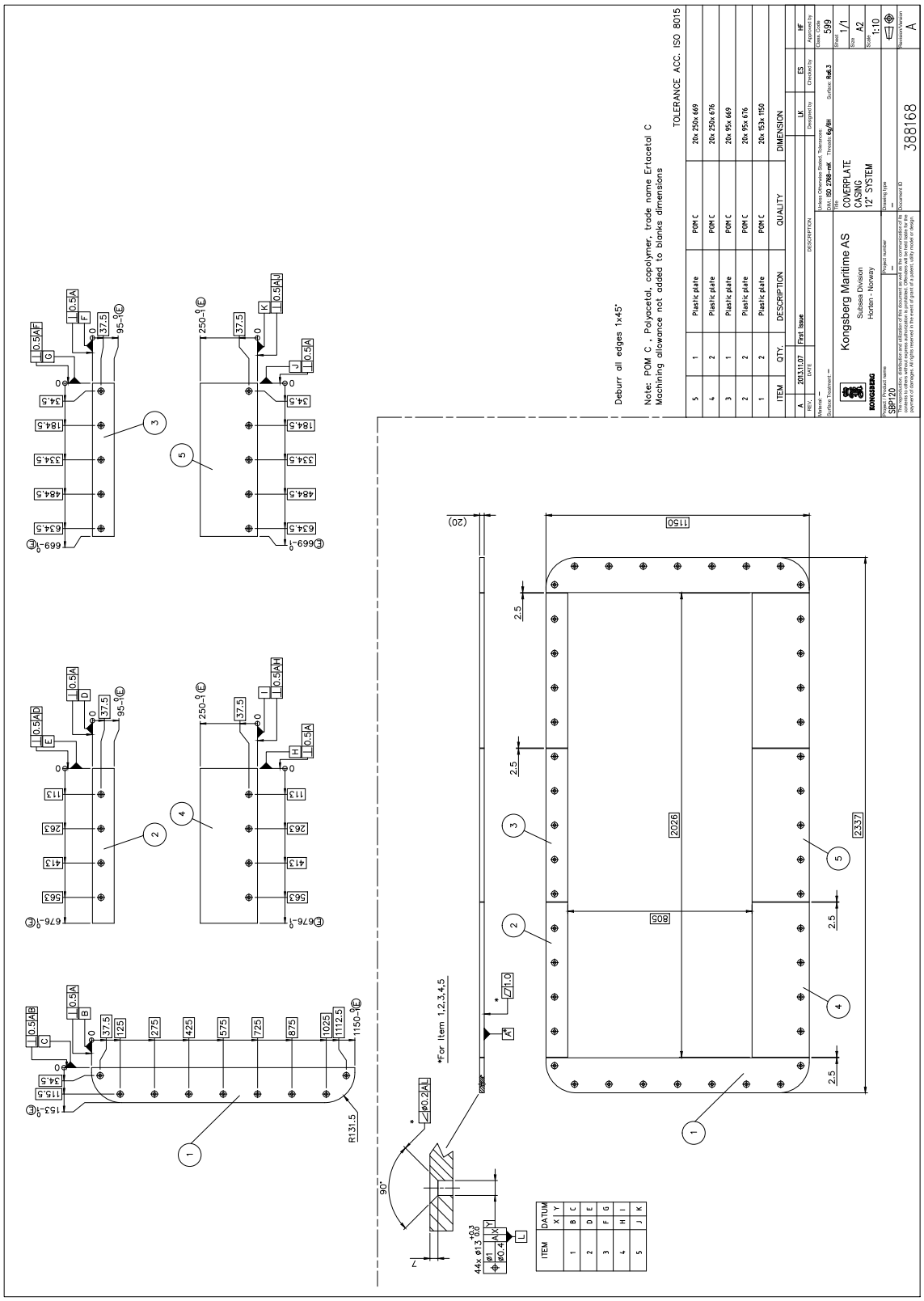


Figure 18 , 871–219187

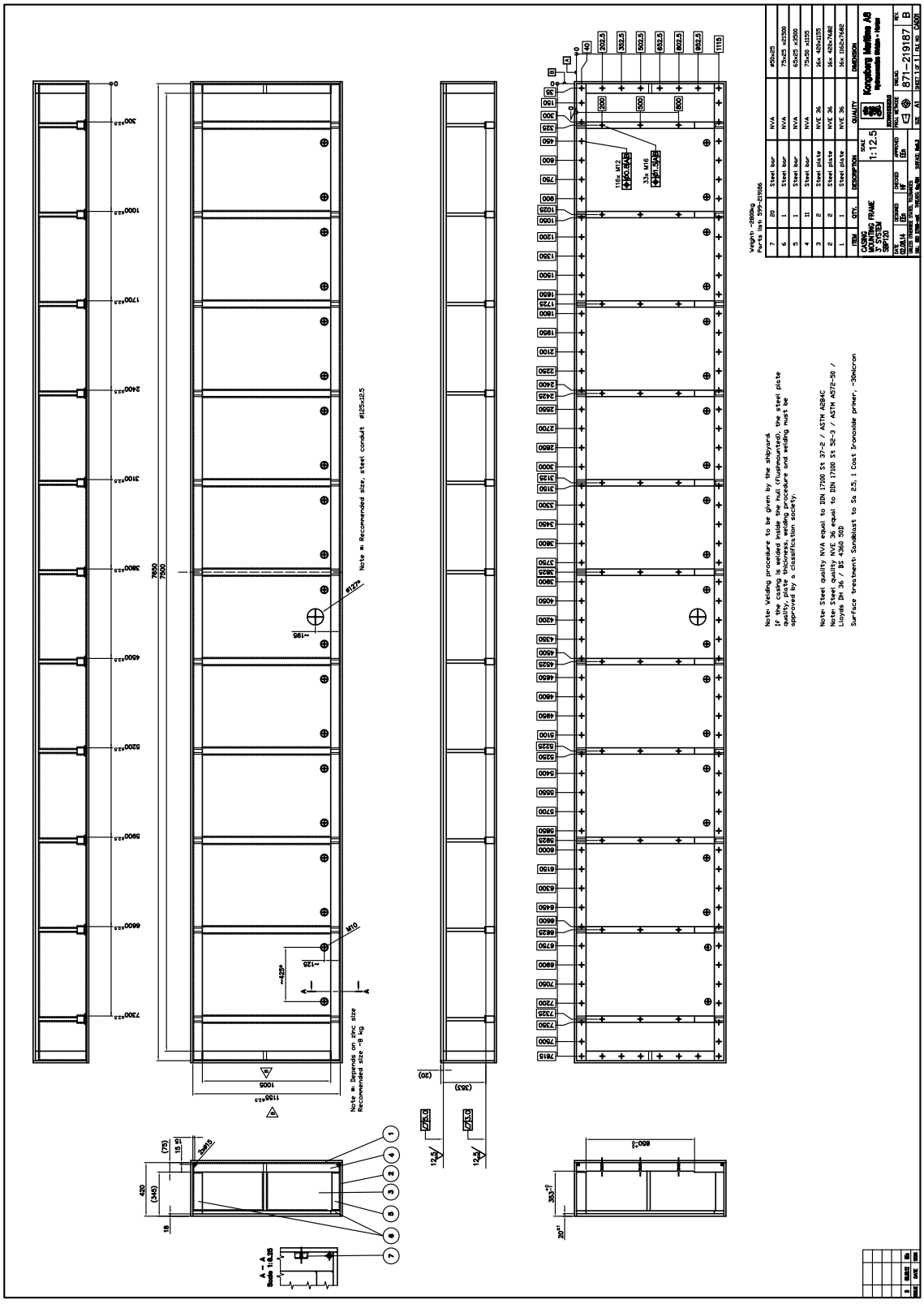


Figure 19 , 821–219199

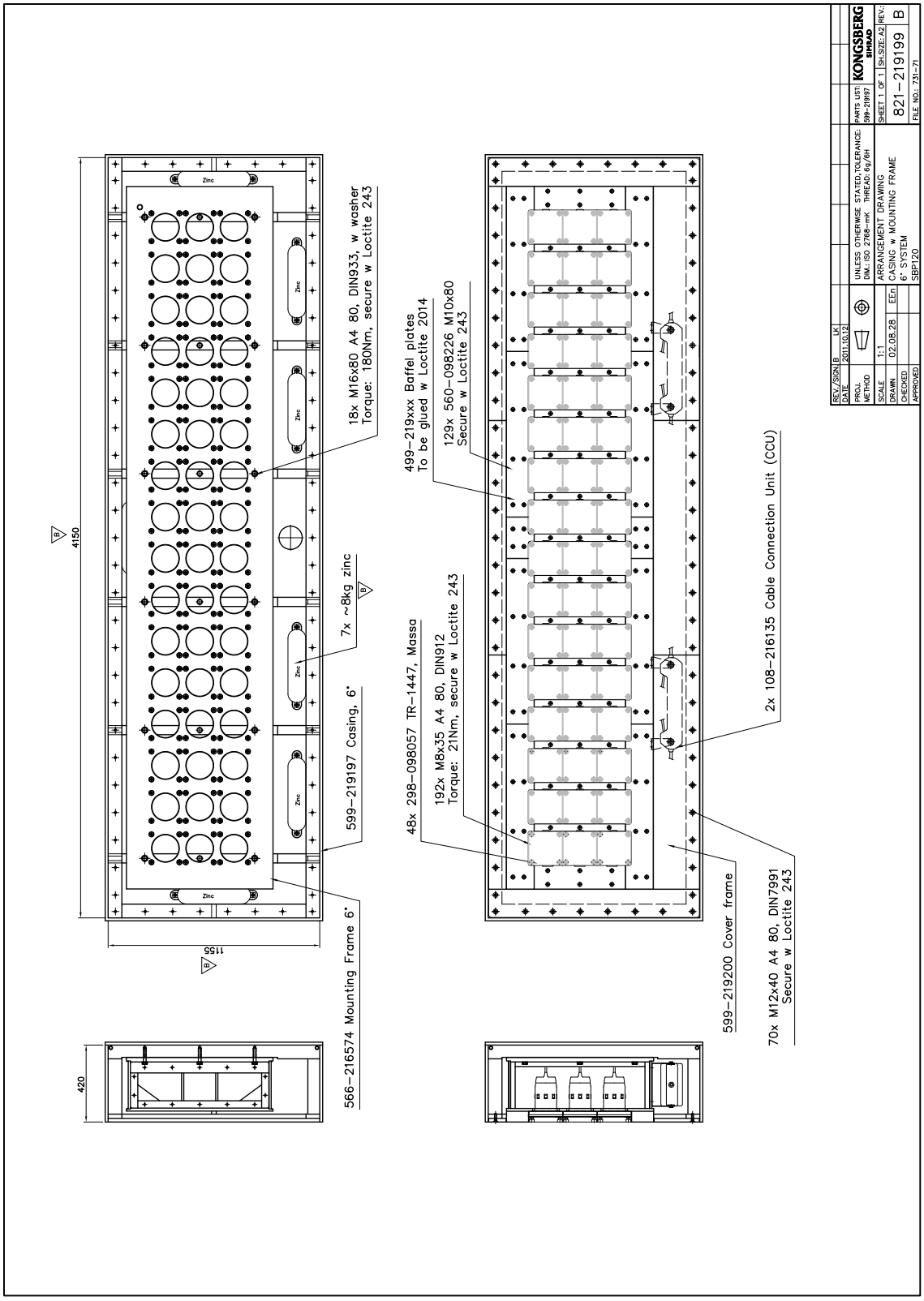


Figure 20 , 388235

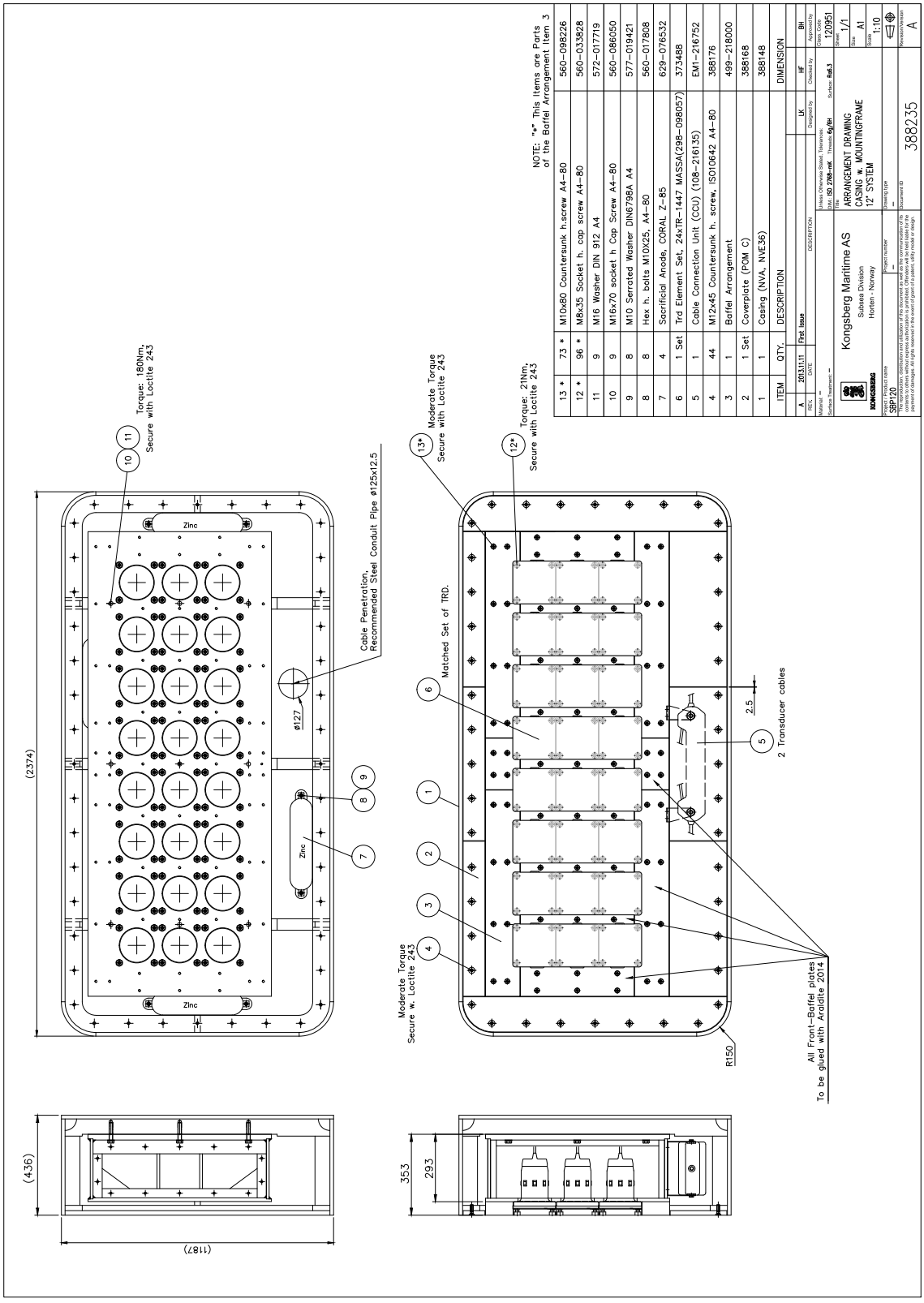


Figure 21 , 871–219198

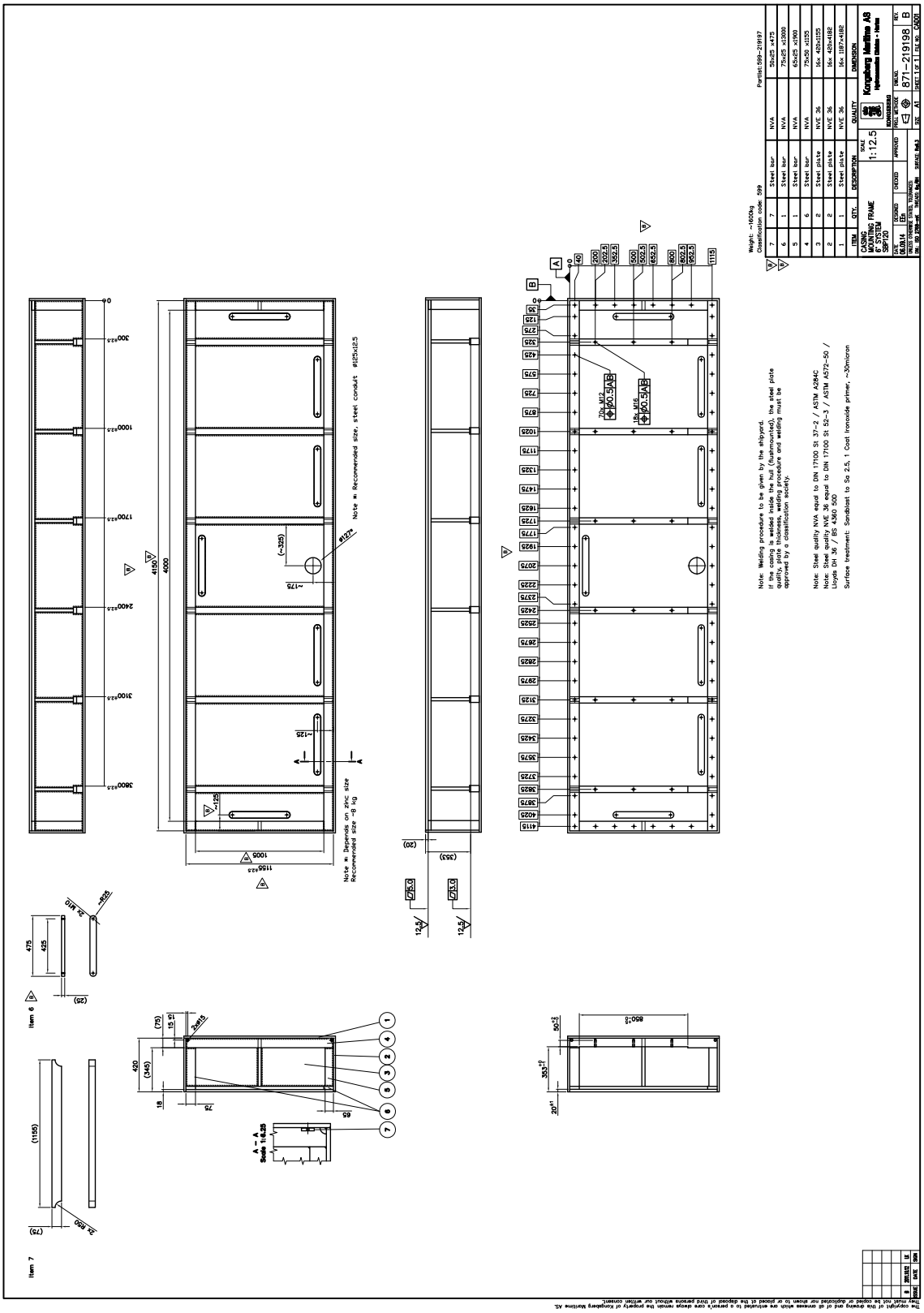


Figure 22 , 388148

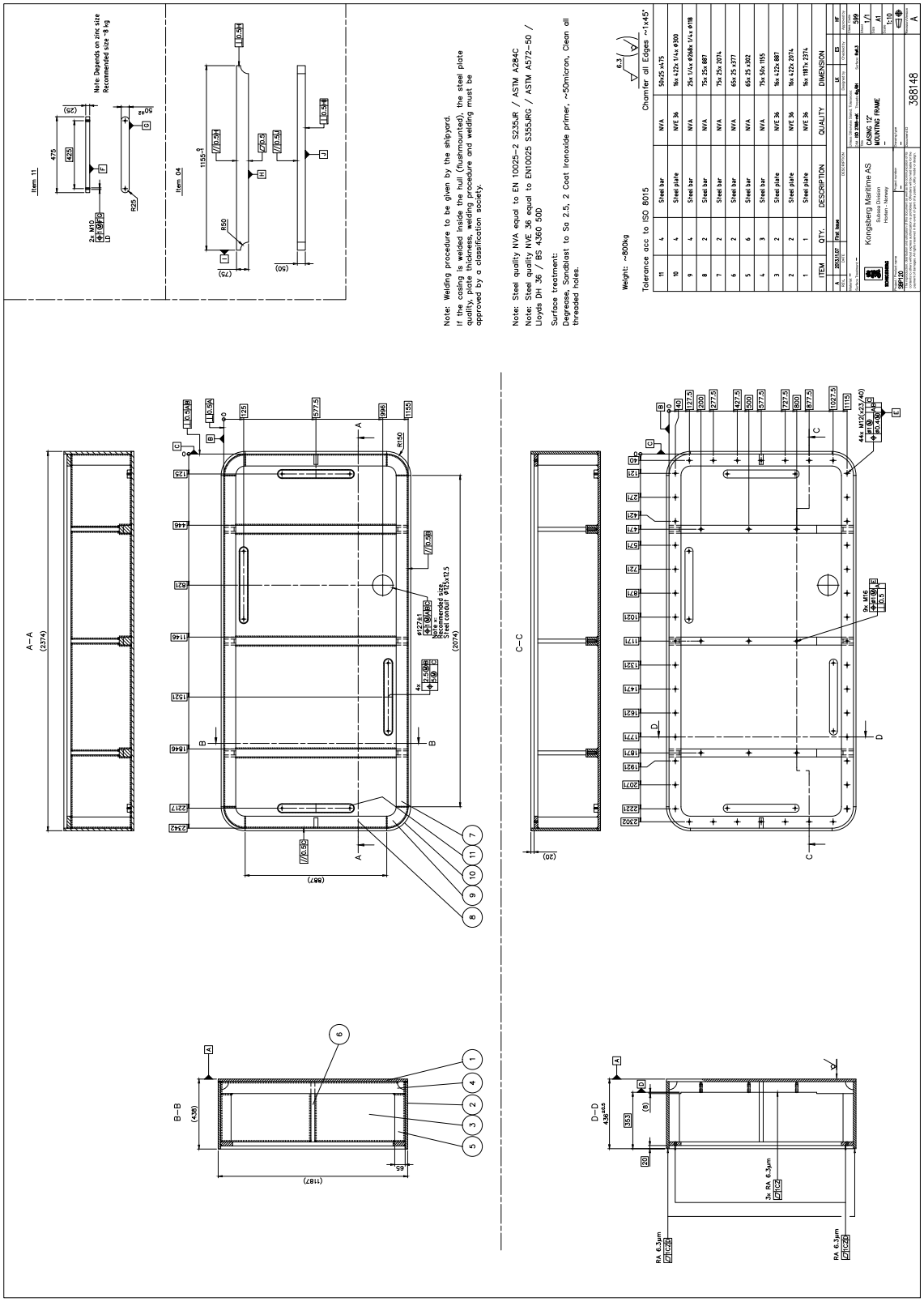


Figure 23 , 315550

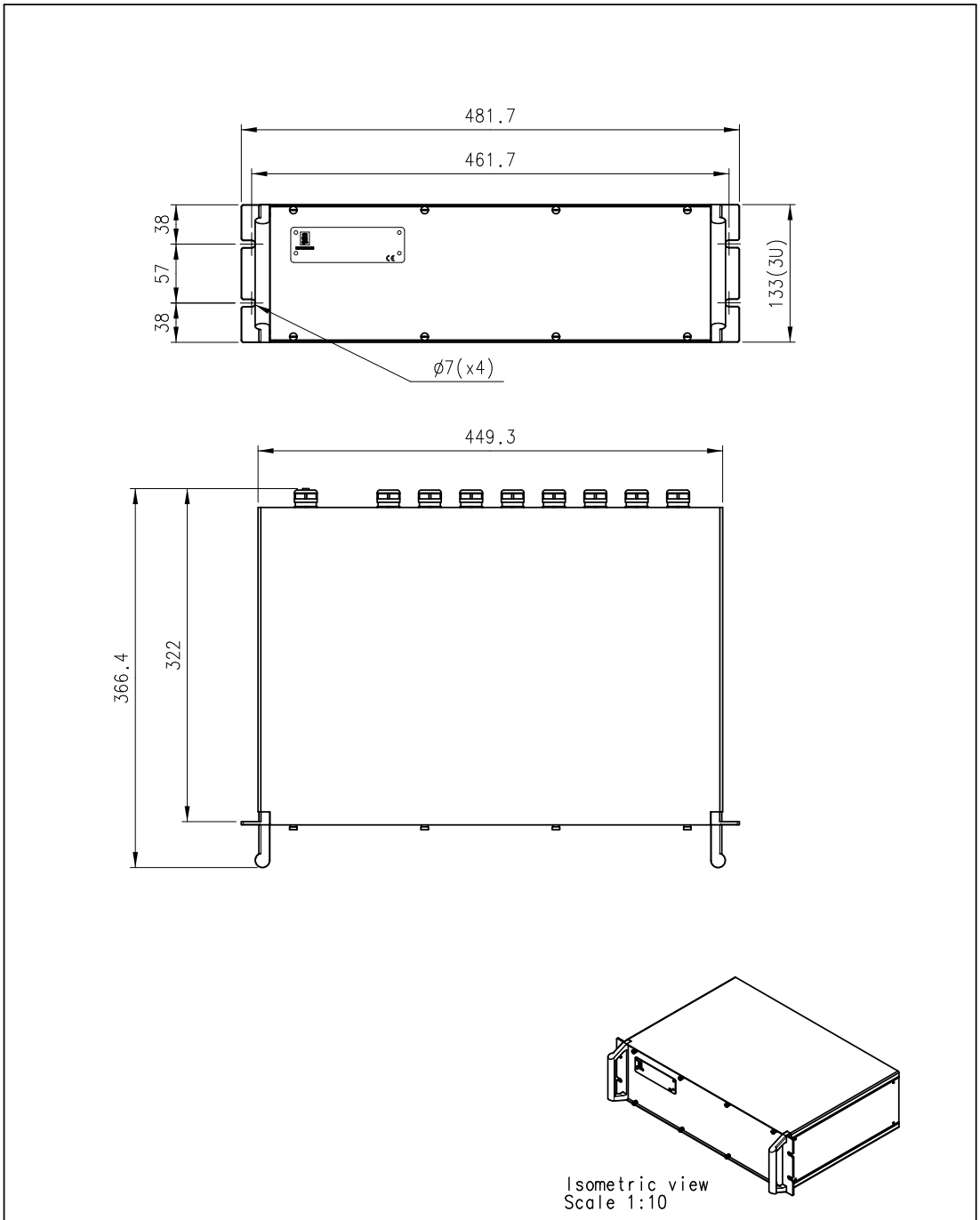


Figure 24 , 430751

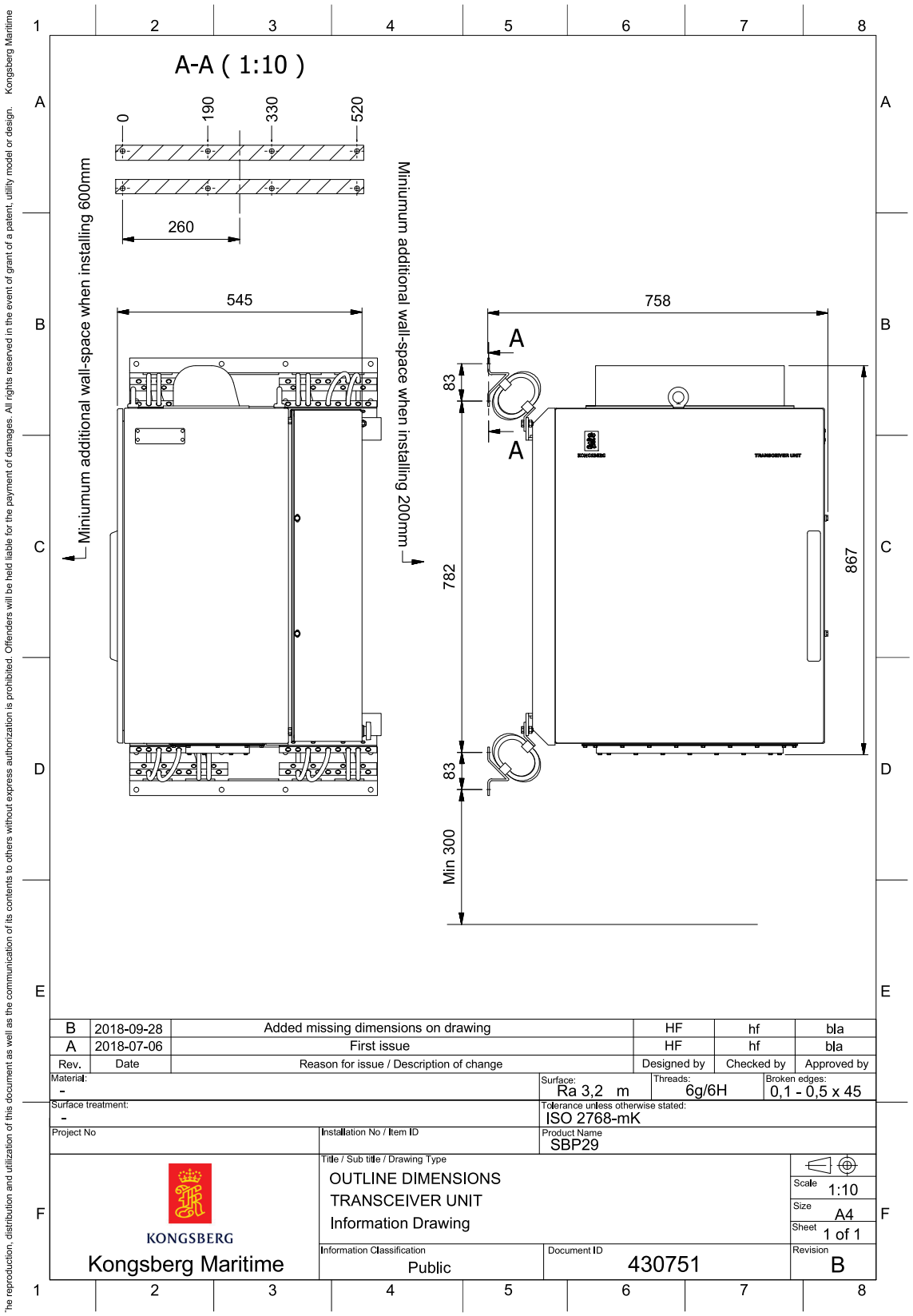


Figure 25 , 871–212984

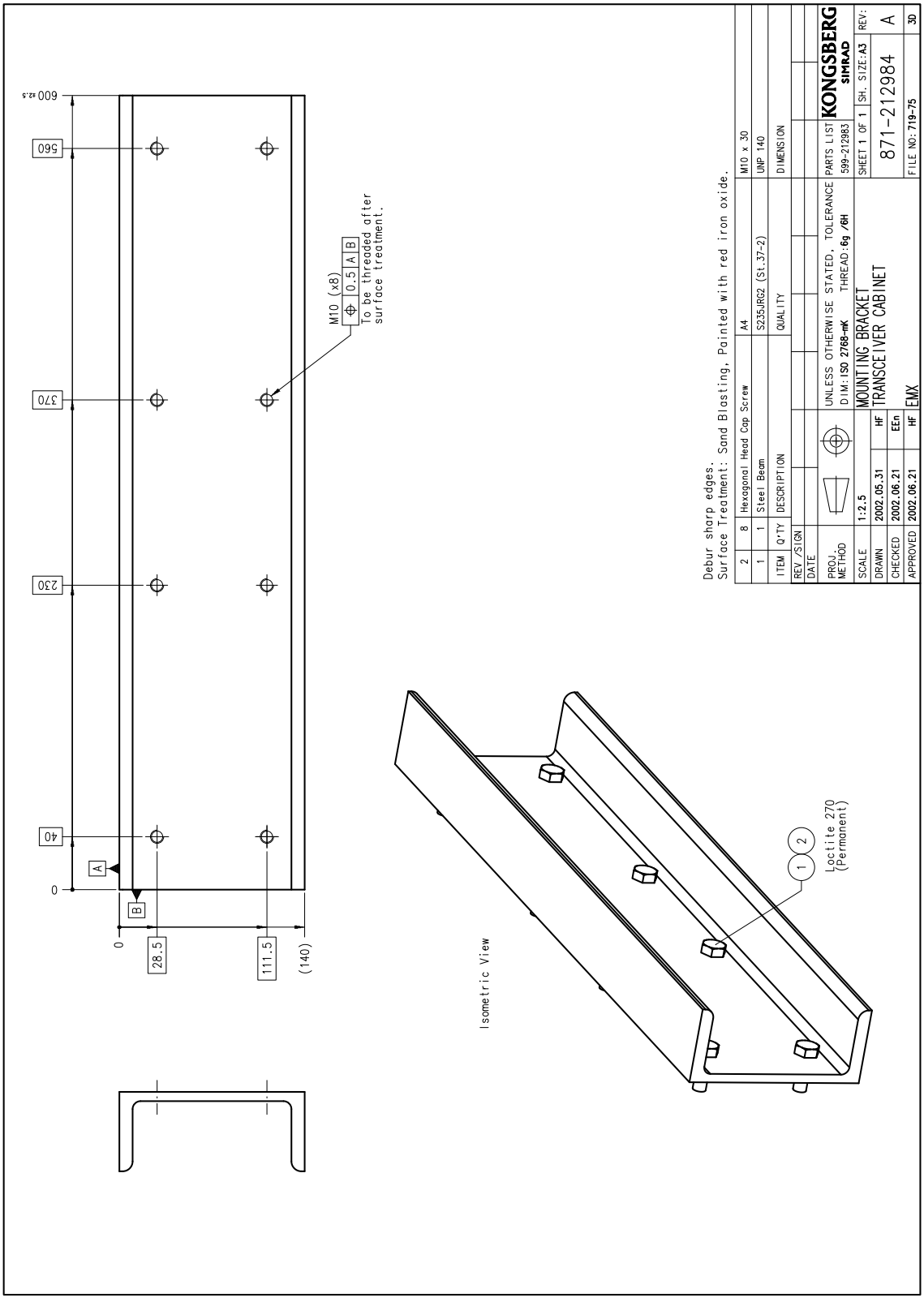


Figure 26 , 407070

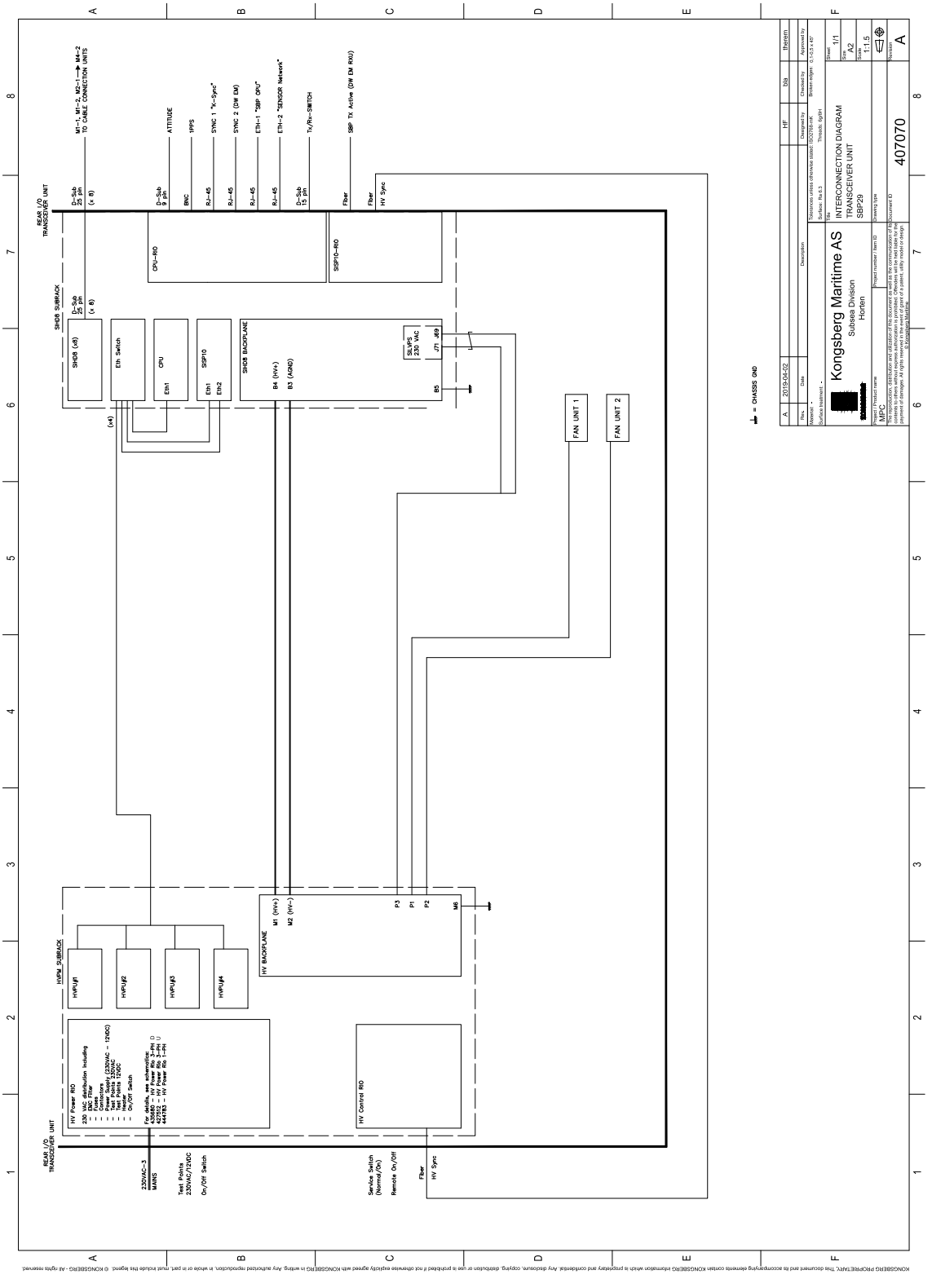


Figure 27 , 448231_1A

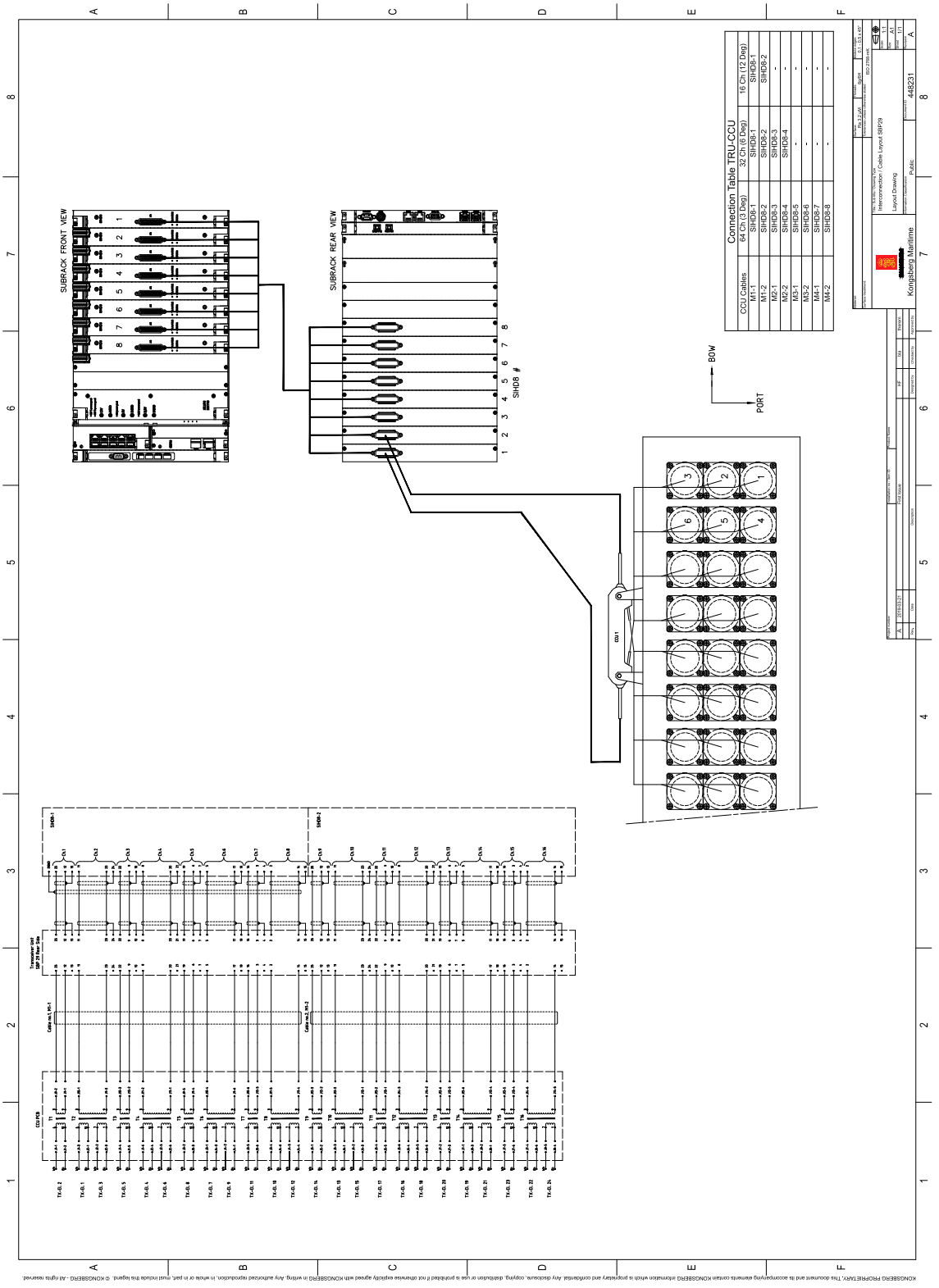


Figure 28 , 427512

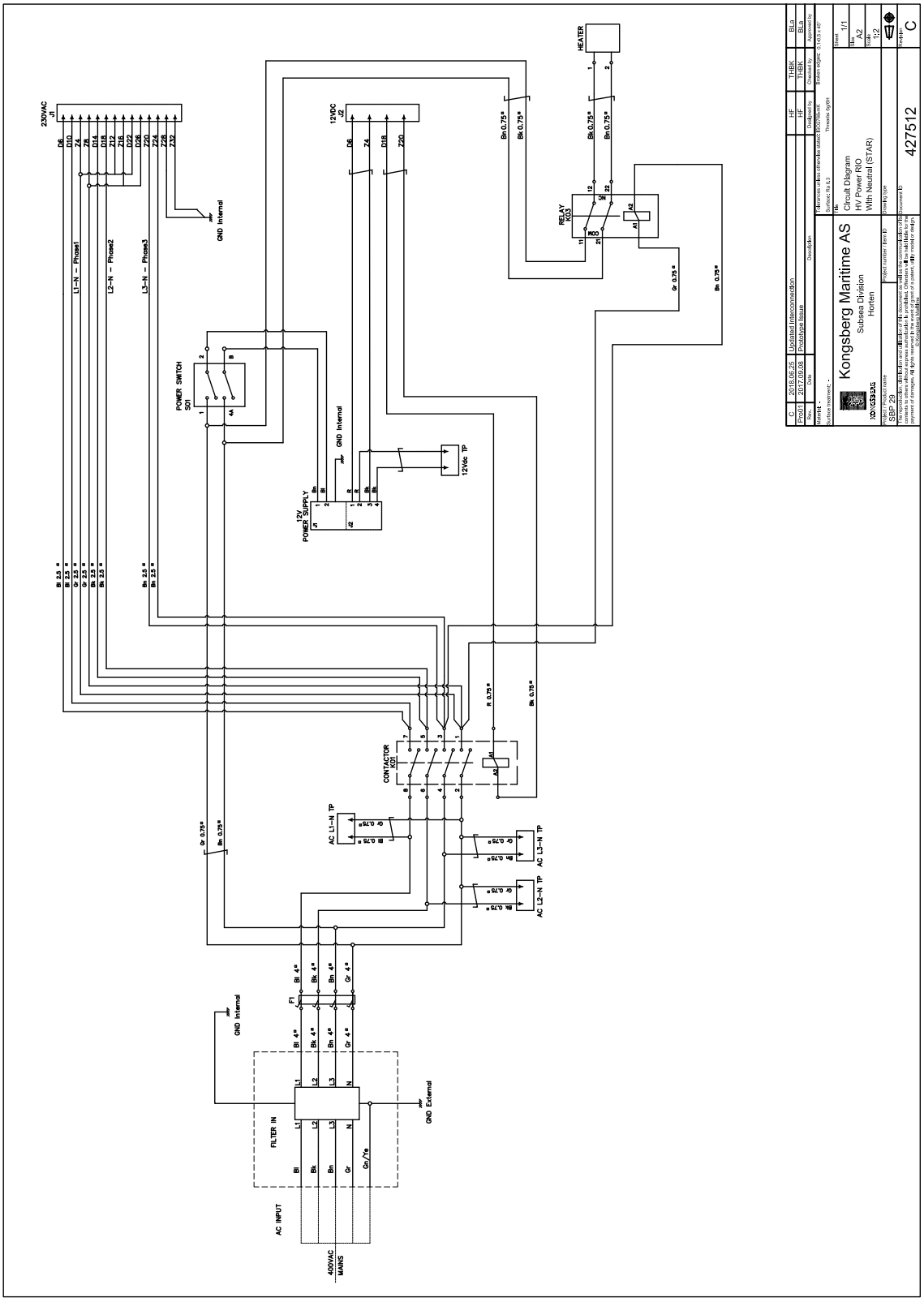


Figure 29 , 435680

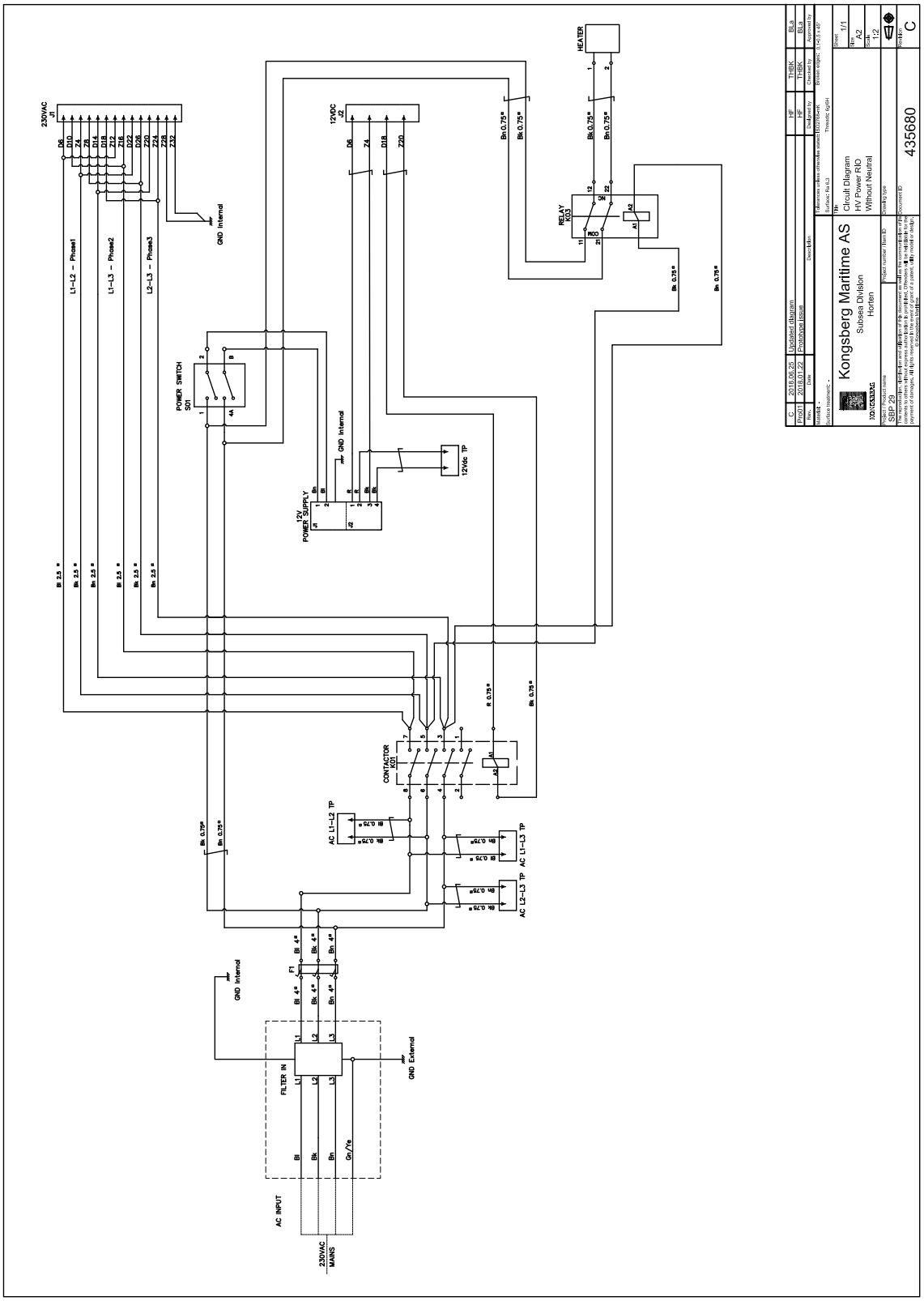
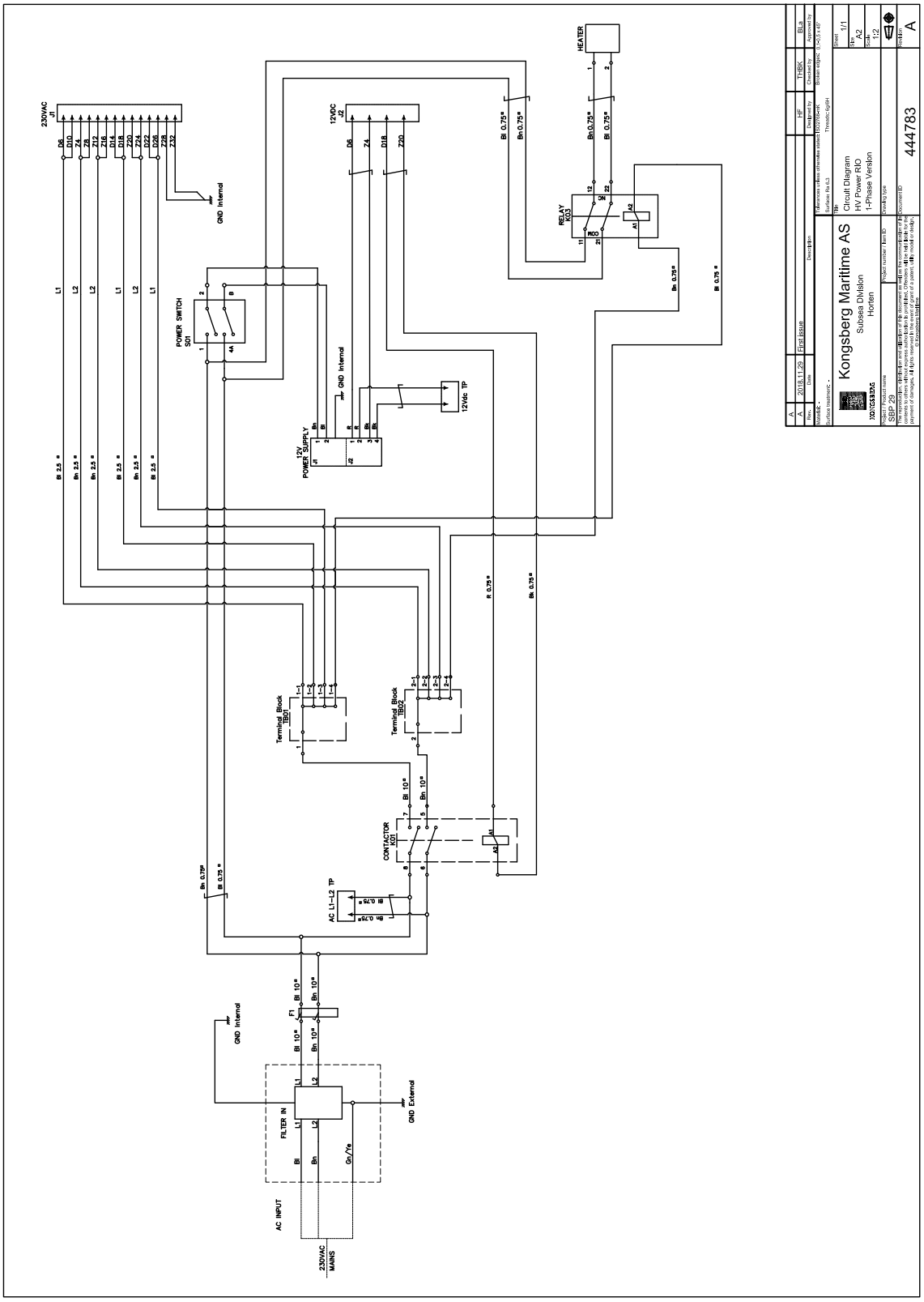


Figure 30 , 444783



Installation requirements

Supply power requirements

Observe the general requirements related to the supply power.

The supply voltage to the SBP 29 must be kept within ±10% of the installation's nominal voltage.

Maximum transient voltage variations on the main switchboard's bus-bars are not to exceed -15% to +20% of the nominal voltage (except under fault conditions).

Uninterruptible power supply (UPS) requirements

Observe these requirements related to the Uninterruptible Power Supply (UPS).

The Uninterruptible Power Supply (UPS) must have the capacity to independently maintain power to the SBP 29 for a minimum of 10 minutes. This ensures that the SBP 29 can be turned off in a controlled manner in the event of a power failure.

Cables and wiring requirements

Correct wiring is crucial for the operational performance of the SBP 29.

All cables running between system cabinets located in different rooms and/or on different decks must be supported and protected along their entire lengths using conduits and/or cable trays. Note that the cables must not be installed in the vicinity of high-power supplies and cables, antenna cables or other possible sources of interference.

All SBP 29 cables must be run in steel conduits.

For more detailed information about cables and wiring, refer to the basic cable requirements.

Compass deviation requirements

SBP 29 units that are installed on the bridge may have an effect on the compass.

Once the installation is complete, the vessel must be swung with the SBP 29 in both operative and inoperative modes.

The shipowner and captain are responsible for updating the compass deviation table accordingly with regard to the vessel's national registry and corresponding maritime authority.

Noise sources

The operational performance of the SBP 29 Sub-bottom profiler depends on the noise conditions. It is essential that the noise signature is as low as possible.

The vessel's hull, rudder(s) and propeller(s) must be thoroughly inspected in dry dock prior to installation.

Roughness below the water-line deformities in the shell plating and protruding obstacles can create underwater noise. These sources of turbulence must be smoothed or removed as best as possible.

Note

It is especially important that the propeller(s) are not pitted or damaged.

Dry docking requirements

Whenever devices for hydroacoustic use are mounted under the vessel's hull, special considerations must be made prior to dry docking.

Do not place supporting blocks or structures in the vicinity of the SBP 29.

The location of the SBP 29 must be noted on the vessel's docking plan for future reference.

Prior to dry docking, power down the SBP 29. Disengage the circuit breaker if necessary. Label the Hydrographic Work Station and/or the circuit breaker clearly to prevent anyone from powering up the SBP 29 accidentally.

Requirement for classification approval

Classification approval is required for the SBP 29 installation.

The shipowner and shipyard performing the installation are responsible for obtaining the classification approval.

Equipment handling

Observe these basic rules for transportation, storage and handling of units. In this context, a *unit* may be any large or small part of the system. It can be supplied as part of the initial delivery, or as a spare part. The phrase *box* is used to describe all kinds of cases, wooden or cardboard boxes etc used to hold the *unit*.

Supply power requirements

The supply voltage to the SBP 29 must be kept within ±10% of the installation's nominal voltage.

Maximum transient voltage variations on the main switchboard's bus-bars are not to exceed -15% to +20% of the nominal voltage (except under fault conditions).

Kongsberg Maritime strongly recommends that the SBP 29 Hydrographic Work Station is powered through Uninterruptible Power Supply (UPS). The UPS must be large enough to allow minimum 10 minutes operation. The system can then be switched off in a controlled manner in case of power failures.

Environmental requirements

Vibrations

If the equipment is expected to be exposed to excessive vibration for extended periods, special dampening precautions must be taken.

Temperature and humidity

All equipment, unless otherwise specified, must be protected from temperature extremes and excessive humidity.

Wiring

All cables between the bridge, the various operation- and equipment rooms, must be supported and protected along their entire length using conduits or cable trays. Note that the cables must not be installed in the vicinity of high-power supplies and cables, antenna cables or other possible sources of interference.

Transporting Kongsberg Maritime equipment

Unless otherwise stated in the accompanying documentation, electronic, electromechanical and mechanical units supplied by Kongsberg Maritime can be only transported using methods approved for delicate and fragile equipment.

Prerequisites

Transportation methods approved for delicate equipment includes transportation by road, rail, air or sea.

Context

The units are to be transported in accordance with general or specific instructions for the appropriate unit(s), using pallets, transport cases, wooden boxes, or carton boxes as appropriate.

Observe the packing instructions.

Note

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

Procedure

1 Ensure that all local transportation is done according to the same specifications as for the initial delivery.

2 Make sure that the box containing the unit is kept dry at all times, and sheltered from the weather.

It must not be subjected to shocks, excessive vibration or other rough handling. The box will normally be marked with text or symbols indicating which way it is to be placed. Follow the instructions provided, and make sure that the box is always placed with its “top” facing upwards.

3 Make sure that the box is not used for any purpose for which it was not intended (step, table, etc.).

In the absence of other information, no other boxes must be stacked on top of it.

4 Handle all boxes and units with care.

Note

Due to the nature of Kongsberg Maritime’s products, and the extensive use of delicate electronic parts, all units and boxes must be regarded and handled as fragile equipment.

Lifting units and transportation boxes

Some of the boxes used to hold equipment units may be heavy. Use caution when lifting.

Prerequisites

Units and boxes may be heavy. Make sure that you have the necessary equipment required for lifting heavy items. Persons using the lifting equipment must be skilled and have the relevant certificate(s).

Context

A heavy box will normally be marked with its weight. The weights of other boxes in the shipment will normally be entered on the packing list(s).

Heavy units may be equipped with dedicated lifting lugs for transportation by crane within the workshop or installation area.

Note

Observe the local rules and regulations related to the use of lifting equipment.

Procedure

1 Check the weight of the box or unit before you attempt to lift it.

2 Make sure that you have the relevant lifting apparatus required, and that this equipment is approved and certified for the load.

3 If you need to use a crane:

   a Check the applicable weight certificate for the crane.

   b Check the security of the lifting lugs.

   c If the unit to be lifted is provided with dedicated lifting lugs, make sure that all available lugs are used.

   d Make sure that the unit remains under full control during the lifting operation.

   This is important to avoid damage to the unit, equipment or personnel.

4 If you need to use a forklift truck:

   a Check the applicable weight certificate for the truck.

   b Check the limitations for lifting height and angles.

   c Pay special attention to the position of the unit's centre of gravity.

   d Make sure that the unit is properly secured to the truck during the lifting and transportation operations.

5 Handle all units and boxes with care.

Note

Due to the nature of Kongsberg Maritime's products, and the extensive use of delicate electronic parts, all units and boxes must be regarded and handled as fragile equipment.

Inspection of units and transportation boxes after arrival

A visual inspection must be done immediately after the box(es) have arrived at their destination.

Prerequisites

If you suspect that the equipment has been damaged during the transport, request that a representative of the carrier is present during the inspection.

Procedure

1 Check all boxes (wooden or cardboard boxes, plastic bags and/or pallets) for physical damage.

Look for signs of dropping, immersion in water or other mishandling.

2 If external damage is detected, open the box to check its contents.

Request that a representative of the carrier to be present while the box is opened, so any transportation damage can be identified and documented.

3 If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

Describe the damage, and collect photographic evidence if possible. Return the inspection report to Kongsberg Maritime as soon as possible.

4 If units are not damaged, check the humidity absorbing material.

If required, dry or replace the bags, then re-pack the unit(s) according to the packing instructions.

Specifications for storage prior to installation or use

When a system, a unit or a spare part has been delivered to the customer, it may be subject to long time storage prior to installation and use.

General specifications

During this storage period, certain specifications must be met. The equipment must be preserved and stored in such a way that it does not constitute any danger to health, environment or personal injury.

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

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

3 The box must not be used for any purpose for which it was not intended (work platform, steps, table etc.).

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

5 Boxes must not be placed directly on a dirt floor.

6 Do not open a box for inspection unless special circumstances permit so.

"Special circumstances" may be suspected damage to the box and its content, or inspections by civil authorities.

a If a unit is damaged, prepare an inspection report stating the condition of the unit and the actions taken. Describe the damage and collect photographic evidence if possible. Re-preserve the equipment.

b If the unit is not damaged, check the humidity absorbing material. If required, dry or replace the bags, then re-pack the unit according to the packing instructions.

7 If a box has been opened, make sure that is it closed and sealed after the inspection. Use the original packing material as far as possible.

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

9 The storage room/area's mean temperature must not be lower than -10° C, and not warmer than +50° C. If other limitations apply, the crates will be marked accordingly.

10 Boxes must not be exposed to moisture from fluid leakages.

11 Boxes must not be exposed to direct sunlight or excessive warmth from heaters.

12 Boxes must not be subjected to excessive shock and vibration.

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

Caution

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

Refer to the applicable product data sheets or battery handling procedures for further details.

Temperature protection

Any units that requires protection against extreme temperatures are identified as such in the applicable documentation. The box used to transport and store such units are clearly marked, for example:

Must not be transported or stored in temperatures below -5 °C.

Other temperature limits may be used if applicable.

If a unit needs temperature protection, the box to be used for storage and transportation must be lined on all walls, base and lid, using minimum 5 cm thick polyurethane or polystyrene foam.

Most system units can normally be stored in temperatures between -30° C and +70° C. Refer to the relevant technical specifications for details.

Note

Unless otherwise specified, transducers and hydrophones must not be stored in temperatures below −10°C and above +50°C.

Unpacking instructions

Prior to installation or use, electronic, electromechanical and mechanical units must be unpacked from their transport boxes. It is important that this unpacking is done according to the relevant instructions, and without inflicting damage to the equipment.

Topics

Unpacking standard parts and units, page 140

Prior to installation or use, parts and units must be inspected, and then unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Unpacking mechanical units, page 141

Prior to installation or use, mechanical units must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Unpacking electronic and electromechanical units, page 142

Prior to installation or use, electronic and electromechanical units must be unpacked from their transport boxes. It is important that unpacking is done without inflicting damage to the equipment.

Unpacking transducers, page 143

Prior to installation or use, transducers, sonar heads and hydrophones must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Unpacking standard parts and units

Prior to installation or use, parts and units must be inspected, and then unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Context

This procedure provides the basic tasks of unpacking units (main unit, spare parts etc) from boxes shipped from Kongsberg Maritime.

Note

If the unit in question is not unpacked for immediate use, you may consider storing it unopened in its original box. However, it may be useful to open the box to check its contents for damage and retrieve any accompanying documentation.

Do not use a knife to open cardboard boxes - the contents may be located close to the surface, and can then be damaged by the blade.

Procedure

1 Check the carton before opening it to ensure it shows no signs of dropping, immersion in water or other mishandling.

   1 If external damage is detected, open the box to check its contents.

   2 Request that a representative of the carrier to be present while the box is opened, so any transportation damage can be identified and documented.

   3 If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

     Describe the damage, and collect photographic evidence if possible. Return the inspection report to Kongsberg Maritime as soon as possible.

2 Place the box on a stable work bench or on the floor with the top of the box facing upwards.

3 In the absence of other instructions, always open the top of the carton first.

   The contents of the box will normally have been lowered into the carton from above, so this will usually be the easiest route to follow. Be careful when you open the box, and make sure that the contents are not damaged. Do not use a knife to open cardboard boxes.

4 If the box has been closed using staples, remove the staples from the carton as you open it.

   This will reduce the possibilities of scratch injury to yourself and damage to the contents.

5 If a wooden box has been closed using screws, always remove them using a screwdriver.

   Do not attempt to force the lid open with a crowbar or similar tool.

6 Once the carton is open, carefully remove all loose packing and insulation material.

7 Check for user manuals and other documents that may have been added to the carton during packing.

8 Check also for special tools, door keys etc.

Unpacking mechanical units

Prior to installation or use, mechanical units must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Mechanical and electromechanical units may be heavy.

Procedure

1 Obtain the necessary lifting equipment, and make sure that the equipment is certified for the weight.

2 Lift the unit out of the transportation box.

3 Place it in a stable position on the floor/work bench.

4 Inspect the unit for visual damage.

5 Remove any packing material that may be inside the unit.

6 Collect and keep the relevant user manuals and/or documents provided with the unit.

Unpacking electronic and electromechanical units

Prior to installation or use, electronic and electromechanical units must be unpacked from their transport boxes. It is important that unpacking is done without inflicting damage to the equipment.

Context

Electronic and electromechanical units are normally wrapped in clear antistatic plastic bags.

Do not break the seal to open a printed circuit board, an electronic module or a unit before it shall be used. If the unit is returned with a broken seal we will assume that it has been used. You will then be billed accordingly.

Note

Beware of Electrostatic Discharge (ESD)!

When you handle electronic circuit boards and modules, you must beware of the dangers of electrostatic discharge (ESD), both to yourself and to the equipment. In order to ensure safe transport and storage, circuit boards and other electronic units will always be wrapped in a clear plastic protective bag, and the bag will be sealed.

Procedure

1 Lift the unit, in its protective bag, out of the transport box.

Note

You must never use the cables to lift or carry a unit.

2 Place it in a stable position on the floor or on the workbench.

3 Inspect the unit for damage.

a If a unit has been damaged, prepare an inspection report stating the condition of the unit and actions taken.

b Describe the damage, and collect photographic evidence if possible. Return the inspection report to Kongsberg Maritime as soon as possible.

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

5 Take out and keep the documentation.

You will need the documentation if the item shall be returned to us.

6 If applicable, open the unit and check inside.

7 Remove any packing and desiccant material that may be found inside the shipping container or bag.

8 Collect and keep the relevant user manuals and/or installation documents provided with the unit.

Unpacking transducers

Prior to installation or use, transducers, sonar heads and hydrophones must be unpacked from their transport boxes. It is important that this unpacking is done without inflicting damage to the equipment.

Prerequisites

Observe the procedure for unpacking of standard parts and units.

Context

Transducers may be supplied mounted to a hull unit (if any), or packed separately. Sonar heads and hydrophones are normally packed and shipped in separate boxes. Boxes are identified by the order number and the serial number of the unit inside.

Note

Once a transducer, sonar head or hydrophone is unpacked, make sure that the body and the cabling are not exposed to any mechanical stress. Protect the transducer face with a padded cover plate to prevent damage.

Transducers may be heavy.

A SBP 29 must always be handled as a delicate instrument. Incorrect actions may damage the SBP 29 beyond repair.

Observe these SBP 29 handling rules:

- **Do not** activate the SBP 29 when it is out of the water.
- **Do not** lift the SBP 29 transducer elements or Cable Connection Units by their cables.
- **Do not** step on the SBP 29 cables.
- **Do not** handle the SBP 29 roughly and avoid impacts.
- **Do not** expose the SBP 29 to direct sunlight or excessive heat.
- **Do not** use high-pressure water, sandblasting, metal tools or strong solvents to clean the SBP 29 transducer face.

Procedure

1 Obtain the necessary lifting equipment, and make sure that the equipment is certified for the weight.

2 Lift the transducer, sonar head or hydrophone out of the transportation box.

3 Place it in a stable position on the floor/work bench.

4 Inspect the unit for visual damage.

5 Make sure that the relevant protection is kept in place until the final stages of the installation.

6 Collect and keep the relevant user manuals and/or documents provided with the unit.

7 Observe the handling rules for transducers.

Specifications for storage after unpacking

The unit must whenever possible be stored in its original transportation crate until ready for installation.

General specifications

During storage, each box must not be used for any purpose for which it was not intended (work platform, table, steps etc.).

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

Note

Do not break the seal to open a circuit board package before the board is to be used. If the board package is returned to Kongsberg Maritime with the seal broken, we will assumed that the unit has been used, and then you will be billed accordingly.

Each unit must be installed in its intended operating position as soon as possible after unpacking. If the unit contains normal batteries, these may have been disconnected/isolated before the unit was packed. These must then be reconnected during the installation procedure. Units containing batteries are marked.

Caution

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

Refer to the applicable product data sheets or battery handling procedures for further details.

Temperature protection

Any units that requires protection against extreme temperatures are identified as such in the applicable documentation. The box used to transport and store such units are clearly marked, for example:

Must not be transported or stored in temperatures below -5 °C.

Other temperature limits may be used if applicable.

If a unit needs temperature protection, the box to be used for storage and transportation must be lined on all walls, base and lid, using minimum 5 cm thick polyurethane or polystyrene foam.

Most system units can normally be stored in temperatures between -30° C and +70° C. Refer to the relevant technical specifications for details.

Note

Unless otherwise specified, transducers and hydrophones must not be stored in temperatures below −10°C and above +50°C.

General safety rules

The following safety precautions must be followed at all times during installation and maintenance work:

WARNING

The SBP 29 operates on 230 VAC at 50/60 Hz. This voltage is lethal! You must never work alone on high-voltage equipment!

1 You must always switch off all power before installation or maintenance work on the SBP 29 system.

   Use the main circuit breaker, and label the breaker with a warning sign that informs others that maintenance or installation work is in progress on the system.

2 Do not open racks or cabinet doors while sailing in rough seas.

   Doors and/or cabinet parts may suddenly swing open and cause damage or injury.

3 For safety reasons, two persons must always be present during troubleshooting with power ON.

4 Read and understand the applicable first aid instructions related to electric shock.

5 Whenever maintenance is in progress, it is essential that a first aid kit is available, and that all personnel are familiar with the first aid instructions for electrical shock.

6 The various parts of the system may be heavy.

   Make sure that the appropriate tools and certified lifting equipment are available. The personnel must be trained in relevant installation and maintenance work.

Index

E

F

G

H

I

T

U

V

W