Installation Manual

ShipCEMS Continuous Emission Measurement System

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The purpose of this installation manual is to provide the information required to install ShipCEMS in a safe and efficient manner.

This manual is intended for personnel performing the installation. The information supplied shall be used as basis for the installation contractor's own drawings applicable to the ship. On completion of the installation, this manual must be kept on the ship for reference purposes during system maintenance.

NA-E-INS-014

Revision status

Revision	Date	Prepared	Checked	Approved
Rev. 07	21.01.2019	ALI	MBA	TESA
Rev. 08	27.02.2019	ALI	MBA	TESA
Rev. 09	14.08.2019	ALI	MBA	TESA

Document history

Revision	Reason for issue
Rev. 07	Norsk Analyse logo and part no. Updated dwg/references. Additional span gas mixture. More type approvals. Higher power consumption on SCS due to heater.
Rev. 08	Part number on probe winter kit updated (chapter 7.2). Class NK added to type approvals.
Rev. 09	Exception: Quill location on wide scrubbers. New type approvals. 4.5 unpacking analyser, general updates.

Important

Before using the equipment, read all instructions thoroughly and follow all precautions and warnings contained within this document. Improper use may cause personal injury and/or damage to the equipment and may void the warranty. Norsk Analyse disclaims any responsibility for damage or injury caused by improper installation, use or maintenance of the equipment.

Table of contents

Acronyms and abbreviations

AC	Analyser Cabinet
Back flush	Refer to Back-purge
Back-purge	Cleaning of probe by flushing compressed air through
CEMS	Continuous Emission Measurement System
CO2	Carbon dioxide
DCS	Distributed Control System
DWG	Drawing
EGCS	Exhaust Gas Cleaning System (scrubber)
EMC	Electromagnetic Compatibility
GA	General Arrangement Drawing
N2	Nitrogen
PFA	Perfluoroalkoxy alkane (plastic tube material)
PTFE	Polytetrafluoroethylene (plastic tube material)
SCS	Sample conditioning system
SO2	Sulfur dioxide
SP	Sample probe

Admonitions

Note	*Text set off in this manner presents clarifying information or specific instructions relevant to the immediate instruction.*
Caution	*Text set off in this manner provides a warning notice that failure to follow the directions in this caution can result in damage to equipment.*
Warning	***Text set off in this manner provides a warning notice that failure to follow the directions in this warning can result in bodily harm or loss of life and/or extensive damage to equipment.***
DANGER	***TEXT SET OFF IN THIS MANNER PROVIDES A WARNING NOTICE THAT FAILURE TO FOLLOW THE DIRECTIONS IN THIS WARNING WILL RESULT IN BODILY HARM OR LOSS OF LIFE AND/OR EXTENSIVE DAMAGE TO EQUIPMENT.***

1 Introduction

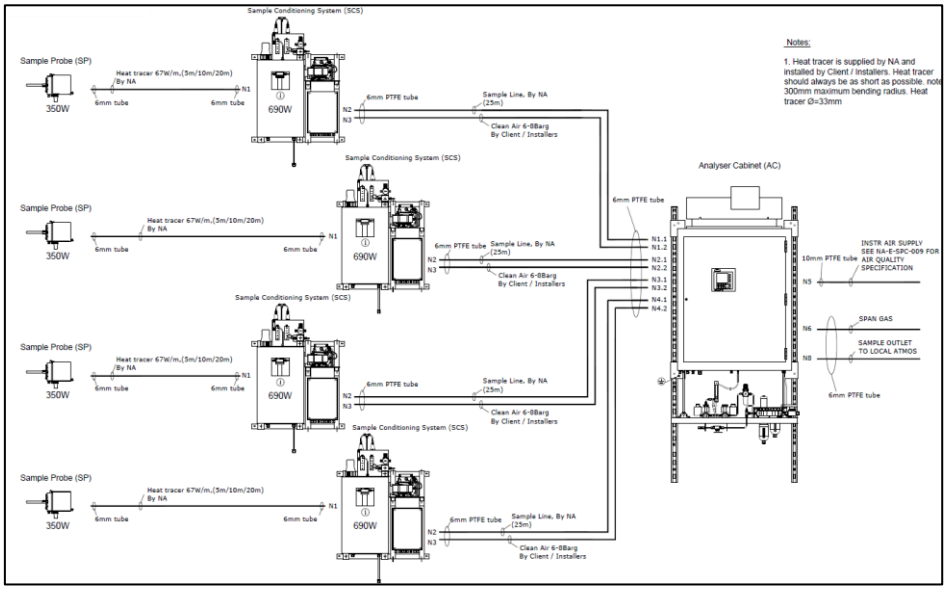
1.1 Purpose

The purpose of this installation manual is to provide the information required to install ShipCEMS in a safe and efficient manner.

This manual is intended for personnel performing the installation. The information supplied shall be used as basis for the installation contractor's own drawings applicable to the ship. On completion of the installation, this manual must be kept on the ship for reference purposes during system maintenance.

In addition to this installation manual a drawing package is prepared for your system to facilitates installation of power and signal. Request the drawing package or Quickstart guide at:
support@norskanalyse.com

Refer to chapter 10 for installation overviews.



1.2 Supply conditions

The installer performing the installation becomes fully responsible for the ShipCEMS equipment upon receipt unless otherwise stated in the contract. The duration of responsibility includes:

- The period of time the equipment is stored locally before installation.
- During the entire installation process.
- While commissioning the equipment.
- The period of time between commissioning and the final acceptance of the equipment by the ship owner.

Note	*Prior to installation, check all units for damage as described in the chapter 4.*
Note	*Installation check list needs to be signed and sent to Norsk Analyse in order to obtain guaranty of the ShipCEMS. Refer to chapter 8.*

1.3 Contact details

For enquiries related to sales, service, support, maintenance and spare parts, please contact us at:

Norsk Analyse
P.O. Box 2313, 3103 Tønsberg, Norway
www.shipcems.com

Phone: +47 3337 5100
Fax: +47 3337 5149

Support: support@norskanalyse.com
Service: service@norskanalyse.com
Spare parts: vimex@norskanalyse.com

2 General safety rules

Safety precautions must be followed at all times during installation, operation and maintenance of the system.

Personnel shall be sufficiently qualified, and proper caution shall be taken to avoid injuries or damage to life, health, environment, equipment and property.

2.1 High voltage

Warning	***ShipCEMS operates at a potentially lethal AC voltage.***

Always switch off all power before installation or maintenance. Adhere to safety precautions and instructions as directed by company policy.

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

Whenever installation or maintenance is carried out, it is essential that a first aid kit is available, and that personnel are familiar with the first aid instructions for electrical shock.

2.2 Hazardous components

The sample gas may contain trace amounts of hazardous components.

Warning	***Many toxic gases are colourless, odourless and non-irritating, and may overcome exposed persons without notice.***

Personnel should have a thorough knowledge and understanding of the physical properties and safety precautions for the relevant gas samples before operating the system.

Gas inlets and outlets are hot in heated analyser systems. Skin contact may result in serious burns even for a long period after the equipment has been switched off.

Make sure the ventilation is good especially if the analyser cabinet is in a small room. Ensure that gas has access to free air.

2.3 Heavy equipment

The cabinets for the analyser system and the sample conditioning system are heavy units.

Caution	*During installation or replacement of larger units, appropriate safety clothing and certified lifting equipment must be used.*

Do not open cabinet doors while in rough seas. Doors may suddenly swing open and cause damage or injury.

3 System description

3.1 System overview

The main purpose of the ShipCEMS Continuous Emission Monitoring System is to analyse sulphur dioxide and carbon dioxide in wet marine exhaust gas.

The standard ShipCEMS consists of the following main units:

- Analyser cabinet (AC)
- Sample conditioning system(s) SCS)
- Heated sample probe(s)
- Heated sample line (wet)
- Sample line (dry)

Optional equipment covered by this manual:

- Air dryer units

Optional gas cylinders are provided by the ship owner or by Norsk Analyse as specified by contract.

External tubing and electrical interface cables to be provided by installer.

Note	*Equipment provided locally by the installation contractor or by local dealers is not described in this manual.*

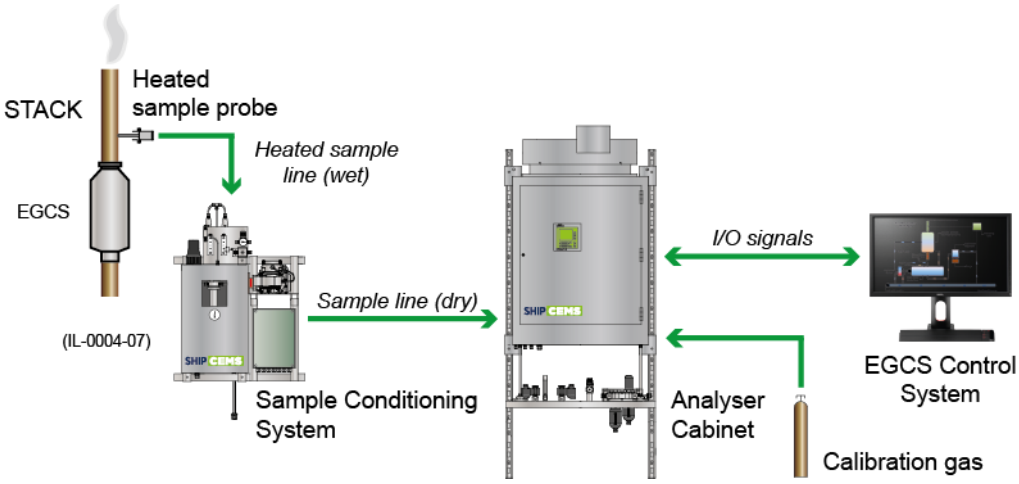


Figure 1 *Block diagram for ShipCEMS analyser system*

3.2 Example of layout

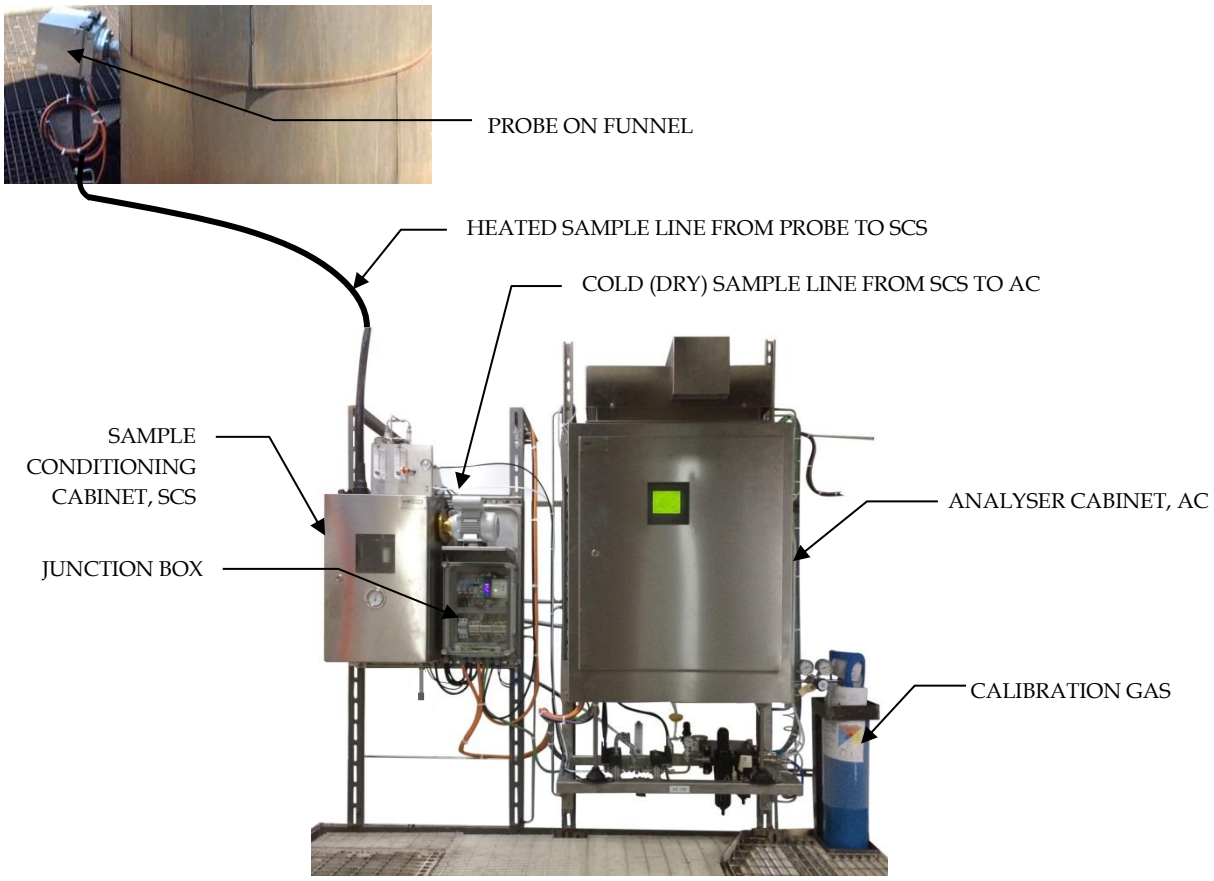


Figure 2 ShipCEMS main parts

3.3 Sample and calibration gas flow

Compressed air supply is provided by the ship. The tube is provided and installed by the installation contractor (refer to A in Figure 3 and to utility requirements ShipCEMS). All other tubes are provided by the manufacturer but is installed by the installation contractor (refer to B-F2 in Figure 3).

The sample line (wet) between the probe and the sample conditioning cabinet is heat traced (refer to C in Figure 3).
The sample line (dry) between the sample conditioning cabinet and the analyser cabinet is normally not heated. It should only be heated if the ambient temperature may drop below +5°C (+41°F) (outdoor installations only) (refer to D in Figure 3).

The compressed air supply tube between ShipCEMS cabinets must be heated if the ambient temperature may drop below 0°C (+32°F) (outdoor installations only). Compressed air must be clean according to specification in chapter 5.10.

Warning ***F1 and F2: Outlet gas and calibration gas from AC needs to be vented to free air. If AC is installed in a small room, the outlet gas level will increase unless it is vented. For personal safety, ensure the outlet gas has access to free air.***

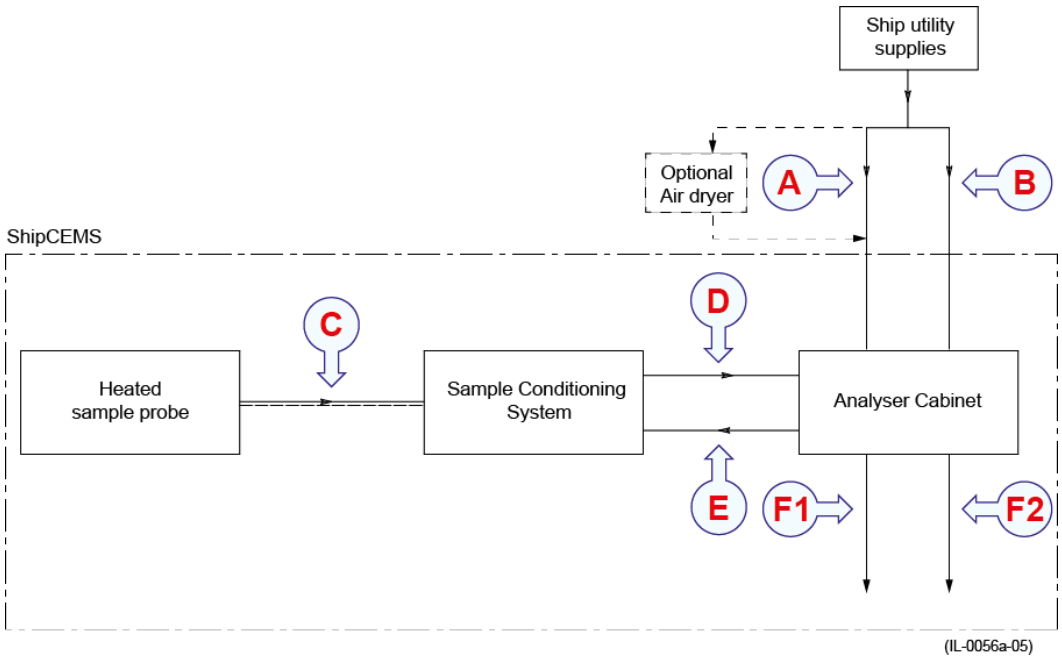


Figure 3 *Block diagram – sample and calibration gas flow*
A: Compressed air supply, 10 mm o. d. tube, SS316 compression tube fitting
B: Calibration gas, 6 mm o. d. tube, SS316 compression tube fitting
C: Heated sample line (wet), 37 mm o. d. PFA/PTFE tube
D: Sample line (dry), 6 mm o. d. PFA/PTFE tube
E: Compressed air supply tube, 6 mm o. d. PFA/PTFE tubing
F1: Analyser Atm. vent
F2: Atm. vent from stream solenoids

3.4 Power distribution

ShipCEMS requires continuous power supply 230/110V, 50/60 Hz to operate.
The minimum requirement for the power feed cables is:

- 230V: 2 x 2.5 mm² + PE (protective earth)
- 110V: 2 x 4mm² + PE (protective earth).

All system units must be connected to a local On/Off two-pole power switch located within a radius of 1.5 metres. All switches must be provided by the installation contractor.

Warning	***Use the appropriate circuit breaker in the ship's switchboard and label the breaker with a warning sign informing that installation work is being carried out before connecting external power.***

The circuit breaker label can only be removed after all power and signal interfaces have been connected.

The heated sample line for the exhaust gas sample is powered from the sample conditioning system, SCS.

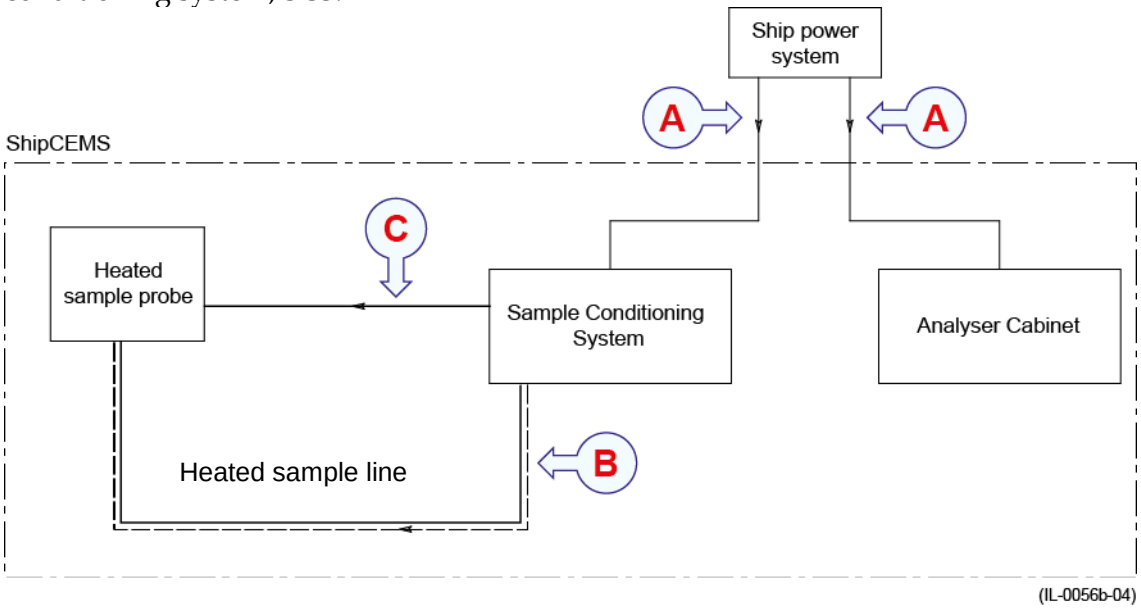


Figure 4 *Block diagram – power distribution*
A: Power supply, 2-phase
B: Heated sample line from sample conditioning cabinet
C: Power feed from sample conditioning system

3.5 Signal distribution

Refer to the following block diagrams for overview:

→ *[6001] System Block Diagram Pipe and Gas Distribution Overview*

→ *[6002] Electrical Block Diagram Signal and Power Distribution Overview Interface unit - Optional*

3.5.1 Without ShipCEMS interface unit

Digital and analogue signals to and from the DCS or EGCS must be interconnected using multicore/multipair instrument cables (refer to A and B in Figure 5).

Alarm signals between ShipCEMS units must be interconnected using two pair instrument cables (ref. C in Figure 5).

All cables shall be provided and installed by the installation contractor.

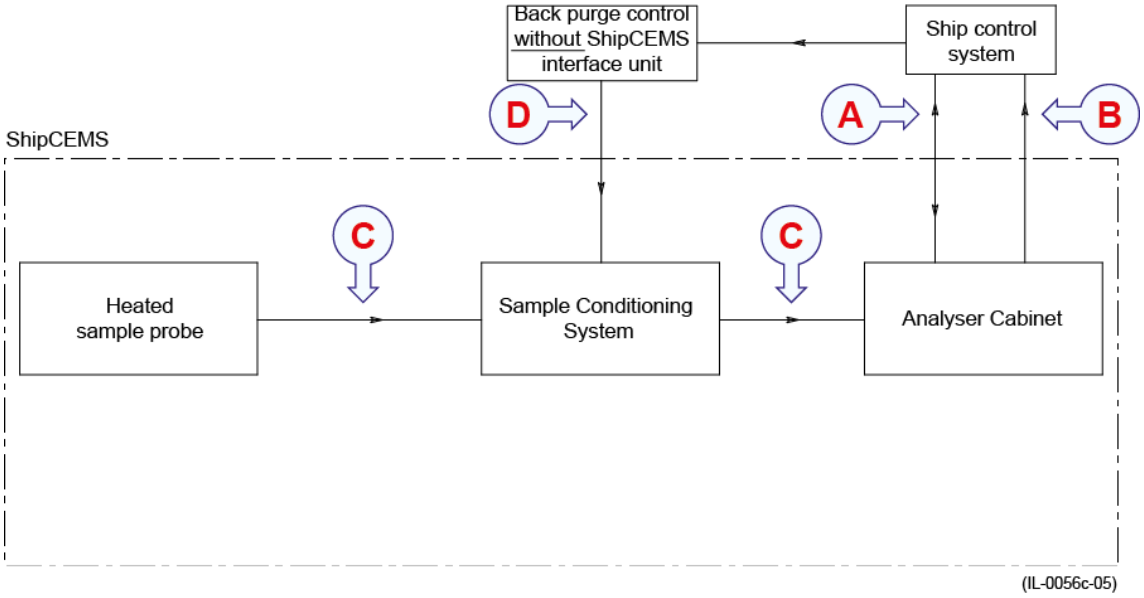
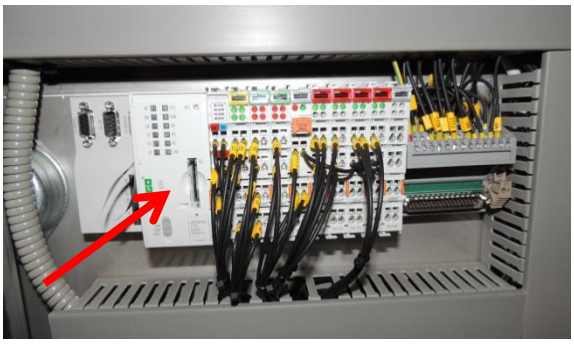


Figure 5 *Block diagram – signal distribution*
A: Digital signals
B: Analogue signals
C: Alarm signals (digital)
D: Back-purge control signal (+24VDC), supplied by customer

3.5.2 With ShipCEMS interface unit, SC-IU (option)

Communication to client is through fieldbus communication, usually Profibus and Modbus. Refer to A in Figure 6.



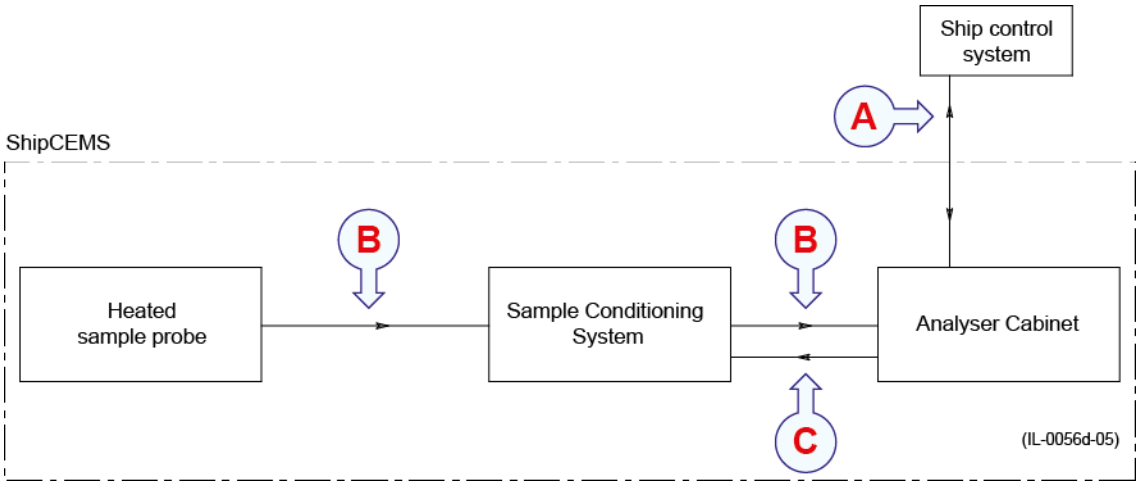


Figure 6 *Block diagram – signal distribution*
A: Field bus communication
B: Alarm signals (digital)
C: Back-purge control signal (+24VDC)

4 Equipment handling

This chapter describes the equipment handling procedures needed for the installation contractor to evaluate the equipment dispatch and to make plans for receipt, storage and installation of the equipment.

Note	*Failure to adhere to instructions given may render the guarantee void.*
Caution	***During all stages of equipment handling, including installation, use adequate protective covers to shelter the equipment from falling objects from overhead work or similar.***

4.1 Transportation

Unless otherwise stated in the accompanying documentation, equipment supplied by Norsk Analyse can be transported using all methods approved for fragile equipment. The units must be transported in accordance with general or specific instructions for the appropriate units, using pallets, transport cases or carton boxes as appropriate.

1) Always keep the equipment dry and ensure it is sheltered from weather.
   All equipment shall therefore be transported below deck for sea transport, and preferably under a canopy for road transport.
2) When equipment is marked with text and symbols indicating which way it is to be placed, follow the instructions given.
3) Ensure that ambient conditions, such as temperature and humidity, are always within the equipment's specifications.
4) Securely restrain the equipment to avoid mechanical damage and injury to the equipment and to personnel.
5) Ensure that the equipment will not be subject to shock, excessive vibrations or other rough handling.
6) Handle equipment containing fragile electronic components, such as analyser model, with special care.

4.2 Inspection at receipt

A visual inspection must be carried out immediately after the equipment has arrived at its destination to check for any transport or unloading damages.

1) Check all pallets, wooden boxes, plastic bags and other packing media for physical damage. Look for signs of dropping, immersion in water or other mishandling.
2) If damage is detected externally, open the packaging to check the contents. Request a representative of the carrier to be present while opening, so any transportation damage to single units can be identified.
3) If any unit is damaged, prepare an inspection report stating the condition of the unit and actions taken. The report shall be sent promptly to Norsk Analyse.
4) Check the humidity absorbing material. If required, dry or replace the bags, then repack the units.

4.3 Lifting

Heavy equipment will normally be marked with its weight. To ensure selecting the correct lifting apparatus, always check the weight of the equipment before attempting to lift it.

Caution	*Please handle all equipment with care to avoid damage due to sudden shock or impact.*

1) Cabinets and similar equipment are mounted onto pallets and can be lifted by a fork lift or a pallet truck.
2) The AC cabinet is equipped with lifting lugs (Ø15 mm in 4 mm SS316 plate) and can be lifted by a crane or a winch.
3) Instrument boxes, sample probes and other smaller units can be removed from pallets by hand.

4.4 Pre-installation storage

The equipment should be stored in its original transport case until ready for installation. Transport cases must not be used for any purpose for which they were not intended.

It is recommended that the equipment is stored indoors until placed in its intended operating position.

If stored outdoors and exposed to ambient conditions, additional heaters provided by the installation contractor must be used inside cabinets to avoid any vapour to condense in electronic and electrical equipment prior to commissioning and start-up.

1) Keep the equipment in a dry, non-condensing atmosphere, free from corrosive agents and isolated from sources of vibration.
2) Ensure that the temperature at the storage location is at least +15°C (+59°F) with a relative humidity of 0 to 95 % (non-condensing).
3) Carefully unload cabinets onto their foundation or at levelled foundations at the site's storage facilities.
4) If stored in a humid environment, ensure that cabinets are heated to avoid failure of built-in sensitive instrumentation, such as analysers. Note that sample probes and similar equipment may be stored in an unheated environment.
5) Close all doors and other openings to prevent ingress of dust, dirt and moisture.
6) Always lock the cabinets to prevent unauthorised personnel accessing the equipment.

4.5 Unpacking

Normal precautions must be undertaken during unpacking to prevent damage to equipment or to personnel.

It is recommended to store equipment (unless equipment is prepared for immediate use) in its original packing material.

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

It is crucial for the performance and warranty of the analyser module that it is stored in a tempered and clean environment until commissioning. The analyser is packed in the SCS cradle together with the SCS.

1) Place the transport case to be unpacked on the floor or on a stable work bench.
2) When equipment is marked with text and symbols indicating which way it is to be placed, follow the instructions given.

Caution	*When handling heavy units, use suitable certified lifting apparatus.*

Caution	*Be careful when working with pallets and wooden boxes. The metal edges of such units may be sharp.*

3) Check the transport case for signs of dropping, immersion in water or other mishandling.
4) Open the transport case using appropriate tools. Care must be used when opening the case to ensure the contents are not damaged.

Caution	*If a wooden box has been closed using screws, always remove them using a screw-driver. Do not attempt to force the lid off with a crow-bar or similar.*
Caution	*Do not use a knife to open cardboard cartons, as the contents may lie close to the surface, and may therefore be damaged by the blade.*

5) Once the transport case is open, carefully remove all loose packing and insulation material before lifting out and installing the equipment contained.

Caution	*Tubing and cable must never be used as carrying handles or lifting points.*

6) Also check the transport case for additional equipment that may have been added to the cradle during packing such as manuals, special tools, door keys etc.

5 Technical specifications

5.1 Environmental requirements

ShipCEMS is designed to comply with:

- IACS E10 - Test Specification for Type Approval
- IEC 60945 - Maritime navigation and radio communication equipment and systems – General requirements – Methods of testing and required test results
- IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code)

5.2 Type approvals

ShipCEMS is designed in accordance with the requirements of:

- DNV GL (Certificate no. A-13672)
- Lloyd's Register (Certificate no. 13/70009)
- ABS (Certificate no. 15-HS1356772)
- Bureau Veritas (Certificate no. 42658/A0 BV)
- Rina Services (Certificate no. MAC 085816XG)
- Class NK (Certificate no. TA18198M)
- KRS no. CPHT004818
- CCS no. GB19PTB00008

5.3 Physical dimensions

Item	**Specification**
Analyser cabinet	
Dimensions (W x D x H)	800 x 400 x 1000 mm (31 ½″ x 15 ¾″ x 39 ½″)
Weight	143 kg (315 lbs.)
Sample conditioning system	
Dimensions (W x D x H)	400 x 300 x 700 mm (15 ¾″ x 12″ x 27 ½″)
Weight	52 kg (115 lbs.)

Item	Specification
Heated sample probe	
Probe length	254 mm (10″)
Quill length	1 m (40″)
Flange diameter	160 mm (DN65 PN6) or 175 mm (JIS flange 10K DN65) (or other customer specific)
Weight	10 kg (22 lbs.)
Sample probe counter flange	
Dimensions	160 mm (DN65 PN6) or 175 mm (JIS flange 10K DN65) (or other customer specific)
Heated sample line (wet)	
Diameter (OD)	37 mm (1 $^{7}/_{16}$")
Weight	1.2 kg/m (0.4 lbs./ft.)

5.4 Materials

Item	Specification
Cabinets	SS316L
Tubing	PFA/PTFE
Fittings	SS316L
Heated sample probe quill	SS316L
Heated sample probe counter flange	SS316L (or customer specific)

5.5 Ingress protection

- IP44

5.6 Power supply

Item	Specification
Power from ship switchboard	230V, 2-phase, 50/60 Hz Option: 110V, 2-phase, 50/60 Hz
Power cable specifications	230V: 2 x 2.5 mm^2 + PE 110V: 2 x 4 mm^2 + PE

5.7 Power consumption

Item	Specification
Analyser cabinet	590 W
Sample conditioning system	690 W
Heated sample probe	350 W
Heated sample line (wet)	67 W/m
Sample line (dry)	Non heated if ambient temperature > +5°C (+41°F). 15 W/m if ambient temperature < +5°C (+41°F)

5.8 Measuring range

Item	Specification
SO2	Default 0-200 ppm, Max 0-1000 ppm
CO2	Default 0-10 %, Max 0-15 %

5.9 Calibration gas (span)

Item	Specification
Gas composition *Standard specifications. Other gas compositions may be ordered on request.*	160 ppm SO_2 8 mol% CO_2 Rest Nitrogen N_2 Or 40 ppm SO_2 8 mol% CO_2 Rest Nitrogen N_2
Cylinder size	10 litre
Cylinder pressure	> 100 barg (> 1500 psig)

5.10 Compressed air

Item	Specification
Quality	Dry, oil-free according to **ISO 8573-1:2010 class [4: 3: 4]:** Solid particles (1-5 micron) ≤ 10000 Vapour pressure dew point (atm.) ≤ -20°C Total oil (aerosol liquid and vapour): ≤ 5 mg/m^3
Consumption for each connected SCS (max 4)	Minimum 15 Nl/min (0.9 Nm^3/hour) @ atmospheric pressure
Pressure range	6 to 8 barg (90 to 120 psig)

5.11 Tubing

ShipCEMS provides tubing (PFA/PTFE) with the rest of the delivery.

Caution	*Do not use any other tubing. It can lead to incorrect analysis.*

6 Installation guidelines

ShipCEMS is subject for approvals by classification societies. The approval design and verification is obtained according to the latest IACS E10 revision.

Best practice proven over many years of experience by the installation contractor can be used to implement other installation solutions than what Norsk Analyse recommends. As the installation contractor has the final EMC responsibility, the installation contractor must ensure that the installation complies with classification rules. The classification society may also enforce additional requirements influencing the installation. The installation contractor must ensure that the ShipCEMS installation complies with any additional requirement defined by the classification society.

ShipCEMS must be installed by skilled personnel and be supervised by a technician with relevant experience. Recommendations and requirements for installation of main system items are listed in the following.

Note	*Failure to adhere to instructions given may render the guarantee void.*

All work shall be carried out in accordance with approved drawings. Therefore, prior to installation, the drawing file prepared by Norsk Analyse shall be consulted.

Note	*Detailed plant specific mechanical drawings for the installation must be provided by the installation contractor, or any contractor performing the installation. Norsk Analyse may, on special order, provide assistance to these drawings.*
Note	*All physical dimensions in this manual are given in millimetres (metric).*
Caution	***Instruments, cables and other electrical equipment must be protected against mechanical damage during installation.***

Observe that the ShipCEMS framework structure is of stainless-steel material SS316L. Plan your installation procedures accordingly. Install cabinets (especially analyser cabinet) on reinforced floor/wall or structural beams.

Caution	***As instruments are sensitive devices, do not weld onto the ShipCEMS framework.***

If planning to install any ShipCEMS units outdoors, weatherproof protection must be provided. Also avoid installing in open areas with heavy winds, sea splash zones and other areas not suitable for service and maintenance activities.

7 Installation procedures

7.1 Heated sample line (wet)

The heated sample line is supplied on a reel or similar. We recommend that the heated sample line is installed downward towards the SCS, unless other options are better suited for the installation. Refer to *Figure 9*.

Avoid areas where the ambient temperature may exceed +45°C (+113°F).

The heated sample line is an isolated tube bundle consisting of two sample lines (one is spare) and a tracer cable (heating element). Refer to Figure below.

The figure below with the electric end termination is connected to the probe. The other end of the heated sample line is connected inside the SCS. Refer to *Figure 9*.

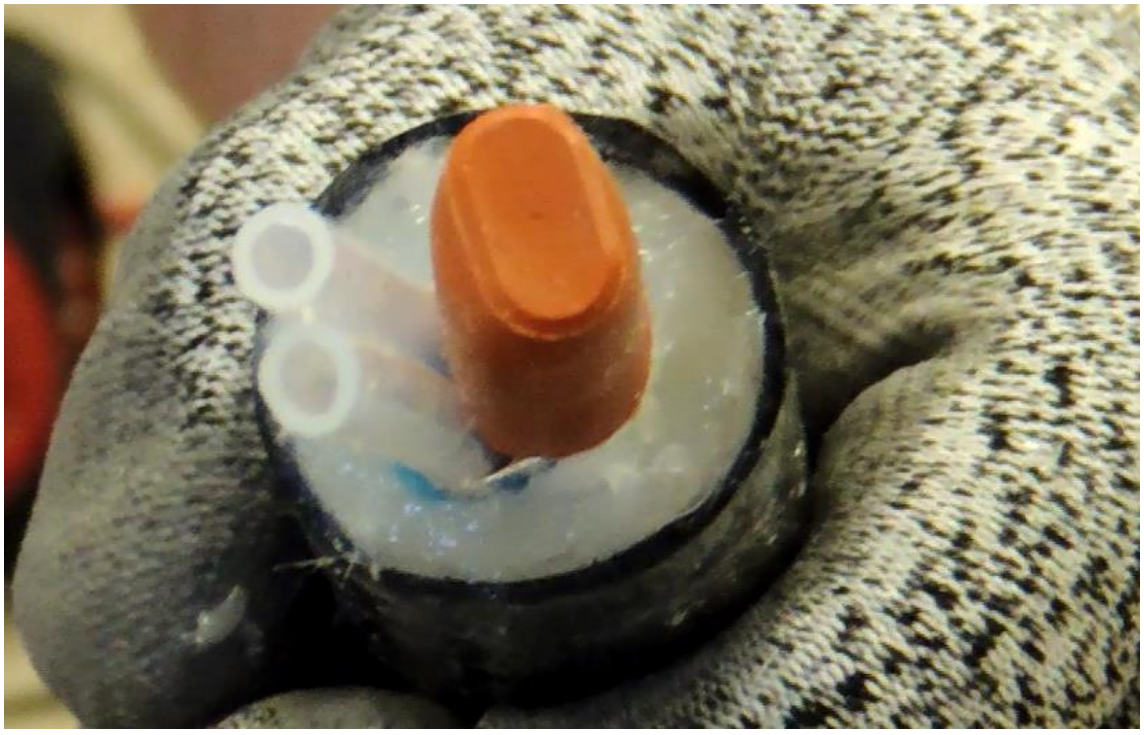


Figure 7 *Heated sample line to be connected to probe (and one spare)*

Caution	*All electrical connections and installations must comply with the requirements of all applicable national and local codes. If there is a conflict between these instructions and the requirements of applicable codes, the requirements of the codes must be followed.*

1) Roll out the heated sample line on a flat surface.
2) Route the heated sample line along existing structures such as cable trays and beams to provide sufficient support.

Caution	*Observe the minimum bending radius of 300 mm when installing the heated sample line to avoid breakage of the internal tubing and heat tracer cable.*

3) Make sure that there will not be any water traps in the heated sample line.

Caution	*Water trap will interfere with the sample and cause flow alarms! Refer to Figure 9.*

4) At both ends, cut the tube to fit the actual distance between the sample probe and the sample conditioning system.

Note	*Allow at least a spare length of one meter at each end for end terminations.*

5) Permanently secure the heated sample line using metal clamps. Make sure to use a sufficient number of support points along the route, typically every two metres to avoid water traps.
6) Temporarily seal both ends of the cable using a plastic bag.

7.2 Heated sample probe with quill

Drawing references:

- → *[1202] – GENERAL ARRANGEMENT DRAWING SAMPLE PROBE (SP)*
- → *[1210] – GENERAL ARRANGEMENT DRAWING COUNTER FLANGE*
- → *[3002] – SYSTEM DIAGRAM SAMPLE CONDITIONING SYSTEM (SCS)*
- → *[5005] – TERMINATION DIAGRAM SAMPLE PROBE (SP)*

The heated sample probe with quill is typically mounted onto the funnel using a flange. The heated sample probe should be mounted minimum 3 metres (1 m is acceptable) above the EGCS. Refer to Figure 11.

Typical size of the flange is DIN flange DN 65, PN 6, or JIS flange 10K DN65. Other sizes may be delivered if required (including ASTM). For ordinary marine exhaust systems, the flange material used is stainless steel SS316L. Other materials can be supplied if required. The opening in the funnel must be minimum 60 mm in order to replace new demister filling. Refer to Figure 11.

The heated sample probe is supplied as a complete unit, excluding the counter flange (available as option). The counter flange to be welded onto the duct shall be provided by the installation contractor.

The heated sample probe should be mounted in a section of straight duct, with a length of five duct diameters before and three diameters after an obstruction or bend. If compromises are necessary, Norsk Analyse should be consulted for advice. The quill (the tube entering the funnel) varies depending on scrubber design.

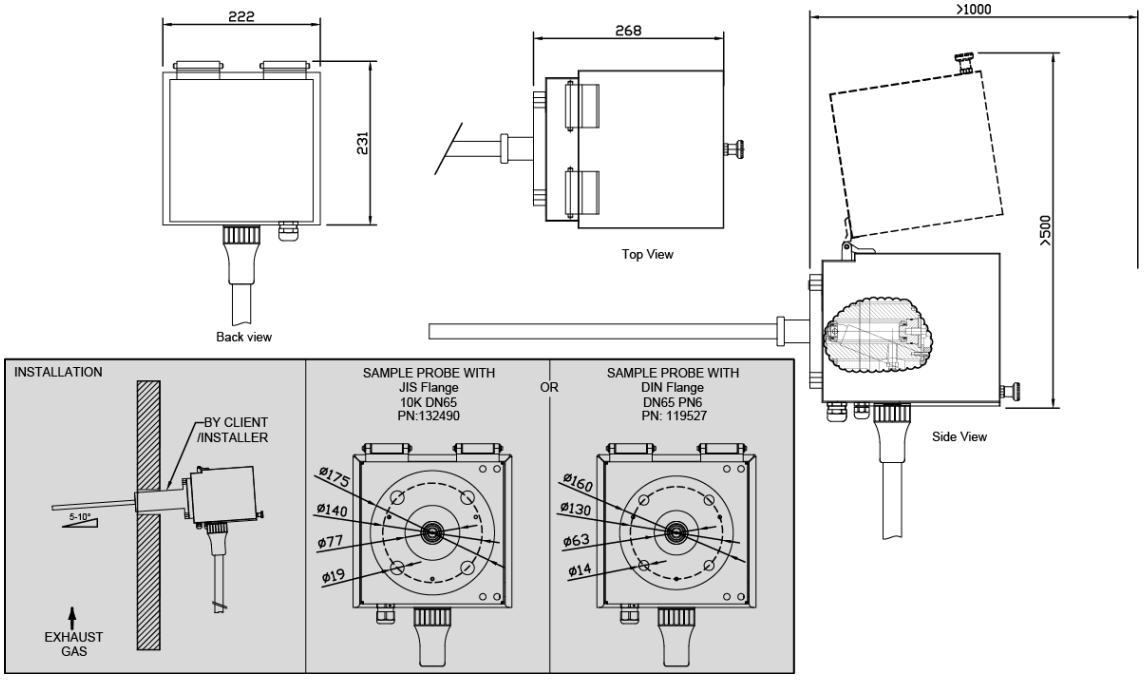


Figure 8 Outline dimensions heated sample probe and flange

Note	*The probe can be installed as per Figure 8 with sample line outlet under the probe. It can also be installed to either side or upwards.* *Make sure there is no water trap when connecting the heated sample line to the probe. Refer to* Figure 9.

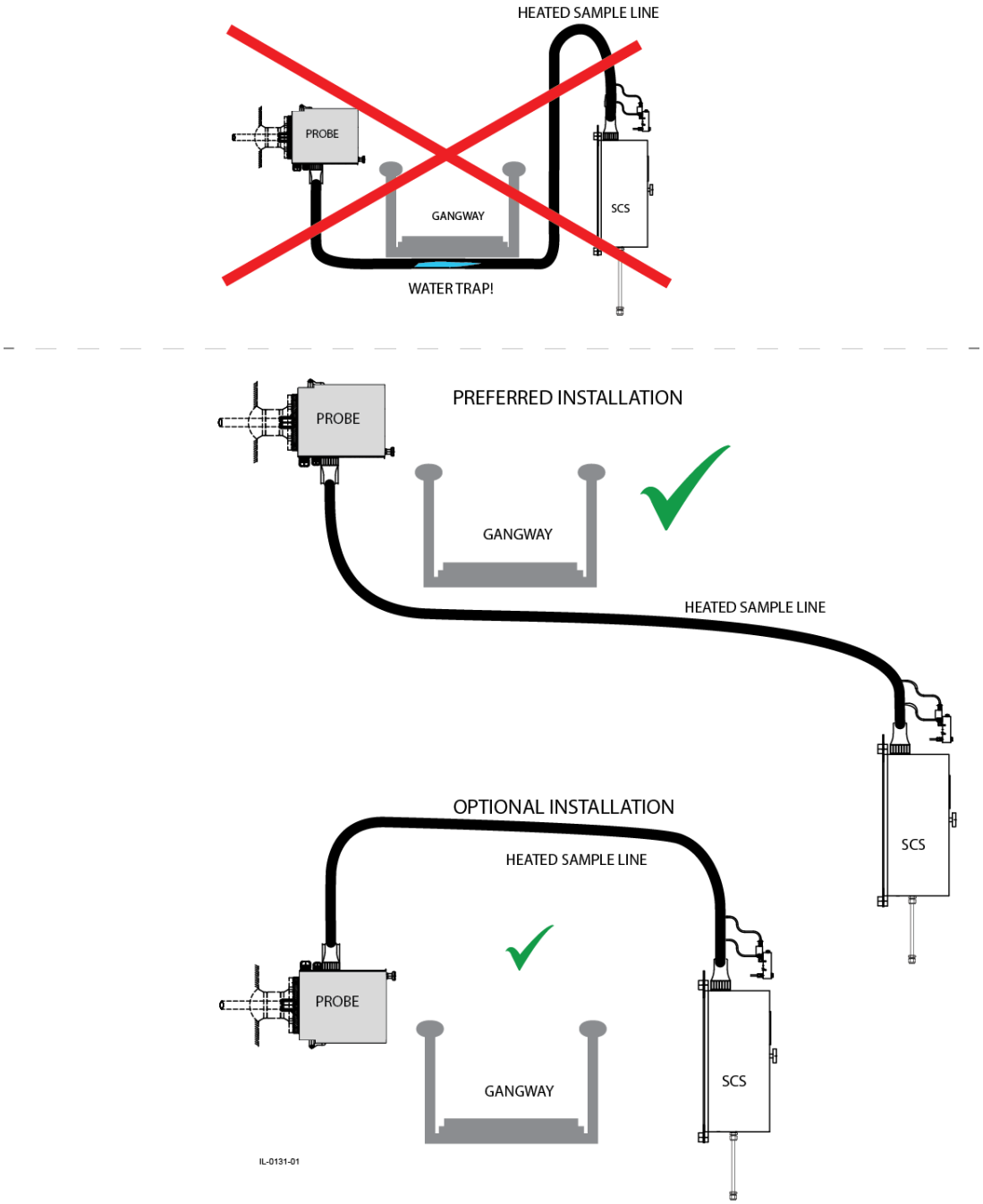


Figure 9 *Correctly installed heated sample line with no water trap*

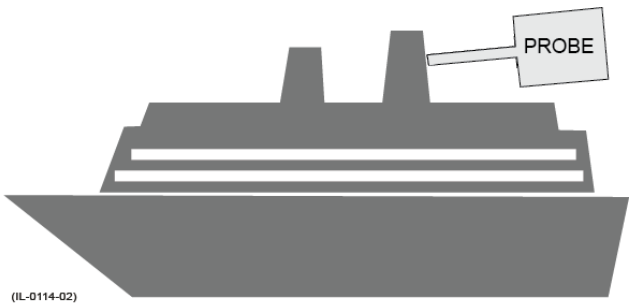


Figure 10 Probe (blow-up) location on vessel

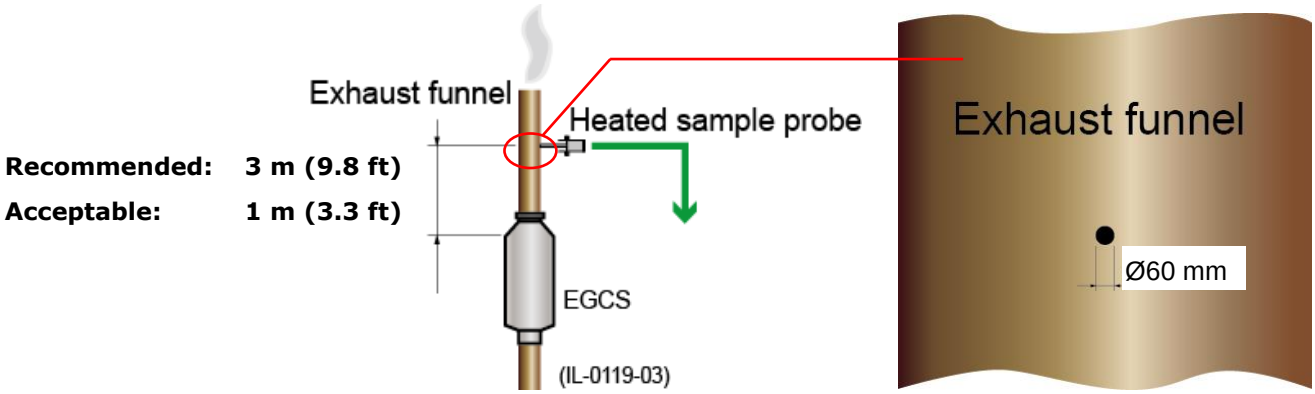


Figure 11
Distance between heated sample probe and EGCS as well as opening in the exhaust funnel

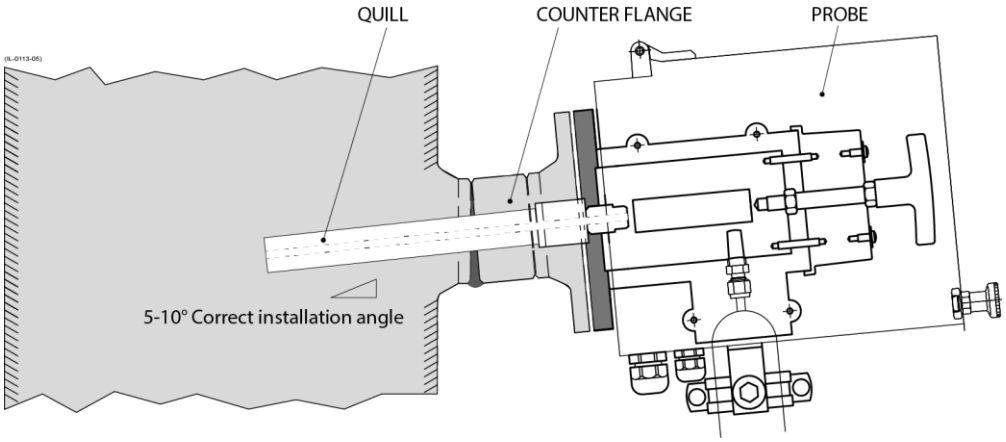


Figure 12 Probe with 5-10° installation angle (standard quill mounted)

Caution	*For outdoor installation in cold climate, Cover the probe with* *ShipCEMS - Probe Winter Kit Part no: 133283*	

1) Find a suitable location for the counter flange.

   a) Make sure the location for the installation is according to Figure 10 (recommended location is in longitudinal ship direction.) Inside installation is preferred; for outside installation the probe must be insulated sufficiently.

   b) Note that the heated sample probe should be located minimum 3 m above the EGCS (preferred location 3m above EGCS).
   Due to the fact that on many ships this recommended length can be difficult to obtain (since the scrubber outlet very often is mounted close to the exit of the funnel) and based on our experience, Norsk Analyse hereby accepts to keep the distance at a minimum of 1 meter (1000 mm) from the upper spraying layer (nozzles) in the scrubber.
   The opening into the exhaust funnel must be Ø 60 mm. Refer to Figure 11.

   c) Make sure the inclination of the probe (and the quill) will be approx. 5-10°. Refer to Figure 12.

Note	*The required minimum maintenance area behind the probe is 1000 mm. Ensure that this space is enough both for probe installation and for probe filter replacement. Refer to Figure 8 and drawings.*

2) Weld the counter flange onto the funnel.
3) Weld a stand-off pipe with flange from the outer wall of the duct to the face of the welded mating flange.

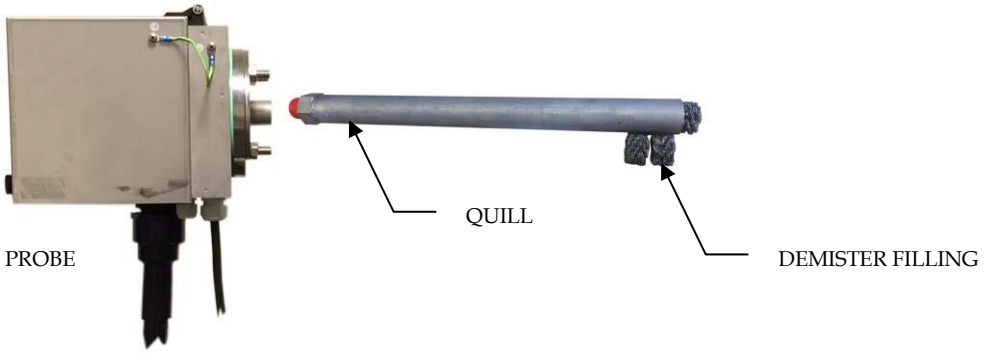
Note	*The recommended stand-off pipe/ spool piece is 100 mm, but this will depend on the insulation thickness used on the exhaust funnel. Refer to: [1210] – GENERAL ARRANGEMENT DRAWING COUNTER FLANGE.*

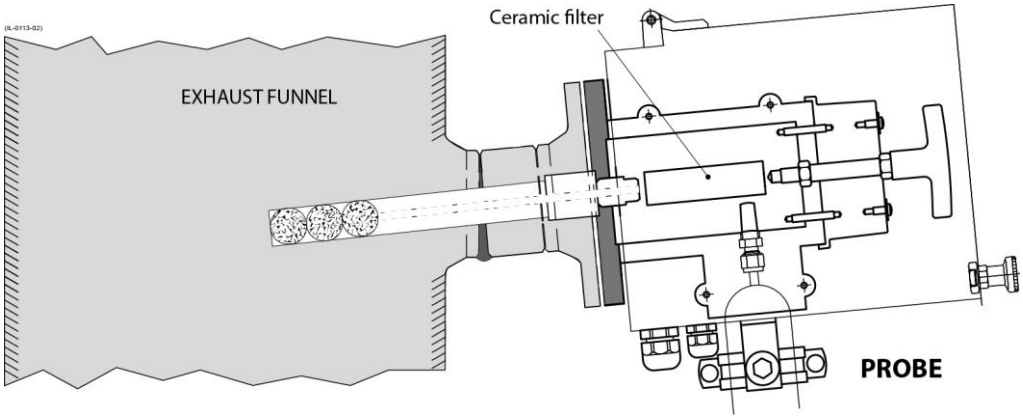
   This will allow space for bolts and funnel insulation. The stand-off pipe and mating flange material can be similar to the funnel structure or as selected by the installation contractor.

   If the funnel is uninsulated, a heat shield in form of a steel plate or similar must be installed to protect sample probe components from radiant heat.

4) Remove (red) cap from quill and use the threaded connection to mount the quill on the probe. Tighten the connection.
5) The sample probe consists of a quill – the sampling tube - that is inserted into the funnel. To obtain a representative sample, the portion of the quill penetrating the funnel should be 1/3 or 2/3 of the inner diameter of the funnel. On very wide scrubbers the distance can be less than 1/3.

Only applicable for demister quills (option):





Check that the demister filling (three steel wool cushions) is inside the quill.
The filling should be in the tip of the quill with no distance between.

6) Insert the quill into the exhaust funnel. Refer to Figure 12.

7) Mount the sample probe onto the counter flange. Check that inclination angle is approx. 5-10°. Refer to Figure 12.

Note	*When the quill is installed sloping slightly into the funnel, condensed water will go to the funnel and not into the heated sample probe.*

8) Check the ceramic filter for contamination or physical damage. Replace if required. Refer to User manual. Liquids can then drain back into the funnel and not into the heated filter assembly. Any liquid drainage into the heated filter will clog the filter, hence reducing the filter performance and sample flow to SCS.

9) Strip the heated sample line at an appropriate length ensuring that the sample tube can be connected to the sample outlet of the probe.

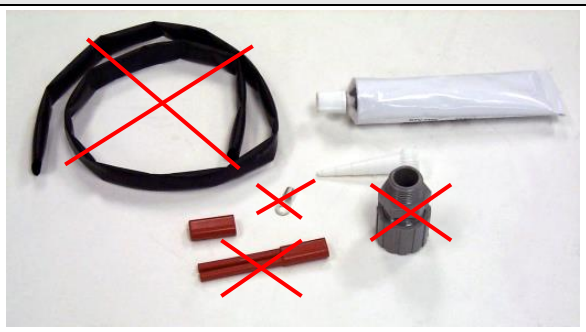
Caution	*Take care not to damage the internal tracer cable, sample tube and spare tube.*

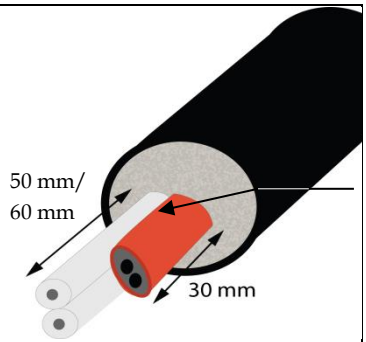
The tracer cable shall have a length that allows the sample to be heated throughout.

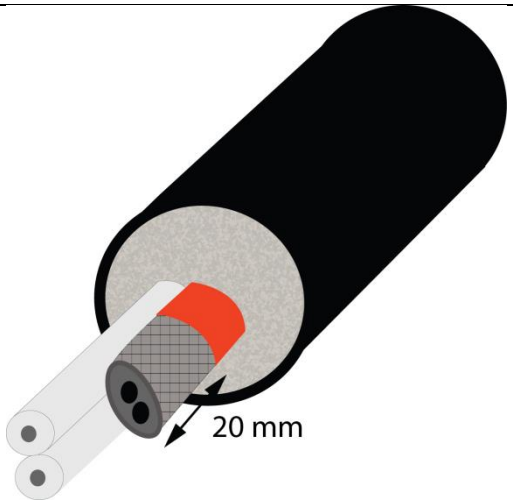
10) End termination of tracer cable:

The entry seal (heat-shrinkable nose) is installed to prevent moisture from entering.

Figure 13 Heated sample line as delivered

T9G90-UC Kit Contents (kit is inside SCS, refer to Figure 19)	
1 pcs Silicone Tracer End Cap	
1 pcsTube of RTV Silicone	
1 pcs Silicone Two-Leg Connection Sleeve – not used	
1 pcs Ring Terminal – not used	
1 pcs Entry Seal – not used	
1 pcs 36" (915mm) Heat Shrink Tubing – not used	

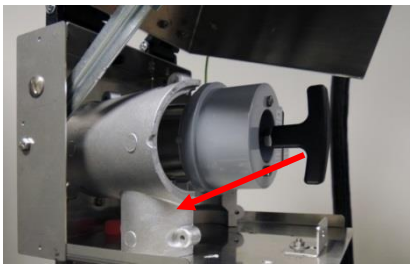
a)	• Cut off 60 mm of the heated sample line insulation to expose sample lines and tracer cable. • Cut the tracer cable to 30 mm above the insulation • Cut sample line to be used to 50 mm above insulation. Mount the nut set. Refer to Figure 15. Let spare sample line be 60 mm (in case of tube shrinking during temperature changes). Seal the spare tube. • Make sure there is no contact between electric leaders and shield.	

b)	Cut off 20 mm of the orange insulation to make the screen (metallic threads) visible.	
c)	Remove 20 mm of the screen (metallic threads).	
d)	Fill silicone end cap with RTV silicone and slide over end of cable. Hold while it sets.	
e)	Cover the entire insulation surface with RTV silicone to prevent water and condensation from entering.	

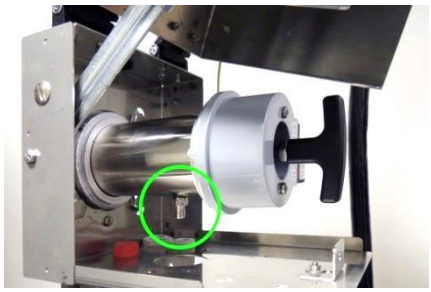
7.2.1 Heated sample line connection on probe

The mounting bracket and heat-shrinkable nose are already attached to the probe at delivery.

Figure 14 Heat-shrinkable nose



1) Remove the plastic cover for connection of the sample line.
2) Decide which tube will be the sample tube and which will be spare. Mark the other end of the heated sample line that will be connected in the SCS accordingly.
3) Insert the heated sample line into the heat shrinkable nose and connect the sample tube to the sample outlet of the probe using the fitting supplied. Hand-tighten first and then use an open 14 mm wrench to hold the counter nut and another 14 mm wrench to tighten one revolution. Refer to Figure 15 and Figure to the right.



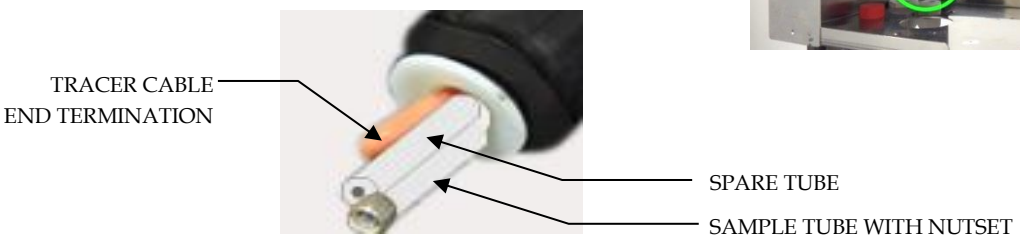
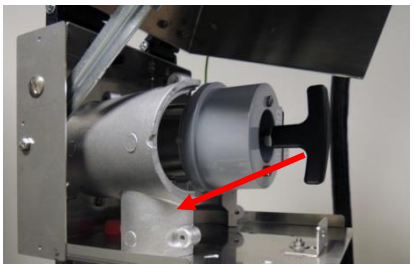


Figure 15 Entry seal assembly including mounting bracket

4) Shrink the expanded nose by applying heat with a heat gun. Move the heat gun back and forth to apply heat evenly. Stop heating when the nose has assumed the shape of the heated sample line.

Caution	*Hold the heated sample line approx. 5 minutes while the heat-shrinkable nose sets. Apply compressed air to speed up the process.*

5) Fasten the plastic covers, one on each side of the sample probe.



6) Cable entrances to the sample probe are through M25 and M20 cable gland at the bottom of the protection shield for the power and signal cables respectively. Connect the power supply cable to the sample probe. The power feed is taken from the adjacent SCS.

7) Connect the low temperature alarm signal cable at the sample probe end.
Both interface connections are standard 3-pole DIN plugs.

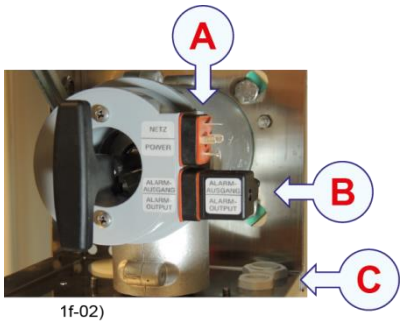


Figure 16 *Heated sample probe, electrical interfaces*
A: Power plug
B: Alarm signal plug
C: Cable glands

7.3 Sample conditioning system, SCS

Drawing references:

- → *[1801] – GENERAL ARRANGEMENT DRAWING SAMPLE CONDITIONING SYSTEM EXTERNAL VIEW, HOOK UP DETAILS*
- → *[1802] – GENERAL ARRANGEMENT DRAWING SAMPLE CONDITIONING SYSTEM INTERNAL VEIW*
- → *[3002] – SYSTEM DIAGRAM SAMPLE CONDITIONING SYSTEM (SCS)*
- → *[5004] – TERMINATION DIAGRAM SAMPLE CONDITIONING SYSTEM (SCS)*

The sample conditioning system is supplied as a complete unit, including a Unistrut profile mounting frame (41 x 21 mm).

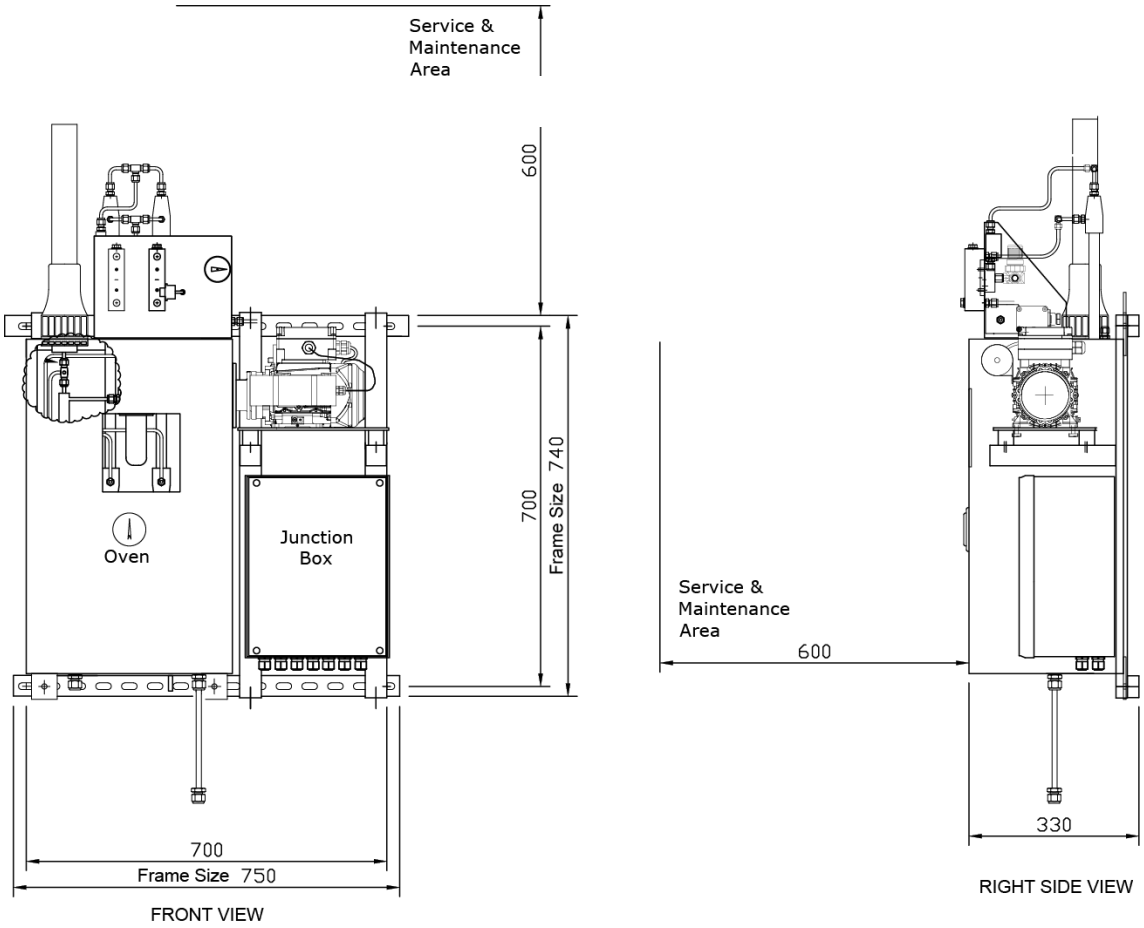


Figure 17 Sample conditioning system (SCS), outline dimensions

1) Find a suitable and stable location for the cabinet. Avoid vibrations.

   The cabinet must be mounted as close as possible to the sample probe, keeping the length of the heated sample line to a minimum. The distance can typically be 2 to 3 metres but should not exceed 30 metres. Contact Norsk Analyse if the distance exceeds 20 meters.

   To ensure maintenance access, make sure that the cabinet is installed with adequate spacing in all directions.

2) Prepare the installation framework by welding steel support for the cabinet on the ship's casing.

3) Lift the cabinet mounting frame onto the prepared framework using the center mounted lifting lug.

4) Fasten the cabinet to its mounting frame with bolts and washers.

   It is recommended to use minimum four M14 bolts with nuts, one at each end of the horizontal support frame bars. The arrangement should be fixed using flat washers and external tooth locks.

   The cabinet requires compressed air supply to operate. The air supply should be supplied via the analyser cabinet. Refer to chapter 5.10 for technical specification on compressed air.

5) Connect the compressed air tube to nozzle N3. The other end shall be connected to the analyser cabinet. Use the 6 mm nut set in SCS installation kit.
   Refer to Figure 18.

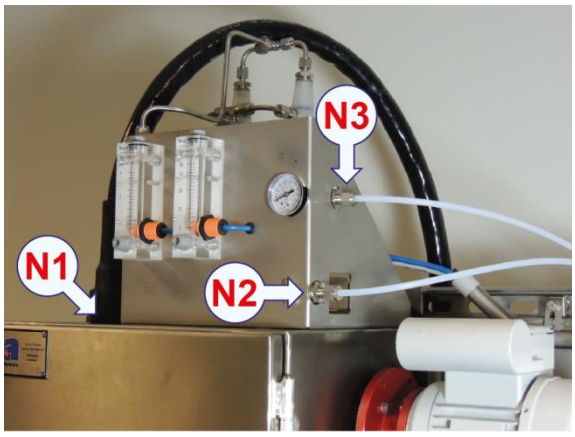


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Figure 18 *Sample conditioning system inlets/outlets*
N1: Wet sample inlet (from heated sample probe)
N2: Dry sample outlet (to analyser cabinet)
N3: Compressed air inlet (from analyser cabinet)

6) Connect the dry sample tube to nozzle N2. The other end shall be connected to the analyser cabinet. Use the 6 mm nut set in SCS installation kit.
Refer to Figure 19.

SCS installation kit includes:

- Black strip (1 pcs) for low profile connection
- Red strips (4 pcs) (high temperature) to attach heat tracer cable to tube.
- 10 mm nut set (1 pcs) for test socket (normally not used)
- 6 mm nut set (3 pcs) for sample in , sample out and air. Refer to N1, N2 and N3 in Figure 18.

Figure 19 *SCS installation kit located in the SCS cabinet*

Note *The 10 mm nut included in the kit is normally not used.*

The test socket is blocked. If it is not blocked, the samples will be taken from this point and not from the probe.

7.3.1 Heated sample line connection in SCS

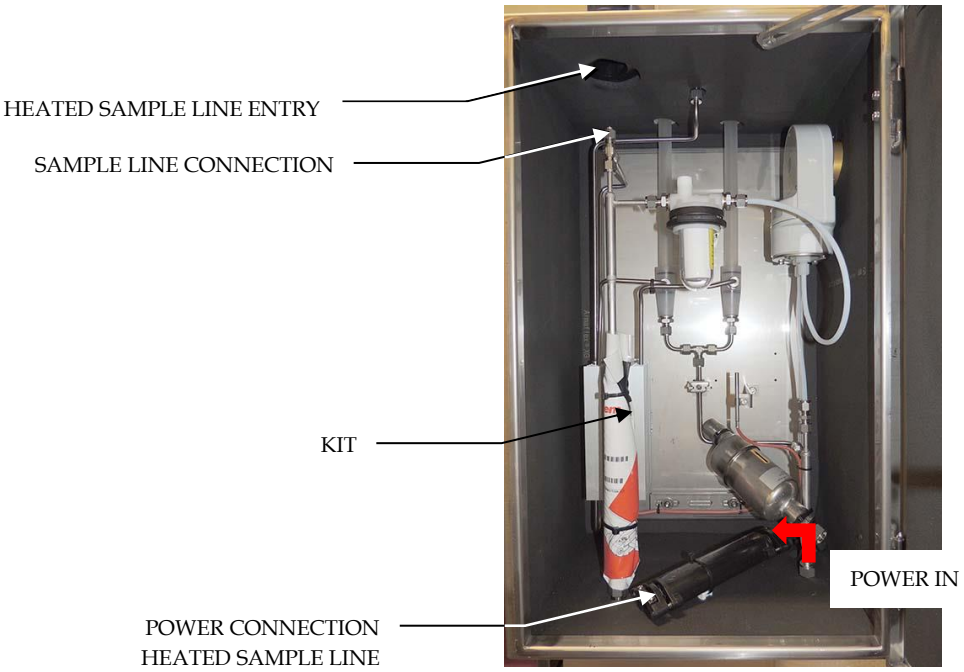
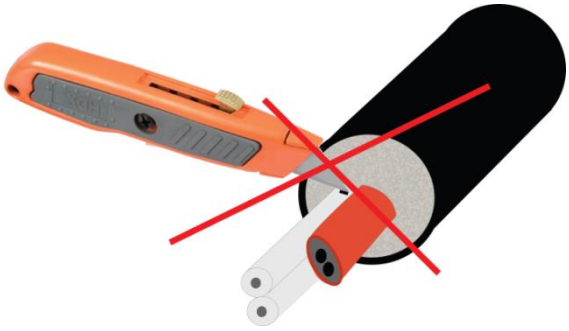


Figure 20 Sample conditioning system inlets/outlets

1) Strip the heated sample line at an appropriate length (1000 mm) to be sure that the tracer cable can be connected to the power connection kit at the bottom of the cabinet.

Caution *Take care not to damage the internal tracer cable and sample tube.*



Caution *If the tubes are damaged the whole heated sample line must be replaced.*

The tracer cable will be connected to the power cable using the power connection kit supplied with the cabinet.

2) Place the threaded nut through nozzle N1 on top of the cabinet so that the flanged end is on the inside of the cabinet.
3) Locate the marked sample tube (marked in chapter 7.2.1).

Note *Make sure the sample tube is connected and not the spare tube!*

4) Adjust and cut the 6 mm sample tube at an appropriate point and connect the end to the sample inlet using the fitting supplied with the cabinet.
5) Cut the spare tube approx. 100 mm below the connection point of the sample tube.
6) Seal the spare tube with e.g. scotch tape to prevent dirt from entering.
7) Shrink the expanded nose (B in Figure 21) by applying heat with a heat gun. Move the heat gun back and forth to apply heat evenly. Stop heating when the nose has assumed the shape of the heated sample line.

Caution ***Hold the heated sample line approx. 5 minutes while the heat-shrinkable nose sets. Apply compressed air to speed up the process.***

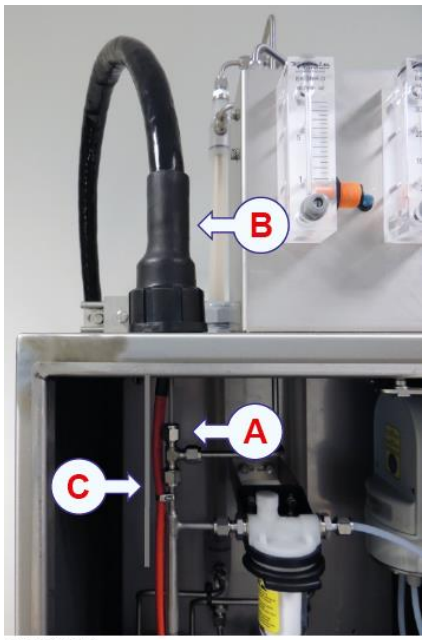


Figure 21 *Connection of sample tube (A), spare sample tube (C) and heat-shrinked nose (B)*

8) Power connection in SCS (using low profile connection)
The heated sample line that was connected to the probe in chapter 7.2 will now be connected to the SCS cabinet.

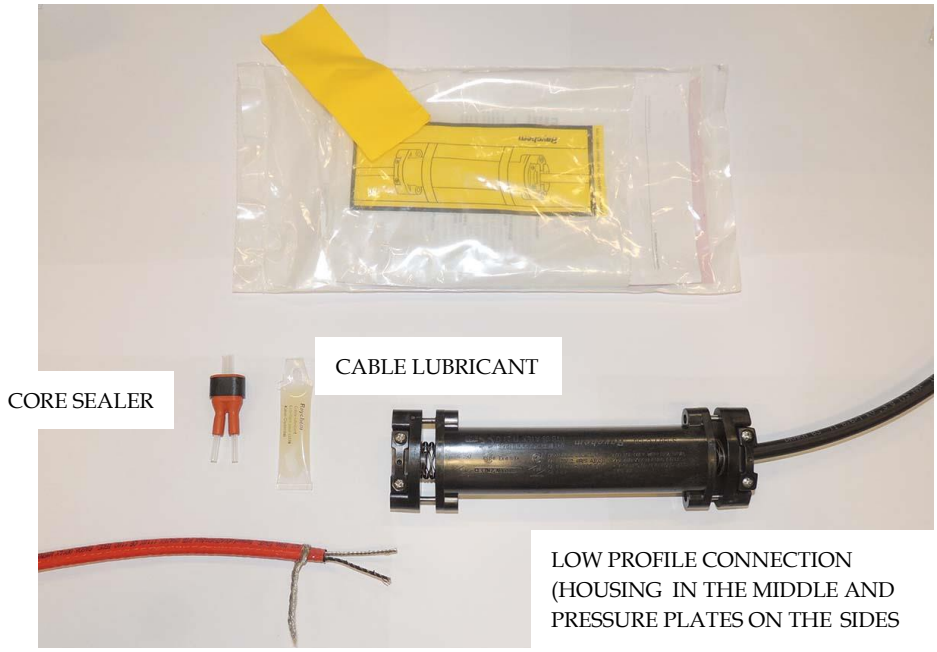
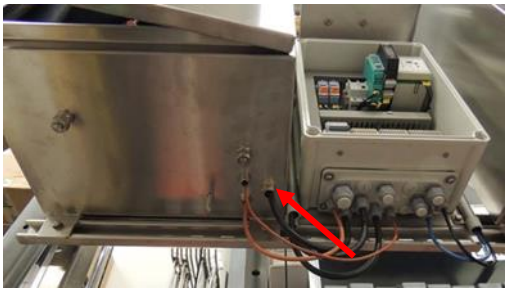
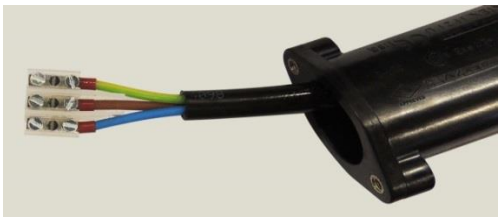
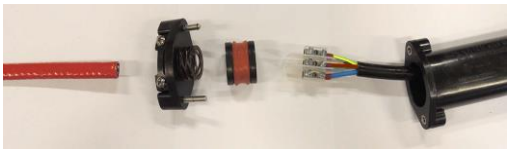
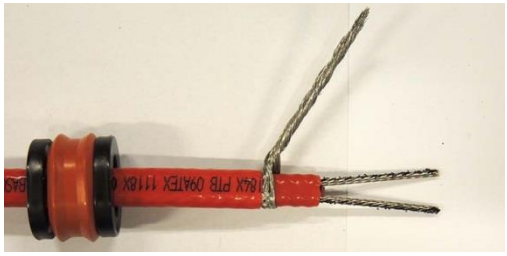
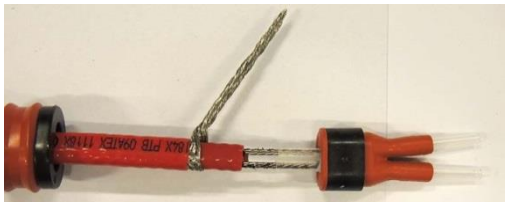
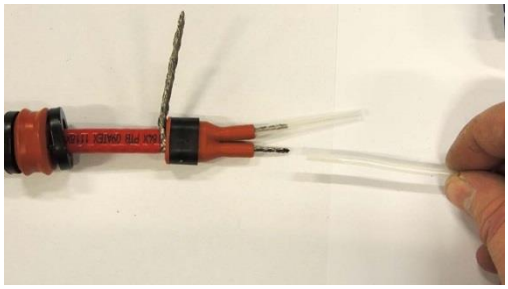
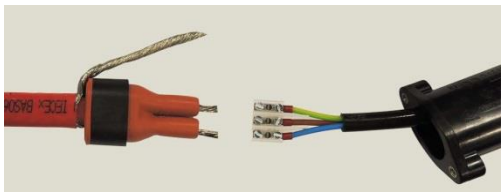
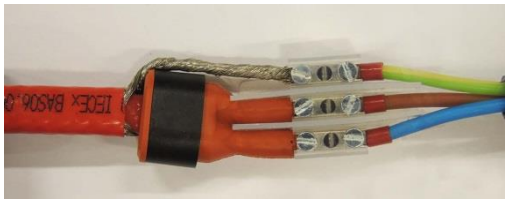
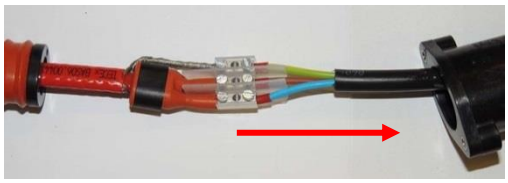


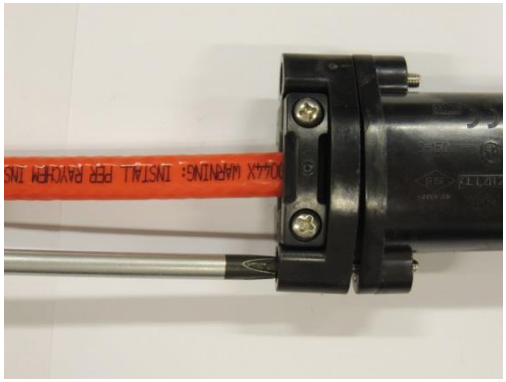
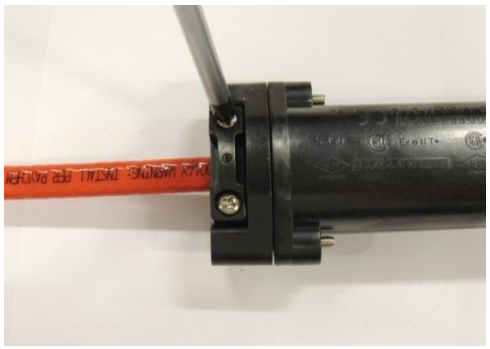
Figure 22 Power connection kit

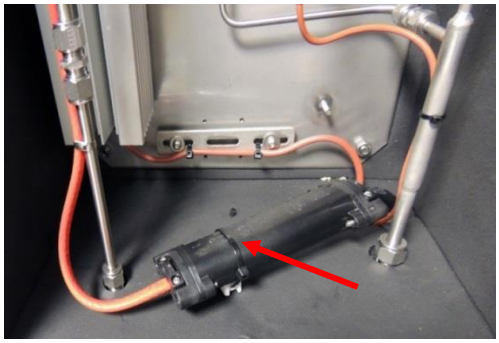
a)	Loosen the cable clip holding the power cable in the rights side of the cabinet.	
b)	Check that the cable gland under the cabinet is loose and pull up some cable.	
c)	Check that the 2 screws on the right pressure plate are loose (for cable to run freely).	

d)	Disconnect pressure plate on the left side using 4 screws.	
e)	Push/pull the power cable through the housing.	
f)	Line up the tracer cable, pressure plate and the sealing grommet.	
g)	Apply lubricant inside the connection.	
h)	Push the tracer cable through the pressure plate and the sealing grommet.	
i)	Remove 70 mm of the outer jacket.	

j)	Spread out and twist the screen (metal threads) to a single wire.	
k)	Remove 50 mm of the inner jacket. • Cut the heating threads with a knife and remove but be careful not to damage the electric wires. • Cut off the brown support under the heating threads using cutting pliers. Dispose.	 
l)	Thread the electric wires into the transparent guiding tubes of the core sealer. Push the core sealer all the way to the braid.	
m)	Remove the 2 guiding tubes.	

n)	Connect the braid to the ground cable on the terminal block. Connect the other two wires to the terminal block.	 
o)	Pull the connection into the housing.	 
p)	Apply cable lubricant from the kit to the sealing grommet.	

q)	Attach the pressure plate to the housing using 2 screws.	 
r)	Secure the cable to the left pressure plate using 2 screws.	
s)	Secure the right pressure plate to the housing using 2 screws.	
t)	Secure the power cable to the right pressure plate using 2 screws.	

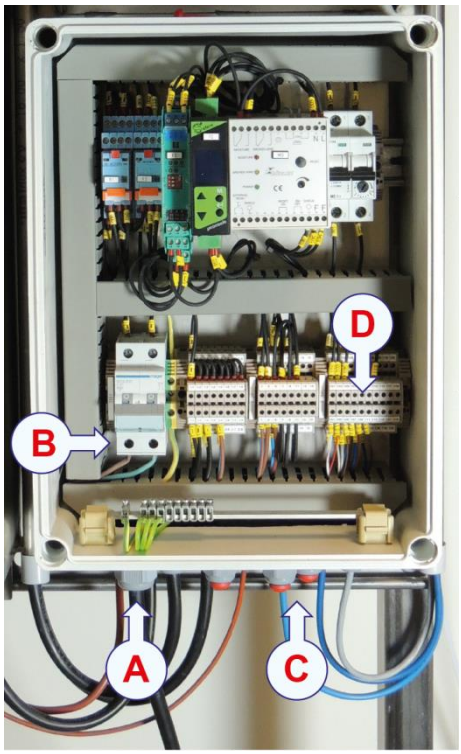
u)	Re-strip the low-profile connection kit the bottom of the cabinet using the bla plastic strips. *Note* *Strips are included in a strip kit at the bottom of the SCS cabinet.*	 
v)	Pull gently excess cable through the ca gland in the bottom of the cabinet. Tig the gland. Refer to step b).	

9) Support the tracer cable vertically using the 4 pcs red plastic strips from the kit.

10) Cable entrances to the SCS are through M25 cable glands at the bottom of the cabinet's electrical junction box. Connect power supply at the dedicated terminals inside the junction box (to the motor protection switch).

11) Connect the low temperature alarm signal at the dedicated terminals inside the junction box.

12) Connect the general SCS alarm signal at the dedicated terminals inside the junction box. Note that this alarm is further relayed to the vessel control system from the analyser system.



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A: Cable gland for power
B: Termination of power cable
C: Cable glands for alarm signals
D: Termination of alarm signal cables

Figure 23 Sample conditioning system, electrical interfaces

13) Back-purge:

- Standard:
  Connect 24 VDC control signal from vessel. Refer to Figure 5.
- With optional Interface unit SC-IU:
  Connect back-purge signal between SCS and AC. Refer to Figure 6.

7.3.2 Calibration gas cylinder

Part no: **125621 40 ppm?which?** or
135030

Unless the order states differently, the standard calibration gas cylinder has the following dimensions:

Volume: 10 litres

Connector: DIN 14 (unless others specified in order)

The calibration gas cylinders come in two different sizes:

Diameter Ø (mm)	**Height (mm)**
100	1500
200	900

Caution *Make sure that gas cylinders are prevented from falling.*

1) Connect the gas cylinder to N6. Refer to Figure 31 in chapter 7.4. Use the coil and regulator provided in the delivery.
2) Refer to user manual for procedure for parameter settings in chapter "Install or replace calibration gas cylinder".

7.3.3 Back-purge

Drawing references:

→ *[5004] – SAMPLE CONDITIONING SYSTEM, TERMINATION DIAGRAM*

Back-purge is standard equipment. Back-purge mode is provided by an additional solenoid valve with tubing being preinstalled in the SCS.
Back purging is then controlled by a dedicated 24 VDC customer signal. Refer to Figure 5 and Figure 6 in chapter 3.5.

1) Connect the 24 VDC back-purge supply voltage and control signal cables to the SCS junction box as described by the termination diagram referred to above.

Note *If optional ShipCEMS bus extension unit (interface unit, SC-IU, is fitted, control signal comes from SC-IU (inside the analyser cabinet).*

7.3.4 Adjust sensitivity of moisture sensor USER

Caution	*To prevent risk of damage to equipment and/or malfunction of system, it is absolutely crucial that the sensitivity of the moisture sensor is adjusted during start-up.*

It is crucial to ensure proper functionality and to prevent possible damage to the ShipCEMS system that moisture sensor sensitivity is set to a proper level. This has to be done at actual installation during commissioning to ensure sensitivity matches dew point of available compressed air.

Prior to adjustment, the system should be fully functional and operational. Make absolutely sure there are no traces of moisture anywhere in the system. Check tubing and filter housing thoroughly.

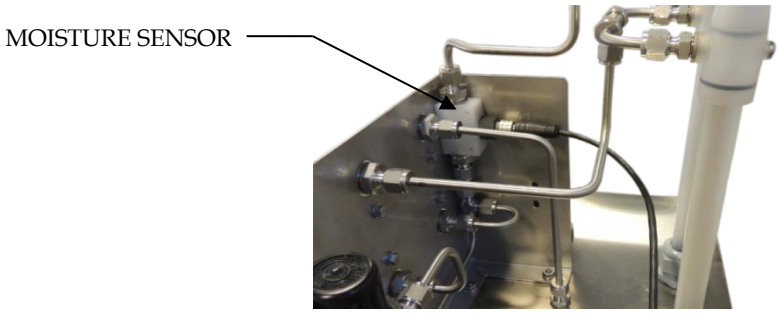


Figure 24 Moisture sensor

1) When scrubber is running and system is sampling, disconnect the heated sample line in SCS to make sure the sample is ambient air. Refer to Figure 25. Refer to Figure 1 for overview of installations.

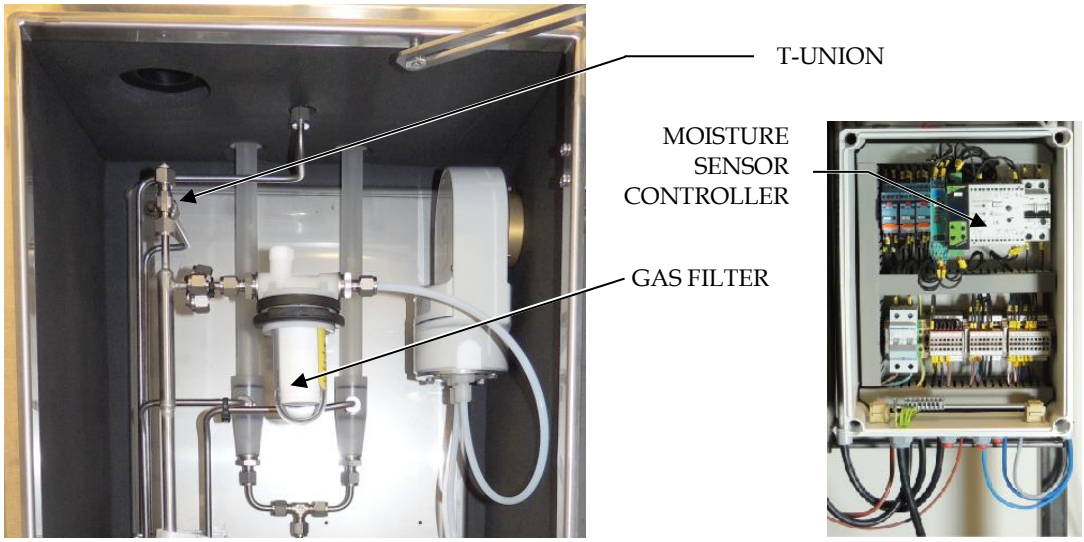


Figure 25 Disconnect heated sample line to make the system analyse ambient air

2) Locate moisture sensor controller. Refer to Figure 25.

3) Make sure bridge for "RESET ON" is removed. Refer to Figure 26.
4) Adjust potentiometer clockwise until moisture alarm is activated (red LED). Refer to Figure 26.
5) To adjust the moisture sensor against ambient air, reset the alarm and activate the set point by adjusting the potentiometer ¼ turn counter clockwise. Refer to Figure 26. (The red LED is turned off.)

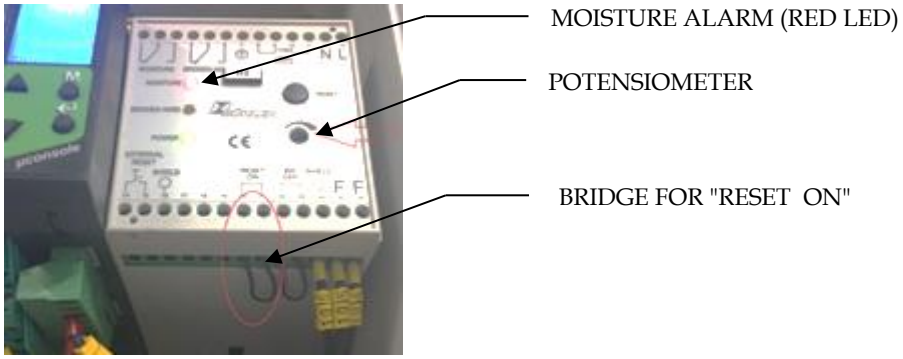


Figure 26 Moisture sensor controller

6) Re-connect heated sample line in SCS. Refer to Figure 25.
7) The sample conditioning cabinet is grounded by attachment on wall and junction box is grounded by the main power inlet. There is an extra earth stud (M8 x 30) under the cabinet if additional grounding of sample conditional cabinet is necessary.

7.4 Analyser cabinet, AC

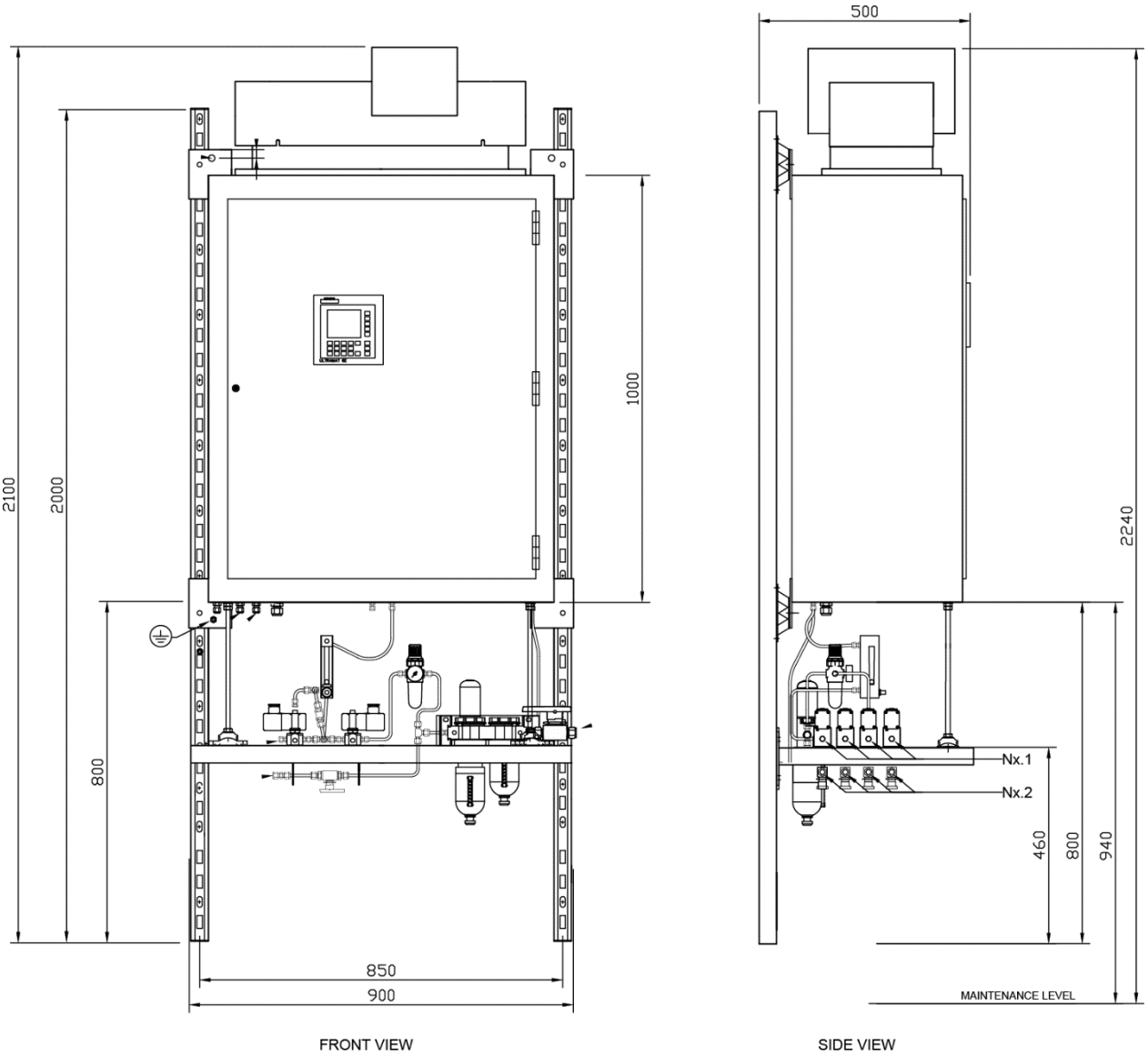
Warning	***Outlet gas and calibration gas from analyser cabinets (AC) need to be vented to free air.***
	If AC is installed in a small room, the outlet gas level will increase unless it is vented. For personal safety, ensure the outlet gas has access to free air.

Drawing references:

- → *[1001] – GENERAL ARRANGEMENT DRAWING ANALYSER CABINET (AC) EXTERNAL VIEW - STANDARD*
- → *[1003] – ANALYSER CABINET, INTERNAL VIEW – OPTIONAL (*)*
- → *[3001] – SYSTEM DIAGRAM ANALYSER CABINET (AC)*
- → *[3002] – SYSTEM DIAGRAM SAMPLE CONDITIONING SYSTEM (SCS)*
- → *[5001] – TERMINATION DRAWING - OVERVIEW ShipCEMS SYSTEM 230VAC STANDARD*
- → *[5002] – TERMINATION DIAGRAM 230VAC & 24/48DC POWER DISTRIBUTION ANALYSER CABINET (AC)*

(*) Option

The analyser cabinet is supplied as a complete unit, including a Unistrut profile



mounting frame (41 x 21 mm) with anti-vibration cushions.

Figure 27 Analyser cabinet, outline dimensions

<table>
<tr>
<td> 
</td>
<td>AC installation kit includes:
• Black strips (3 pcs) for LOGO display and thermostat connection

• Nuts and washers (4 pcs each) for analyser module attachement (incl earth wire and cables for LOGO display and thermostat)

• 10 mm nut set (1 pcs) for air inlet to AC cabinet (N5)

• 6 mm nut set (5 pcs) for
- cal gas (N6)
- sample in (N1.1-N4.1)
- air out to SCS (N1.2-N4.2)
- bypass (sample in)
(By-pass to local vent)
- sample out from AC (N8)</td>
</tr>
<tr>
<td> 
</td>
<td>For 2 stream system:
Additional (2 pcs) 6 mm nut set

For 3 stream system:
Additional (4 pcs) 6 mm nut set

For 4 stream system:
Additional (6 pcs) 6 mm nut set</td>
</tr>
</table>

Figure 28 AC installation kit located in the analyser cabinet

1) Find a suitable and stable location for the cabinet. Mount the cabinet on ship's structural beams.
   To ensure maintenance access, make sure that the cabinet is installed with adequate spacing in all directions.

Caution	*Do not install the analyser cabinet onto the funnel!*

2) Prepare the installation framework by welding steel support for the cabinet on the ship's casing.

3) Lift the cabinet mounting frame onto the prepared framework using the lifting lugs.

4) Fasten the cabinet to its mounting frame with bolts and washers.
It is recommended to use minimum six M14 bolts with nuts, three on each of the vertical support frame bars. The upper bolt on each support bar shall be mounted above the lifting lugs. The arrangement should be fixed using flat washers and external tooth locks. Hand-tighten.

   The cabinet requires compressed air supply to operate. The air supply pressure shall be 6 to 8 barg (90 to 120 psig). Air supply is provided by the ship. Refer to technical specifications on compressed air in chapter 5.10.

5) Remove the cap on the bypass outlet. Make sure that the bypass outlet is not blocked or obstructed. Refer to Figure 29.

Caution	*This is very important as this is also used as a bypass if pressure on analyser inlet is too high. This is a protective feature and might cause damage to system if blocked.*

6) Only for confined spaces or if connection to safe vent is desired:
Attach a 6 mm plastic tube (not provided) to By-Pass flow to local vent and connect the sample gas to safe vent. Use the 6 mm nut set is included in the AC installation kit. Make sure pressure is not built up in the tube.

Caution	*Make sure that By-Pass flow to local vent and analyser outlet (N8) do not share the same tubing for ventilation to free air.*
Warning	***Connect to safe vent if the surroundings do not have sufficient ventilation.***

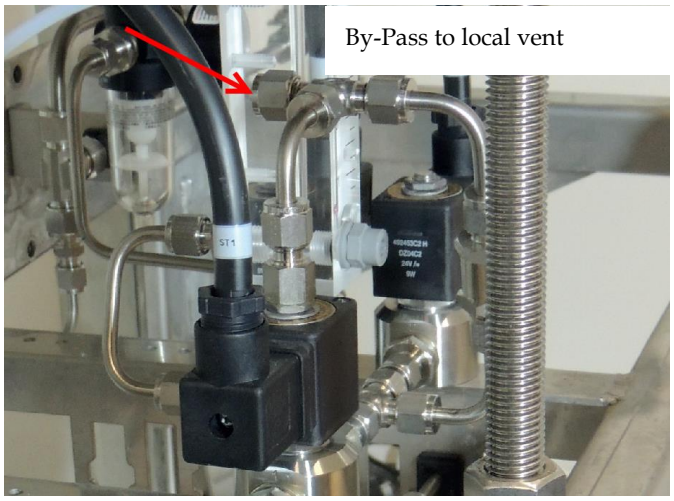


Figure 29 *Bypass flow must not be obstructed!*

7) Connect compressed air supplied by the ship to nozzle N5 using a 10 mm outer diameter tube. Use the 10 mm nut set included in the AC installation kit.

   The compressed air supply must be oil-free and free of particulate matter.
   The dew point must be less than -17°C (-1.4°F).

Note	*If required, install an absorbing chemical unit to the compressed air header upstream the cabinet. This will prevent traces of oil entering the system.*
Note	*If the air supply contains moisture install an air dryer unit to the compressed air header upstream the cabinet.*

Figure 30 *Compressed air dryer. External mount (left) and internal mount (right).*

Note	*Request installation manual for air dryer if this unit is delivered separately.*

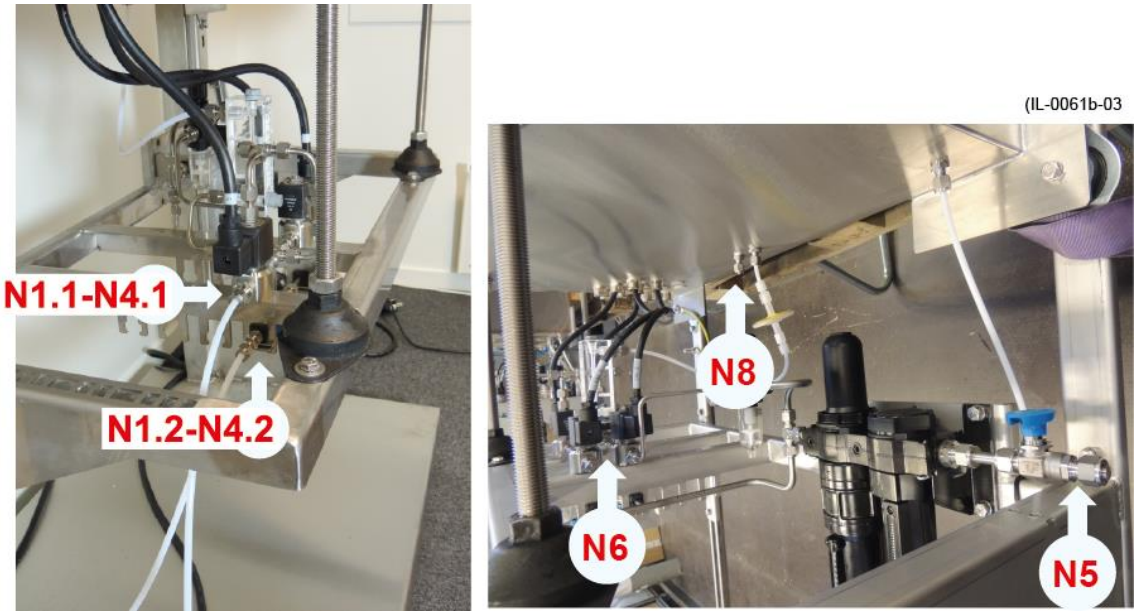


Figure 31 Analyser cabinet inlets/outlets

N1.1-N4.1:	*Dry sample inlet (from SCS)*
N1.2-N4.2:	*Compressed air outlet (to SCS)*
N5:	*Compressed air inlet (ship supply)*
N8:	*Sample outlet (atmospheric vent)*
N6:	*Calibration gas inlet*

8) Connect the compressed air tube to nozzle N1.2-N4.2 using a 6 mm outer diameter tube. Use the 6 mm nut set is included in the AC installation kit. The other end shall be connected to the SCS, nozzle N3.

9) Connect the dry sample line to nozzle N1.1-N4.1 using a 6 mm outer diameter PFA/PTFE tube. Use the 6 mm nut set is included in the AC installation kit. The other end shall be connected to the SCS, nozzle N2

10) Connect calibration span gas to nozzle N6 using a 6 mm outer diameter PFA/PTFE tube.

11) **Only for confined spaces or if connection to safe vent is desired:**
Attach a 6 mm plastic tube (not provided) to by-pass flow to local vent and connect the sample gas to safe vent. Use the 6 mm nut set is included in the AC installation kit. Make sure pressure is not built up in the tube.

Warning	***Connect to safe vent if the surroundings do not have enough ventilation.***

12) Cable entrances to the analyser system are through M25 cable glands at the left-hand bottom of the cabinet. Connect power supply at the dedicated terminals inside the cabinet box (to the circuit breaker).

13) Connect the General SCS Alarm signal from the SCS at the dedicated terminals inside the cabinet.

14) Connect digital I/O signals to the ship vessel control system at the dedicated terminals inside the cabinet.

15) Connect analogue signals (analyser readings) to the vessel control system at the dedicated terminals inside the cabinet as well as the back-purge signal if SC-IU is installed.

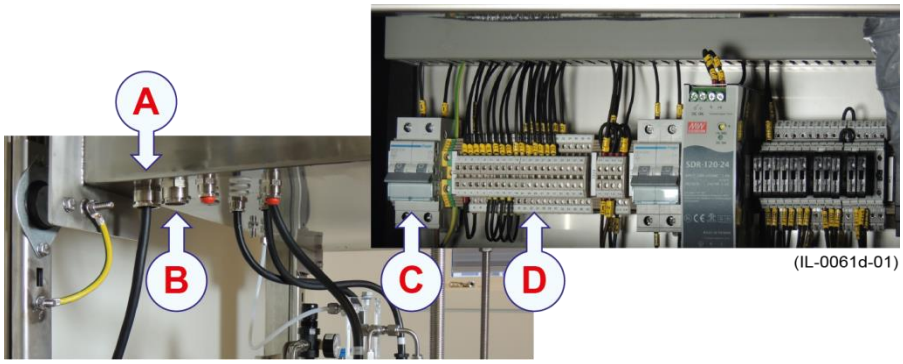


Figure 32 Analyser cabinet, electrical interfaces
A: Cable gland for power
B: Cable gland for I/O signals
C: Termination of power cable
D: Termination of I/O signal cables

16) As the cabinet is isolated from the supporting structure by rubber mounts, bond the cabinet's support frame to the ship's structure using an earthing cable. Figure 33 shows the preinstalled earthing cable between the cabinet and the frame.

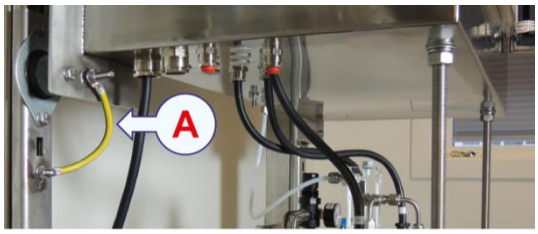


Figure 33 Analyser cabinet, earth bonding

17) The analyser module is delivered in a cardboard box and shall be mounted in the analyser cabinet at site. Lift the analyser module out of the cardboard box. It is recommended that one person shall support the unit physically whilst other person is connecting electrical cables and tubes.

18) Remove the two plugs above the power socket at the back of the analyser module.

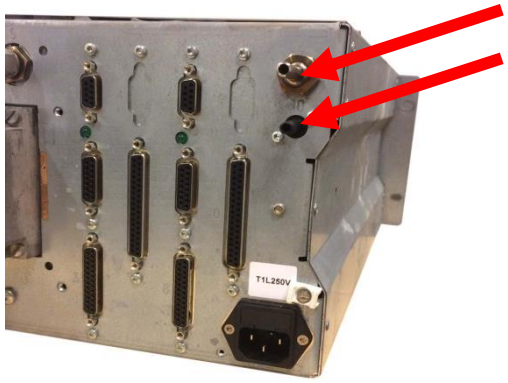


Figure 34 Plugs to be removed

19) Connect the atmospheric vent tube (A in Figure 35) and the sample inlet tube (B in Figure 35) to the analyser module.

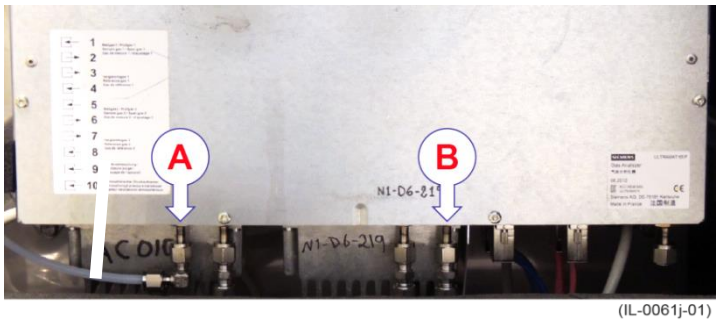
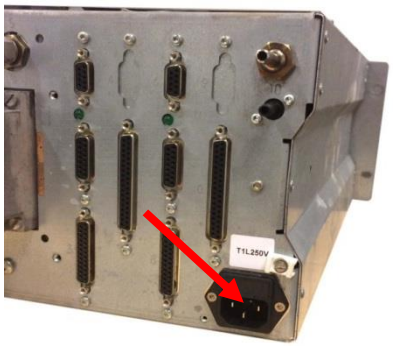


Figure 35 Analyser module assembly, lower connections
A: Atmospheric vent
B: Sample inlet

20) Connect power to the analyser module using the standard appliance plug.

POWER SUPPLY PLUG



MATING POWER SOCKET

Figure 36 Connect analyser module to power

21) Ensure that the internal signal cables are properly fastened to the analyser module. Please note the colour marking of these cables. Refer to Figure 37.

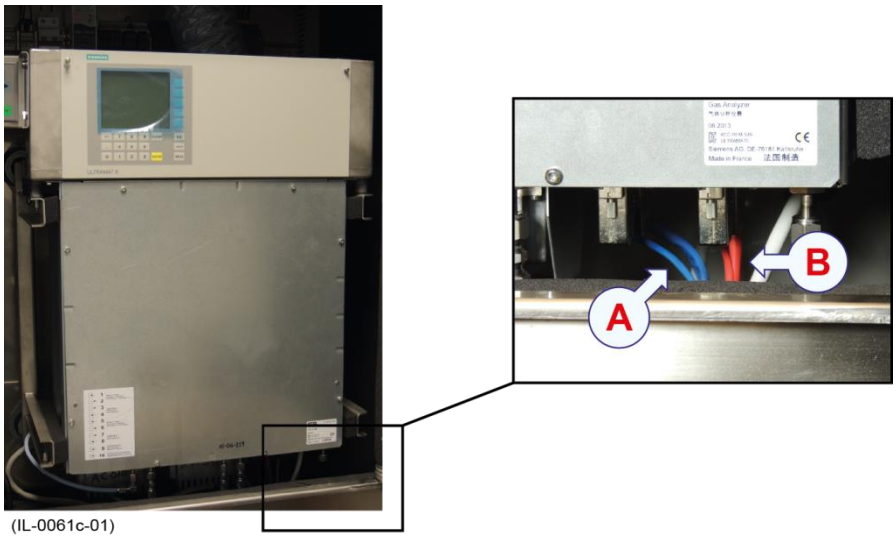
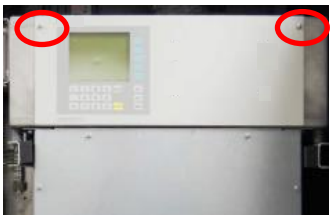


Figure 37 Colour marking of analyser module signal cables
A: Blue cables are used for channel #1 (SO2)
B: Red cables are used for channel #2 (CO2)

22) Lift the analyser module onto the dedicated anti-vibration frame and fasten it with the four accompanying screws.

23) Loosen the two front panel screws and tilt the hinged panel outward.



24) Connect the thermostat signal cable at the dedicated terminals inside the cabinet.

25) Fasten the hinged panel using the two front panel screws.

26) Enter correct date and time on the analyser display by selecting function code 58.

7.4.1 LOGO display

During transport the LOGO display is temporarily mounted with the display towards the analyser to protect the display.

The LOGO TD will be replaced by LOGO TDE and some of the steps below have therefore pictures of both LOGO displays.

Note	*It is not possible to replace the LOGO TD to TDE display. To upgrade to TDE even the PLC must be replaced. Contact Norsk Analyse for more information.*

LOGO TD

LOGO TDE

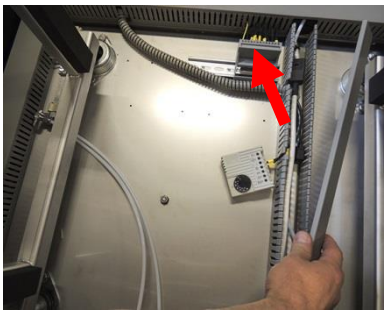
LOGO display installation:

1) Loosen the 2 screws on the hinged panel and gently open the panel.

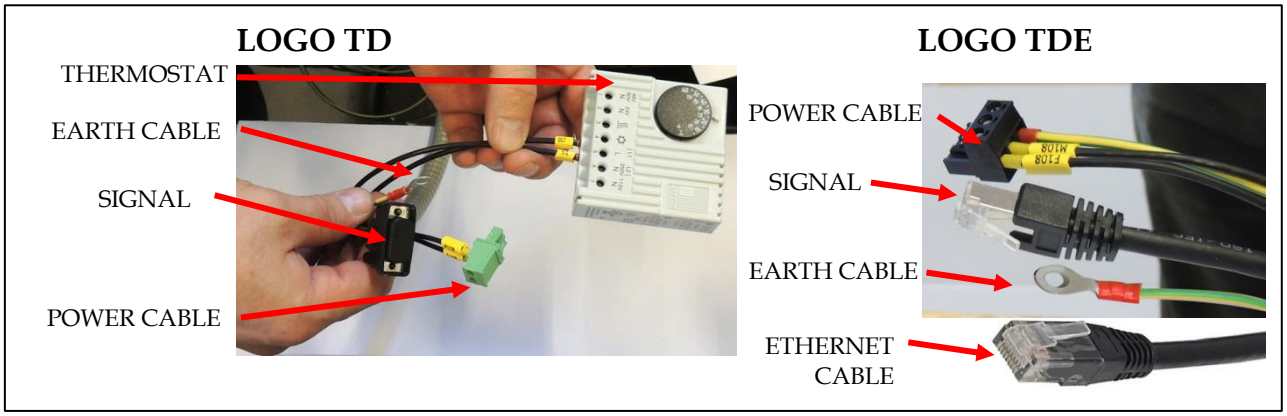
2) Loosen the LOGO display from the hinged panel.

3) Turn the LOGO display and mount it so that the display is visible from the front. Use the same bolts and fasteners.

4) Open the cable tray and lift out the cables connected to the thermostat.



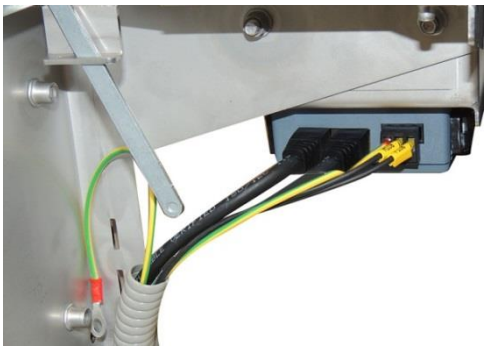
5) Locate the loose cables (LOGO display power cable, signal cable and earth cable, for TDE also Ethernet cable) that are <u>not</u> connected to the thermostat.



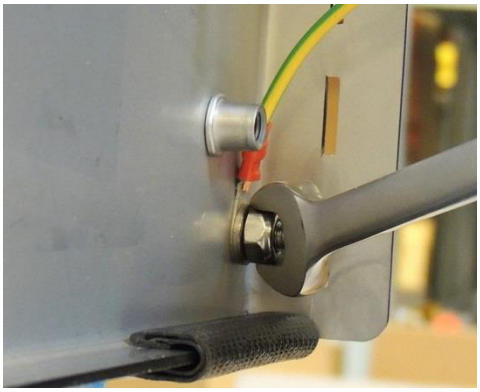
6) **LOGO TD**:
Connect the two cables (LOGO display power cable and signal cable) to the LOGO display. For LOGO TD use the screws to the signal cable.
LOGO TDE:
Connect the three cables (LOGO display power cable, signal cable and ethernet cable) to the LOGO display.

LOGO TD

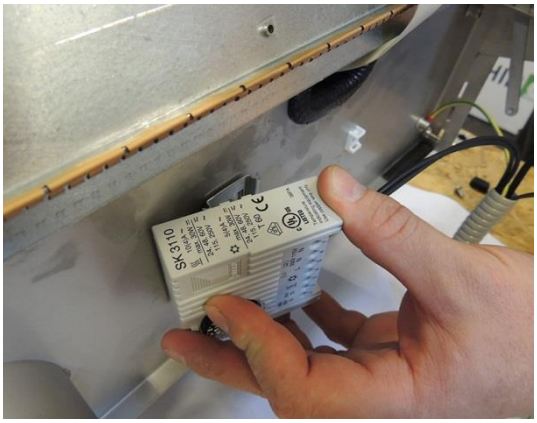
LOGO TDE



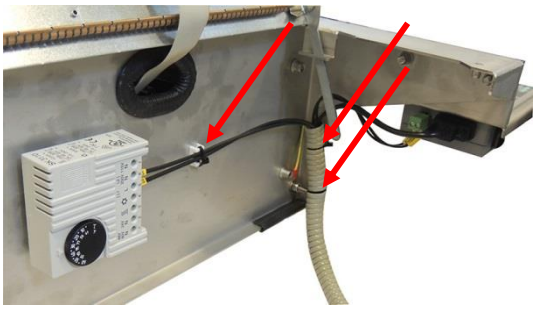
7) Connect the earth cable.



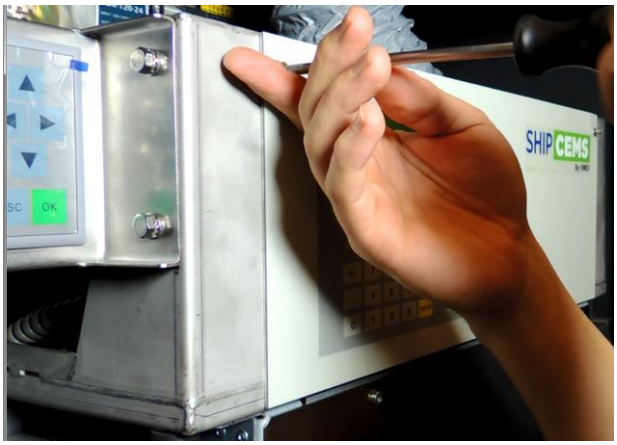
8) Clip the thermostat to the attachment (DIN bracket).



9) Strap the cables in three places. Straps are in plastic bag inside the AC. Refer to Figure 28 in chapter 7.4.



10) Close the hinged panel and fasten with the two screws.



7.4.2 Remove plugs

Analyser cabinet:

At delivery both sample out and safety valve outlet are plugged to prevent ingress of dust. Refer to Figure 38.

Remove these two plugs, marked red in the Figure below, before start-up. Make sure to vent to ventilated area.

Caution	*Remove plugs to avoid buildup of pressure in the analyser cabinet and thereby destroying the analyser.*

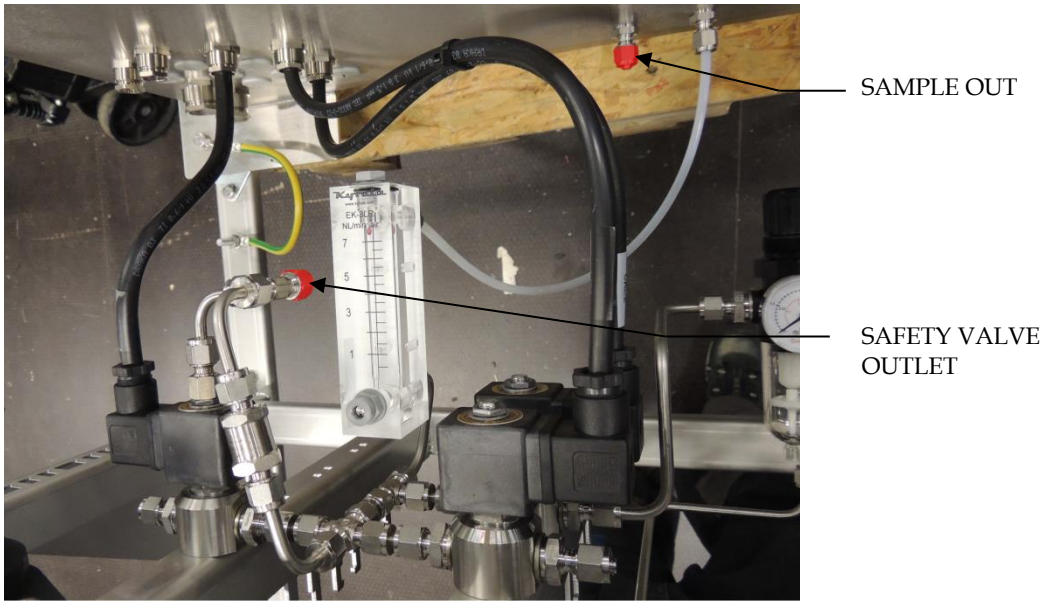


Figure 38 Plugs under analyser cabinet to be removed before start-up

7.5 Emergency power switch (option)

Part no: 119533

Drawing references:

→ *[1901] – EMERGENCY STOP, GENERAL ARRANGEMENT DRAWING*

The emergency power switch assembly consists of a stainless-steel terminal box with a preinstalled emergency switch and brass cable glands for power and stop signal.

Terminal box dimensions are 300 x 300 mm with depth 150 mm.

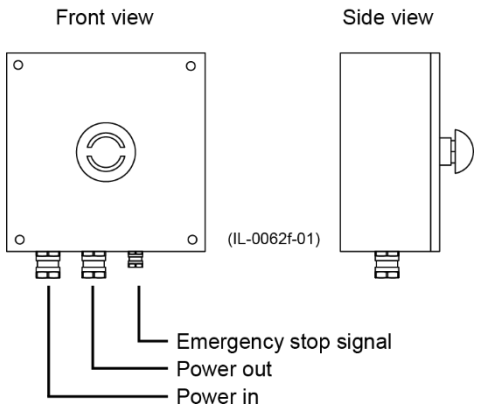


Figure 39 Emergency power switch assembly

1) Find a suitable location for the unit and fasten the box base with the four accompanying fixing screws.
2) Connect power and signal cables to the internal terminal block as described by the termination diagrams referred to above.
3) Fasten the box cover with gasket using the four accompanying cover screws.

8 Installation checklist

After the installation has been performed and before ShipCEMS is brought into operation for the first time, the checklist described in this chapter must be completed to confirm a correct installation.

It is recommended to set aside a period of time at the end of the installation phase specifically for these tests.

All results from the tests and any remarks to the product or the test results shall be recorded by hand in the accompanying tables.

The installation checklist shall be signed by the installation contractor when completed. This chapter shall then be printed or scanned and be returned to Norsk Analyse prior to commissioning.

Note *Return a scanned copy of the Installation checklist with results and if applicable remarks to Norsk Analyse after installation. Send to service@norskanalyse.com and write the following in the subject field:*

ShipCEMS installation checklist, Project number: 15XXX

Guarantee does not apply unless the scanned copy of the Installation checklist is returned to Norsk Analyse.

	Action	Acceptance criteria	Result	Remark
1)	Check that all units have been delivered and installed.	Units shall be handled in accordance with GA and detail drawings.	☐ Accepted ☐ Not accepted	
2)	Check that the units are not damaged.	No mechanical damages, scratches or dents shall be observed.	☐ Accepted ☐ Not accepted	
3)	Check that each unit is accessible for operation and maintenance work.	Verify service access (cabinet doors can open completely, necessary access to internal modules, proper lightening etc.).	☐ Accepted ☐ Not accepted	

	Action	Acceptance criteria	Result	Remark
4)	Check that all units are labelled.	Verify that labels are manufactured and mounted according to requirements.	☐ Accepted ☐ Not accepted	
5)	Check the cabinet's vibration mounting.	Verify that the cabinets are fastened using proper mounting bolts and torque.	☐ Accepted ☐ Not accepted	
6)	Check the sample probe.	Verify that the sample probe mating flange is welded to the funnel as specified. Verify that the sample probe flange is fastened using proper mounting bolts and torque. Verify that the probe quill is correctly inserted. Verify that the ceramic filter is mounted and undamaged.	☐ Accepted ☐ Not accepted	
7)	Check the external tubing.	Verify that sample lines, calibration gas and compressed air is connected as specified. Make sure that the tubing is supported and protected from breakage.	☐ Accepted ☐ Not accepted	
8)	Check compressed air.	Verify that compressed air is dry and oil free acc. to ISO 8573-1:2010 class 4.3.4.	☐ Accepted ☐ Not accepted	

	Action	Acceptance criteria	Result	Remark
9)	Check vents. ***Warning Make sure room is vented!***	Verify that the atmospheric vent is not restricted.	☐ Accepted ☐ Not accepted	
10)	Check sample out and safety valve outlet under analyser cabinet are vented. ***Warning Make sure room is vented!***	Verify that plugs are removed.	☐ Accepted ☐ Not accepted	
11)	Check the heated sample line.	Verify that the heated sample line is sufficiently supported, and that the minimum bending radius is adhered to.	☐ Accepted ☐ Not accepted	
12)	Check the heated sample line.	Verify that there are no water traps.	☐ Accepted ☐ Not accepted	
13)	Check for loose fittings.	Check tightness by hand.	☐ Accepted ☐ Not accepted	
14)	Check the electrical cabling.	Verify that all power and signal cables are routed and terminated according to termination and wiring diagrams.	☐ Accepted ☐ Not accepted	
15)	Check for loose wires.	Verify that all connections in junction boxes and internal terminal blocks are tight and secure.	☐ Accepted ☐ Not accepted	

	Action	Acceptance criteria	Result	Remark
16)	Check electrical fuses.	Verify that all equipment is connected to its correct fuse. Verify correct current rating for all fuses.	☐ Accepted ☐ Not accepted	
17)	Check the gas filter.	Verify adequate filter quality by inspecting the filter housing and filter element. Refer to Figure 25 in chapter 7.3.4.	☐ Accepted ☐ Not accepted	
18)	Check the gas pump in the SCS cabinet.	Inspect the gas pump for any damage or for obstacles.	☐ Accepted ☐ Not accepted	

To be filled in by installation contractor:

Installation contractor	
Ship name / hull no.	
Ship owner	
Checks performed by (date/sign)	
Checks verified by (date/sign)	

9 Drawing references

The ShipCEMS drawings given below are enclosed as separate files.

Note that [nnnn] is used as number identification for standard product drawings, but this is subject to change when specified by contract.

DWG	Description	ShipCEMS standard (230V)	Other options	120V
Mechanical drawings:				
1001	GENERAL ARRANGEMENT DRAWING ANALYSER CABINET (AC) EXTERNAL VIEW - STANDARD	X		X
1003	GENERAL ARRANGEMENT DRAWING ANALYSER CABINET (AC) INTERNAL VIEW - STANDARD	X		X
1202	GENERAL ARRANGEMENT DRAWING SAMPLE PROBE (SP)	X		X
1801	GENERAL ARRANGEMENT DRAWING SAMPLE CONDITIONING SYSTEM EXTERNAL VIEW, HOOK UP DETAILS	X		X
1901	GENERAL ARRANGEMENT DRAWING EMERGENCY STOP, OPTIONAL		X	
1903	GENERAL ARRANGEMENT DRAWING GAS DRYER, OPTIONAL		X	
System drawings:				
3001	SYSTEM DIAGRAM ANALYSER CABINET (AC)	X		X
3002	SYSTEM DIAGRAM SAMPLE CONDITIONING SYSTEM (SCS)	X		X
3003	SYSTEM DIAGRAM ANALYSER CABINET (AC) GAS DRYER, OPTIONAL		X	

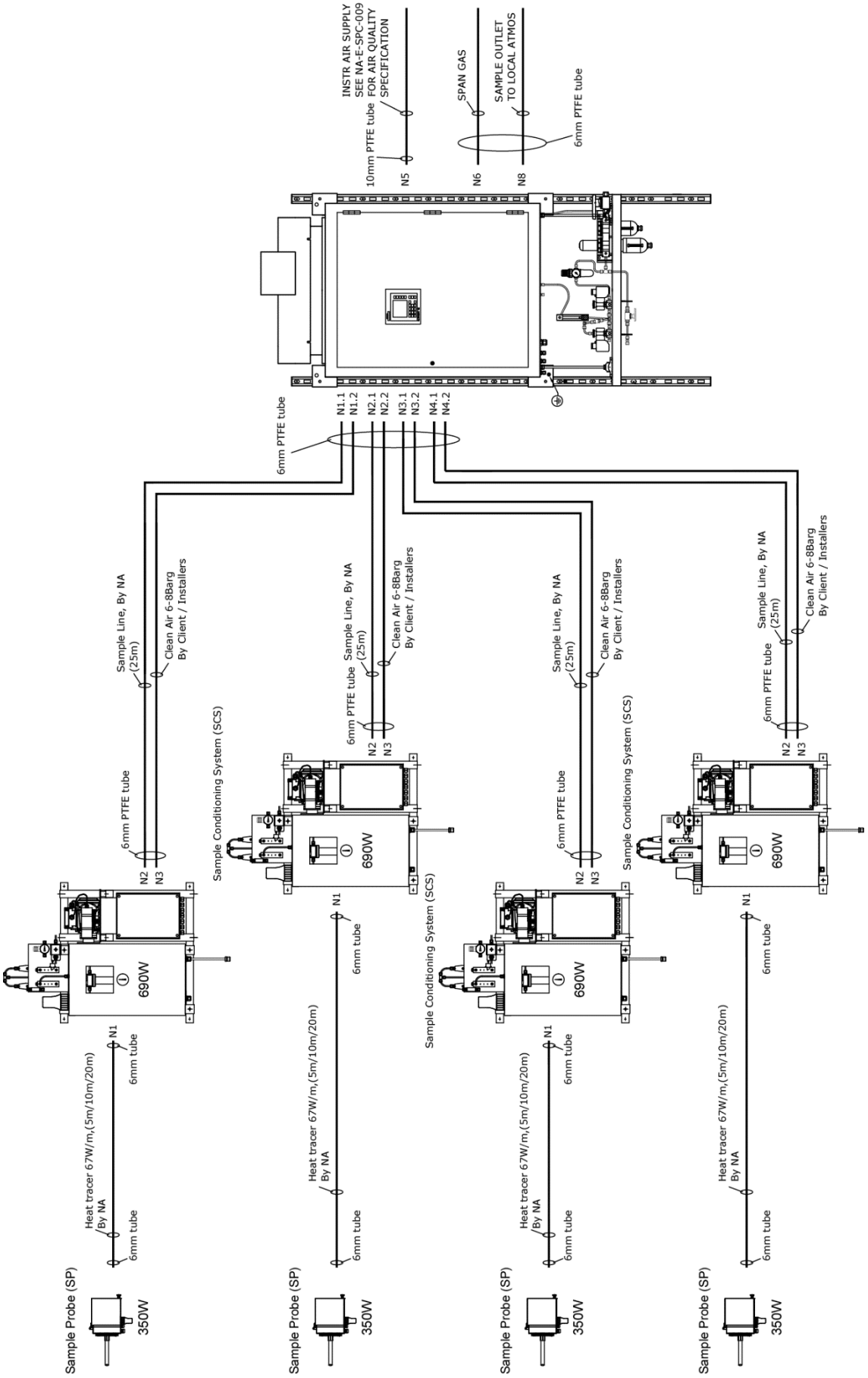
DWG	Description	ShipCEMS standard (230V)	Other options	120V
Electrical drawings:				
5001	TERMINATION DRAWING - OVERVIEW ShipCEMS SYSTEM 230VAC STANDARD	X		X
5002	TERMINATION DIAGRAM 230VAC & 24/48DC POWER DISTRIBUTION ANALYSER CABINET (AC)	X		X
5003	TERMINATION DIAGRAM SIGNAL DISTRIBUTION / INTERFACE ANALYSER CABINET (AC)	X		X
5004	TERMINATION DIAGRAM SAMPLE CONDITIONING SYSTEM (SCS)	X		X
5005	TERMINATION DIAGRAM SAMPLE PROBE (SP)	X		X
Block diagrams:				
6001	SYSTEM BLOCK DIAGRAM P&ID DISTRIBUTION OVERVIEW	X		X
6002	SYSTEM BLOCK DIAGRAM SIGNAL AND POWER DISTRIBUTION OVERVIEW	X		X

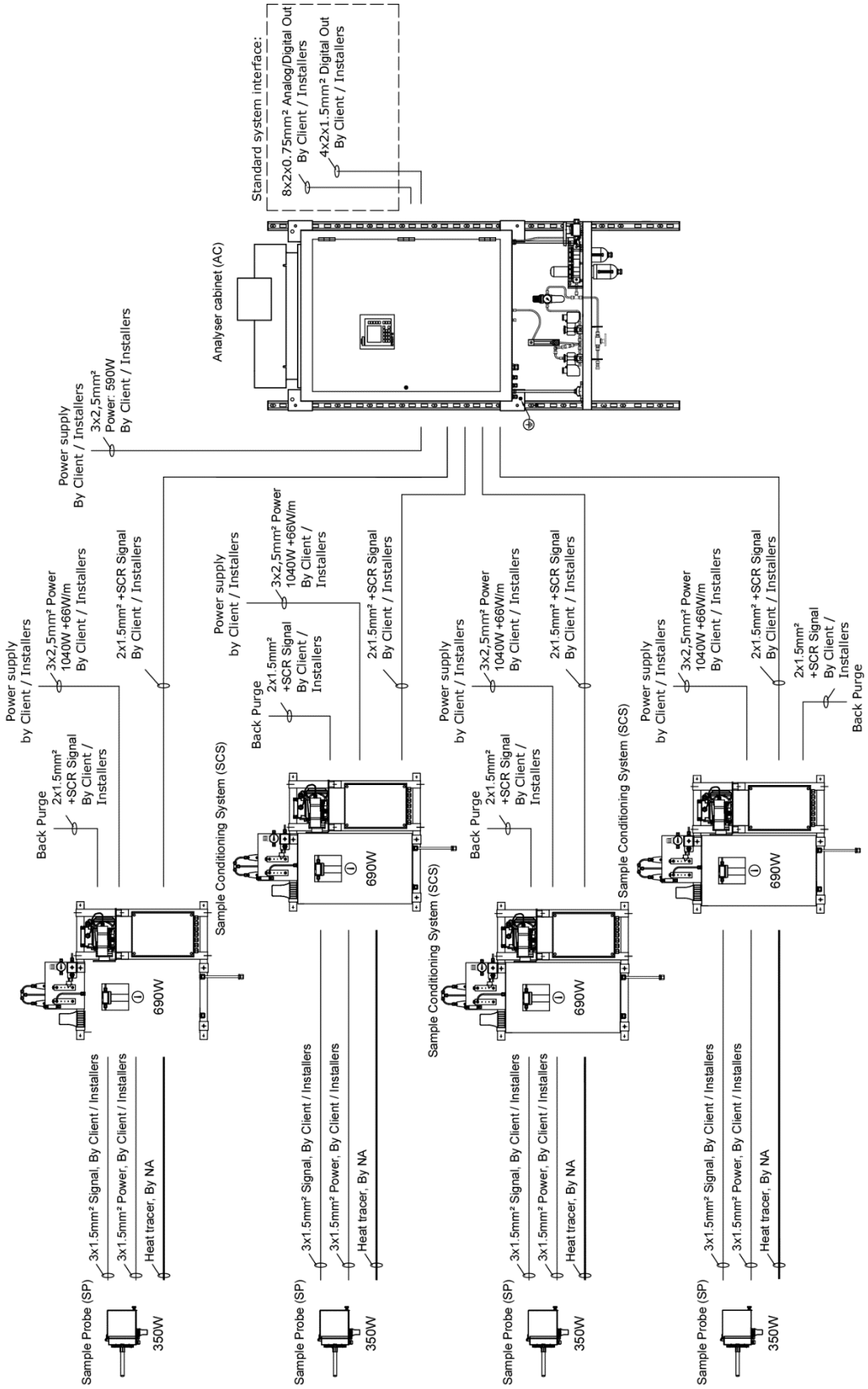
10 Installation overview

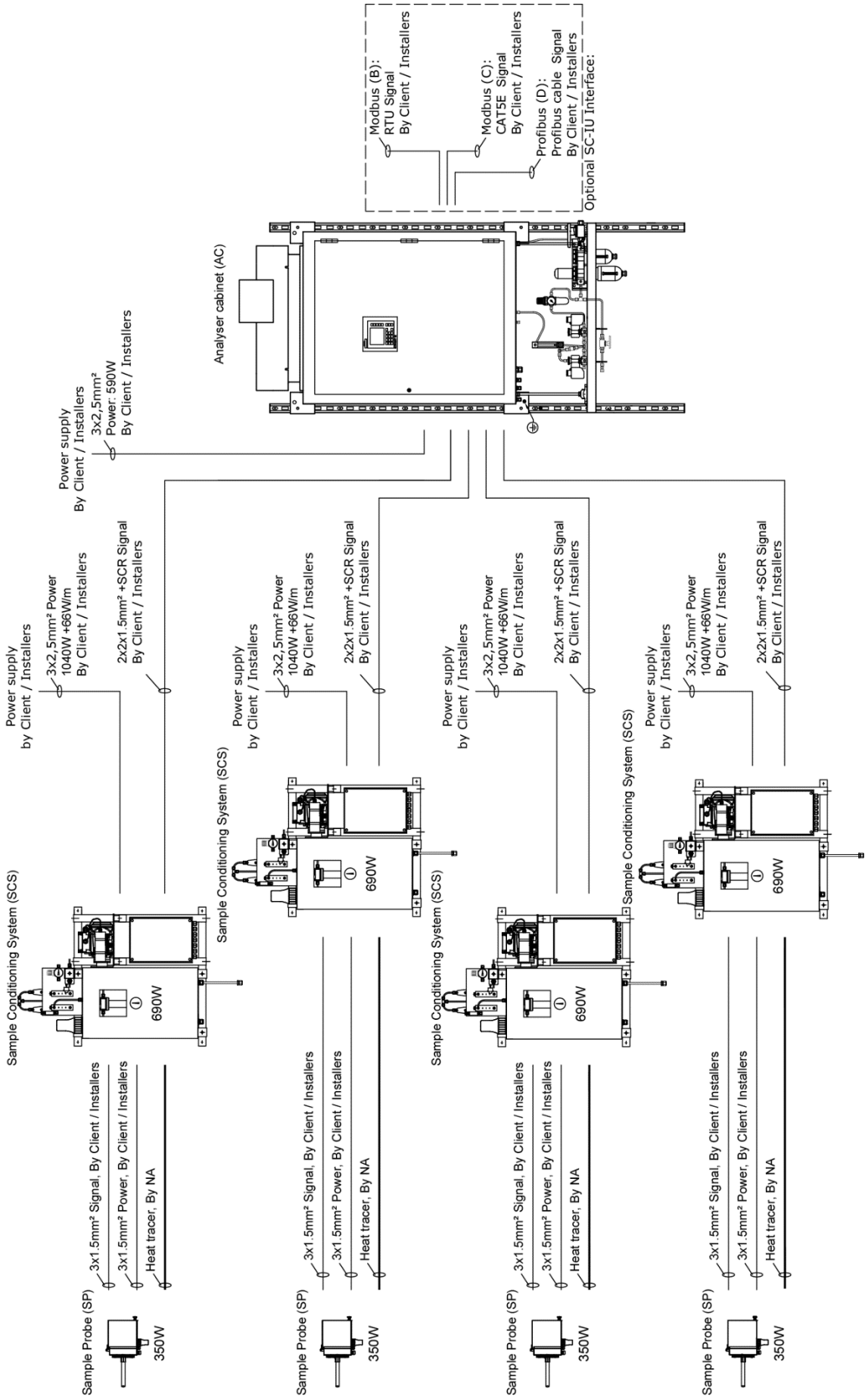
The overviews on the three following pages are extracts from the drawings below. The extracts should be considered as generic examples.

- *[6001] - SYSTEM BLOCK DIAGRAM P&ID DISTRIBUTION OVERVIEW*
- *[6002A] - SYSTEM BLOCK DIAGRAM SIGNAL AND POWER DISTRIBUTION OVERVIEW (for standard system interface)*
- *[6002B/C/D] - SYSTEM BLOCK DIAGRAM SIGNAL AND POWER DISTRIBUTION OVERVIEW (for fieldbus)*

Note	*Always follow the latest revision of the drawing!*


INSTR AIR SUPPLY
SEE NA-E-SPC-009
FOR AIR QUALITY
SPECIFICATION
10mm PTFE tube
N5
SPAN GAS
SAMPLE OUTLET
TO LOCAL ATMOS
N6
N8
6mm PTFE tube
N1.1
N1.2
N2.1
N2.2
N3.1
N3.2
N4.1
N4.2
6mm PTFE tube
Sample Line, By NA
(25m)
Clean Air 6-8Barg
By Client / Installers
6mm PTFE tube
N2
N3
Sample Conditioning System (SCS)
690W
N1
6mm tube
Heat tracer 67W/m,(5m/10m/20m)
By NA
6mm tube
Sample Probe (SP)
350W


Standard system interface:
8x2x0.75mm² Analog/Digital Out
By Client / Installers
4x2x1.5mm² Digital Out
By Client / Installers
Analyser cabinet (AC)
Power supply
By Client / Installers
3x2,5mm²
Power: 590W
By Client / Installers
Power supply
by Client / Installers
3x2,5mm² Power
1040W +66W/m
By Client / Installers
2x1.5mm² +SCR Signal
By Client / Installers
Back Purge
2x1.5mm²
+SCR Signal
By Client /
Installers
Sample Conditioning System (SCS)
690W
Sample Probe (SP)
350W
3x1.5mm² Signal, By Client / Installers
3x1.5mm² Power, By Client / Installers
Heat tracer, By NA


Optional SC-IU Interface:
Profibus (D):
Profibus cable Signal
By Client / Installers
Modbus (C):
CAT5E Signal
By Client / Installers
Modbus (B):
RTU Signal
By Client / Installers
Analyser cabinet (AC)
Power supply
By Client / Installers
3x2,5mm²
Power: 590W
By Client / Installers
Power supply
by Client / Installers
3x2,5mm² Power
1040W +66W/m
By Client / Installers
2x2x1.5mm² +SCR Signal
By Client / Installers
Sample Conditioning System (SCS)
690W
Sample Probe (SP)
350W
3x1.5mm² Signal, By Client / Installers
3x1.5mm² Power, By Client / Installers
Heat tracer, By NA