NORTEK VM Operations

Installation Manual Bottom Penetration - Single Bottom

www.nortekgroup.com

PRODUCT:

Nortek VM Operations

- **333 kHz Sensor Head with Single Bottom Penetration Assembly**

Owner Company Name / Logo	Project No.:
	Contract / P.O. No.:
Originator/Contractor/Supplier Company Name Nortek Netherlands B.V.	Originator/Contractor/Supplier Document Number 2043-NSO-Z-MB-001

Document History

06	23.03.2023	Various product updates	SKA	HHU	CWI
05	10.02.2023	Update with new PU dimensions	SKA	HHU	CWI
04	19.01.2023	Update to Nortek NL and Sign VM Ops	SKA	HHU	CWI
03	30.10.2019	Issued for DnV-GL Approval	OAH	ØDA	MBR
02	26.04.2019	Issued for DnV-GL Pre-Approval	OAH	ØDA	MBR
01	15.10.2018	Issued for Approval	MWB	OAH	MBR
00	27.08.2018	Issued for Review	MWB	MBR	OAH
Rev.	**Date**	**Reason for issue**	**Prepared**	**Checked**	**Approved**

Disclaimer

Nortek Netherlands B.V. endeavours to ensure that the information in this document is correctly and accurately stated but does not accept liability for any errors or omission.

Warning

The equipment to which this document applies must only be used for the purpose for which it was designed. The user must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.

Table of Contents

1. Technical specifications

The VM Operations package with a 333 kHz sensor head is an Acoustic Doppler Current Profiler [ADCP] for use on operational offshore vessels. The modern, directly applicable software allows easy operation. It comes with a junction-box and a processing unit to display data in real time. VM Operations has the primary function of a vessel-mounted current profiler and can provide real-time current profiles up to a range of 125m. As an option the system can output Bottom Track (speed over ground) information over a direct serial line, from the same junction box. Information valuable for navigation or station keeping purpose. An optional DNV type approved bottom penetration allows swift maintenance and hassle free operation of the sensor head.

See for the most recent product information:
https://www.nortekgroup.com/products/signature-vm-operations

This document guides you through the installation of the Single Bottom version of the Bottom Penetration unit.

2. DNV Type Approval Bottom Penetration Unit

The VM Operations can be delivered with a bottom penetration with a type approval of DNV according to DNV certificate TAS000002CU-Revision 1.

Delivery of a bottom penetration consists of:

- Bell housing with accessories. The bell housing is made of Steel EN10250-2/Grade S355j2G3+N with material certificate EN 10204:2005 3.1 and product certificate based on a witnessed pressure test by DNV. Alternatively, the bell housing can be delivered with a product certificate by either Lloyd's Register or Bureau Veritas based on the DNV type approval and witnessed pressure test by Lloyd's Register or Bureau Veritas respectively.
- Gate valve DN200 PN10 of ductile iron according to the DNV type approval certificate with product certificate by DNV, Lloyd's Register, Bureau Veritas, RINA or ABS
- Two flanges for a double hull vessel or a single flange for a single hull vessel according to the DNV type approval certificate. Flanges are made of steel EN10250-2/Grade S355j2G3+N and come with a material certificate EN 10204:2005 3.1. A steel pipe for double hull vessels is to be supplied by the yard.

In case a class society does not accept flanges as described above, drawings in PDF and STEP formats are available free of charge. You may find these drawings suitable in cases the society requests a material certificate 3.2. or requests a different thickness or different material is needed.

We advise to discuss installation of this bottom penetration with the class society well in advance of installation.

3. Installation Guide

This guide provides installation instructions for the sea valve for single hull construction vessels. The assembly drawing/general arrangement drawings provide an overview of components required for installation. The following drawings are referred to in the document, and given below:

Figure 1. N2043-053 NSO SB Assembly

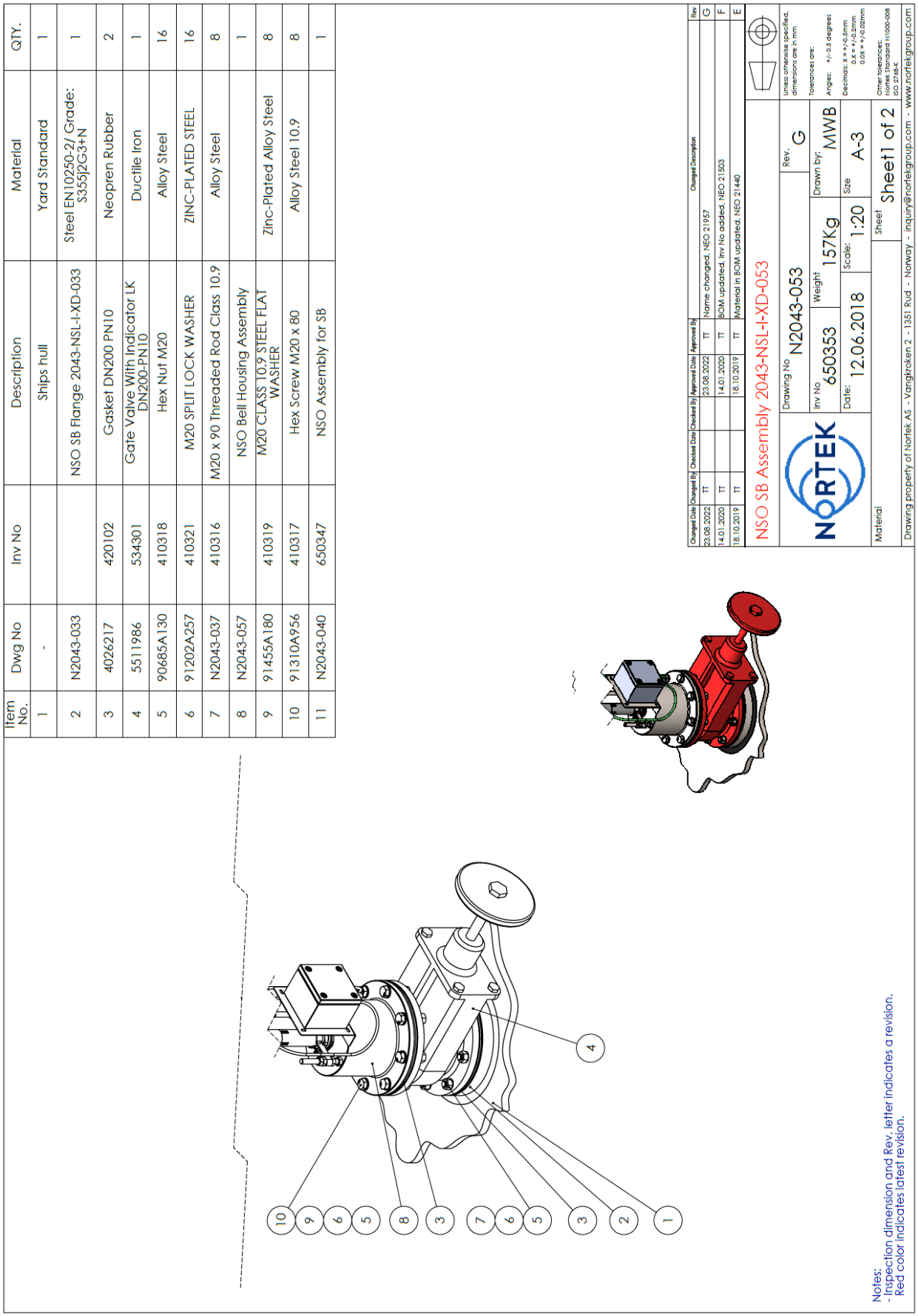
Figure 2. N2043-065 NSO Bell Housing Assembly (JB1, 100 – 240V AC)

Figure 3. N2043-040 NSO Pipe Assembly for SB

Figure 4. N2043-053 NSO Maintenance space for SB

Figure 5. 4430-6010.01 Junction Box VM Operations

Figure 1. N2043-053 NSO SB Assembly (NSO:Nortek Signature Operations)



Item No.	Dwg No	Inv No	Description	Material	QTY.
1	-		Ships hull	Yard Standard	1
2	N2043-033		NSO SB Flange 2043-NSL-I-XD-033	Steel EN10250-2/ Grade: S355J2G3+N	1
3	4026217	420102	Gasket DN200 PN10	Neopren Rubber	2
4	5511986	534301	Gate Valve With Indicator LK DN200-PN10	Ductile Iron	1
5	90685A130	410318	Hex Nut M20	Alloy Steel	16
6	91202A257	410321	M20 SPLIT LOCK WASHER	ZINC-PLATED STEEL	16
7	N2043-037	410316	M20 x 90 Threaded Rod Class 10.9	Alloy Steel	8
8	N2043-057		NSO Bell Housing Assembly		1
9	91455A180	410319	M20 CLASS 10.9 STEEL FLAT WASHER	Zinc-Plated Alloy Steel	8
10	91310A956	410317	Hex Screw M20 x 80	Alloy Steel 10.9	8
11	N2043-040	650347	NSO Assembly for SB		1

Changed Date	Changed By	Checked Date	Checked By	Approved Date	Approved By	Changed Description	Rev
23.08.2022	TT			23.08.2022	TT	Name changed, NEO 21957	G
14.01.2020	TT			14.01.2020	TT	BOM updated, Inv No added, NEO 21503	F
18.10.2019	TT			18.10.2019	TT	Material in BOM updated, NEO 21440	E

NSO SB Assembly 2043-NSL-I-XD-053

NORTEK

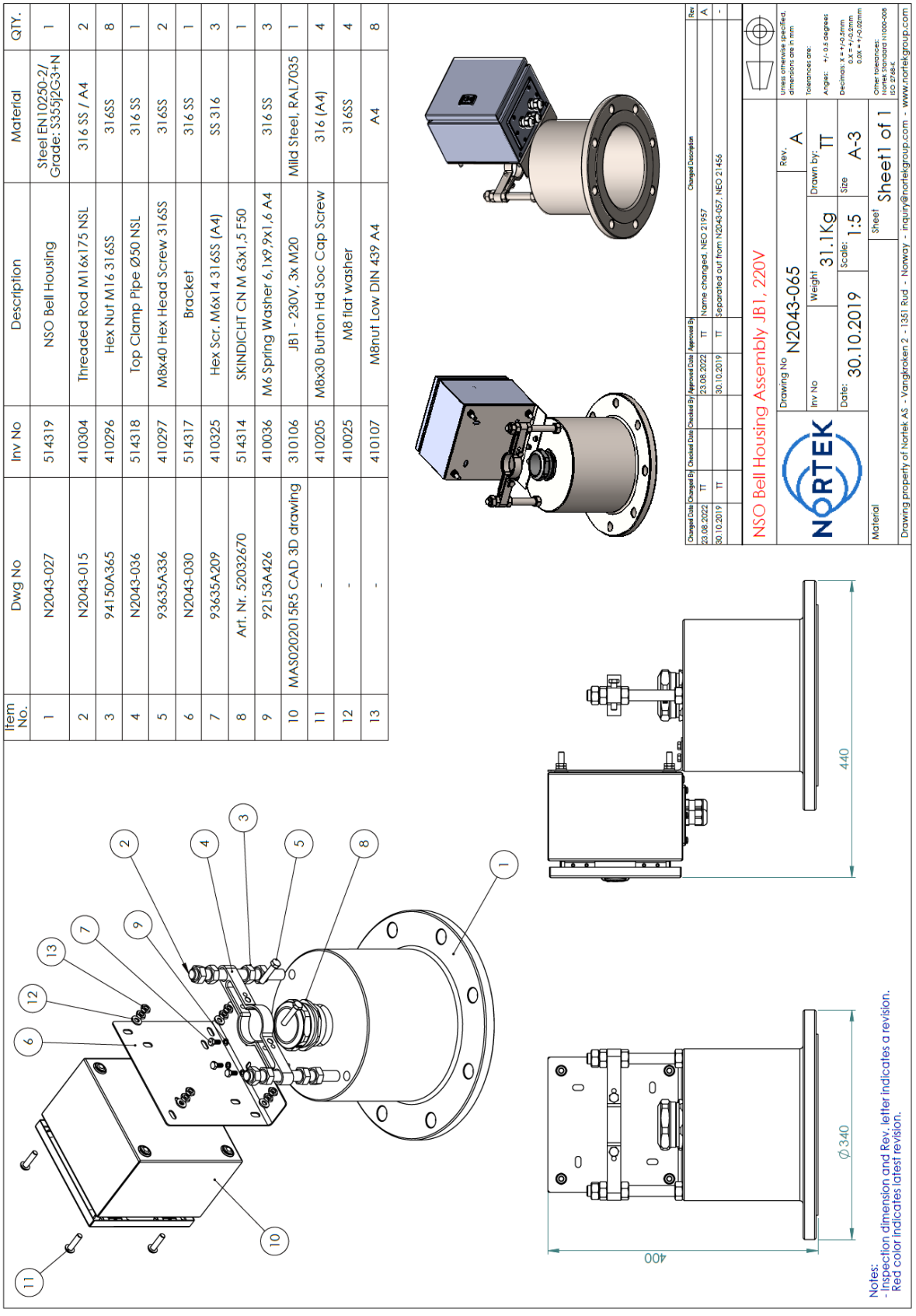
Drawing No N2043-053 | Rev. G
Inv No 650353 | Weight 157Kg | Drawn by: MWB
Date: 12.06.2018 | Scale: 1:20 | Size A-3
Material | Sheet Sheet1 of 2

Unless otherwise specified, dimensions are in mm
Tolerances are:
Angles: +/- 0.5 degrees
Decimals: X = +/-0.5mm, 0.X = +/-0.2mm, 0.0X = +/-0.02mm
Other tolerances: Nortek Standard 111000-008, ISO 2768-K

Drawing property of Nortek AS - Vangkroken 2 - 1351 Rud - Norway - inquiry@nortekgroup.com - www.nortekgroup.com

Notes:
- Inspection dimension and Rev. letter indicates a revision.
- Red color indicates latest revision.

Figure 2. N2043-065 NSO Bell Housing Assembly (100 – 240V AC)



Item No.	Dwg No	Inv No	Description	Material	QTY.
1	N2043-027	514319	NSO Bell Housing	Steel EN10250-2/ Grade: S355J2G3+N	1
2	N2043-015	410304	Threaded Rod M16x175 NSL	316 SS / A4	2
3	94150A365	410296	Hex Nut M16 316SS	316SS	8
4	N2043-036	514318	Top Clamp Pipe Ø50 NSL	316 SS	1
5	93635A336	410297	M8x40 Hex Head Screw 316SS	316SS	2
6	N2043-030	514317	Bracket	316 SS	1
7	93635A209	410325	Hex Scr. M6x14 316SS (A4)	SS 316	3
8	Art. Nr. 52032670	514314	SKINDICHT CN M 63x1,5 F50		1
9	92153A426	410036	M6 Spring Washer 6,1x9,9x1,6 A4	316 SS	3
10	MAS0202015R5 CAD 3D drawing	310106	JB1 - 230V, 3x M20	Mild Steel, RAL7035	1
11	-	410205	M8x30 Button Hd Soc Cap Screw	316 (A4)	4
12	-	410025	M8 flat washer	316SS	4
13	-	410107	M8nut Low DIN 439 A4	A4	8

Changed Date	Changed By	Checked Date	Checked By	Approved Date	Approved By	Changed Description	Rev
23.08.2022	TT			23.08.2022	TT	Name changed. NEO 21957	A
30.10.2019	TT			30.10.2019	TT	Separated out from N2043-057. NEO 21456	-

NSO Bell Housing Assembly JB1, 220V

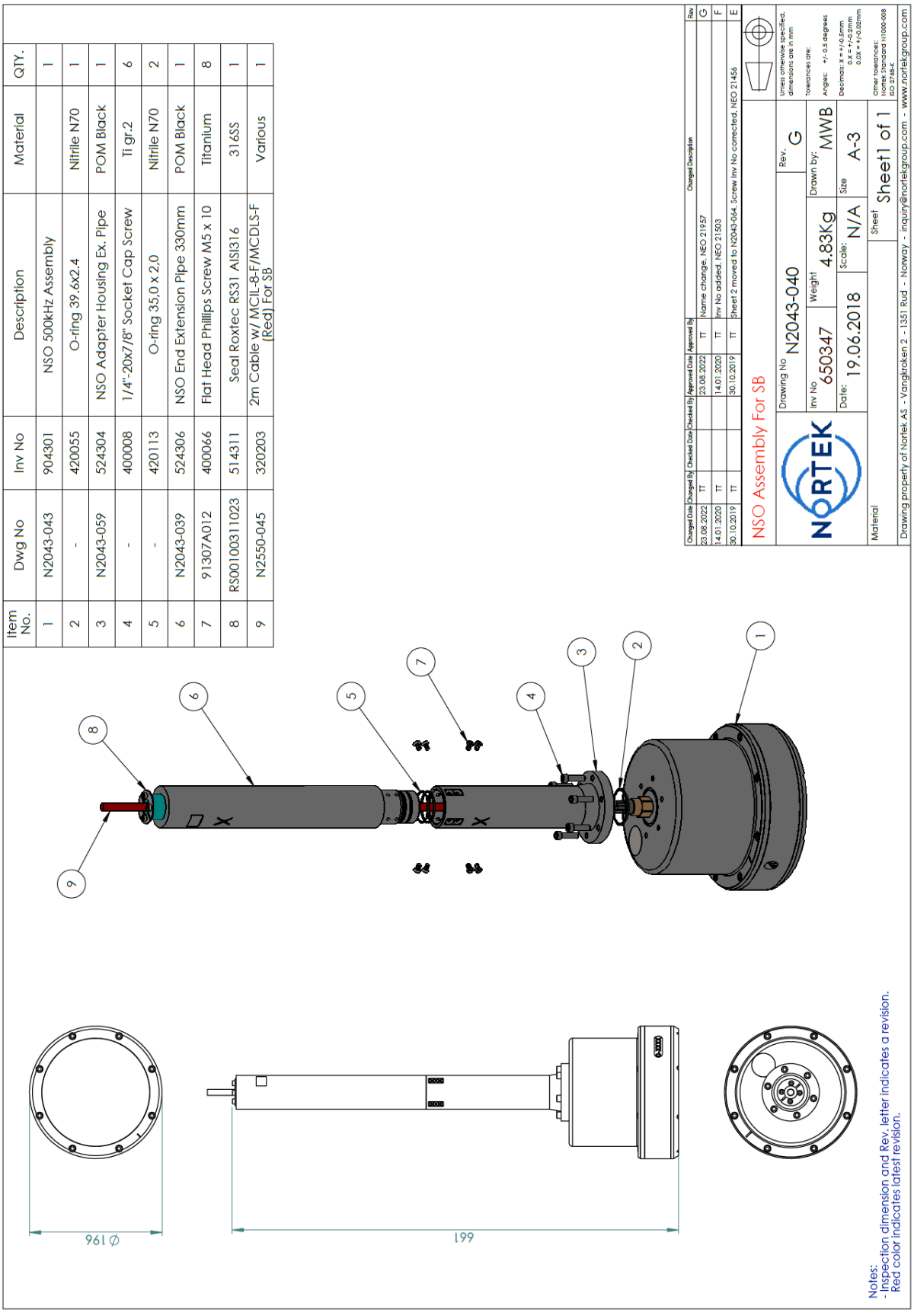
Drawing No N2043-065 | Rev. A
Inv No | Weight 31.1Kg | Drawn by: TT
Date: 30.10.2019 | Scale: 1:5 | Size A-3
Material | Sheet Sheet1 of 1

Unless otherwise specified, dimensions are in mm
Tolerances are:
Angles: +/- 0.5 degrees
Decimals: X = +/-0.5mm, 0.X = +/-0.2mm, 0.0X = +/-0.02mm
Other tolerances: Nortek Standard N1000-008 ISO 2768-K

Drawing property of Nortek AS - Vangkroken 2 - 1351 Rud - Norway - inquiry@nortekgroup.com - www.nortekgroup.com

Notes:
- Inspection dimension and Rev. letter indicates a revision.
Red color indicates latest revision.

Figure 3. N2043-040 NSO Pipe Assembly for SB



Item No.	Dwg No	Inv No	Description	Material	QTY.
1	N2043-043	904301	NSO 500kHz Assembly		1
2	-	420055	O-ring 39.6x2.4	Nitrile N70	1
3	N2043-059	524304	NSO Adapter Housing Ex. Pipe	POM Black	1
4	-	400008	1/4"-20x7/8" Socket Cap Screw	Ti gr.2	6
5	-	420113	O-ring 35,0 x 2,0	Nitrile N70	2
6	N2043-039	524306	NSO End Extension Pipe 330mm	POM Black	1
7	91307A012	400066	Flat Head Phillips Screw M5 x 10	Titanium	8
8	RS00100311023	514311	Seal Roxtec RS31 AISI316	316SS	1
9	N2550-045	320203	2m Cable w/ MCIL-8-F/MCDLS-F (Red) For SB	Various	1

Changed Date	Changed By	Checked Date	Checked By	Approved Date	Approved By	Changed Description	Rev
23.08.2022	TT			23.08.2022	TT	Name change, NEO 21757	G
14.01.2020	TT			14.01.2020	TT	Inv No added, NEO 21503	F
30.10.2019	TT			30.10.2019	TT	Sheet 2 moved to N2043-064, Screw Inv No corrected, NEO 21456	E

NSO Assembly For SB

Drawing No N2043-040 | Rev. G

Inv No 650347 | Weight 4.83Kg | Drawn by: MWB

Date: 19.06.2018 | Scale: N/A | Size A-3

Material | Sheet Sheet1 of 1

Unless otherwise specified, dimensions are in mm

Tolerances are:

Angles: +/- 0.5 degrees

Decimals: X = +/-0.5mm
0.X = +/-0.2mm
0.0X = +/-0.02mm

Other tolerances:
Nortek standard N1000-009
ISO 2768-K

Drawing property of Nortek AS - Vangkroken 2 - 1351 Rud - Norway - inquiry@nortekgroup.com - www.nortekgroup.com

Notes:
- Inspection dimension and Rev. letter indicates a revision.
- Red color indicates latest revision.

Figure 4. N2043-053 NSO Maintenance space for SB

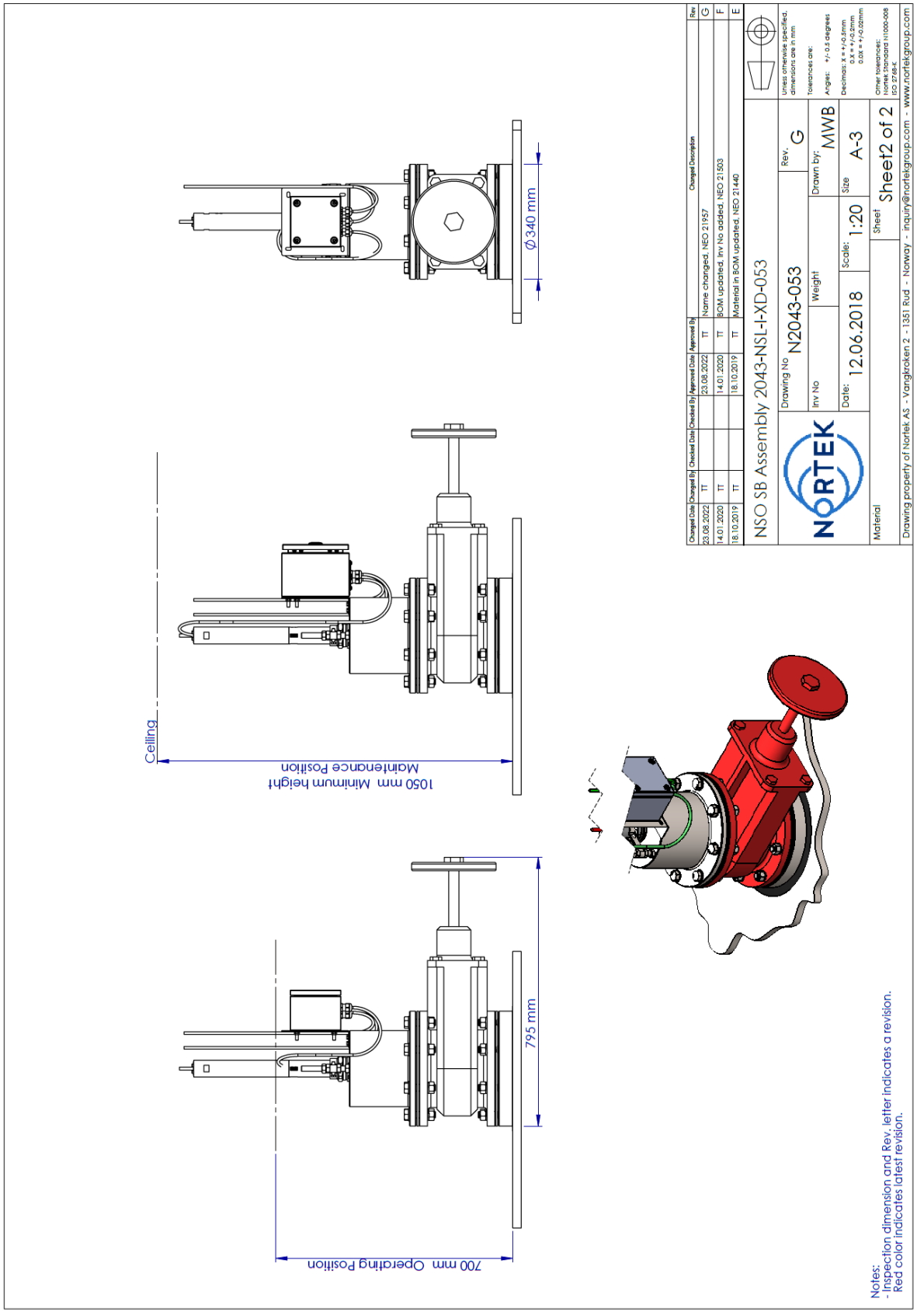
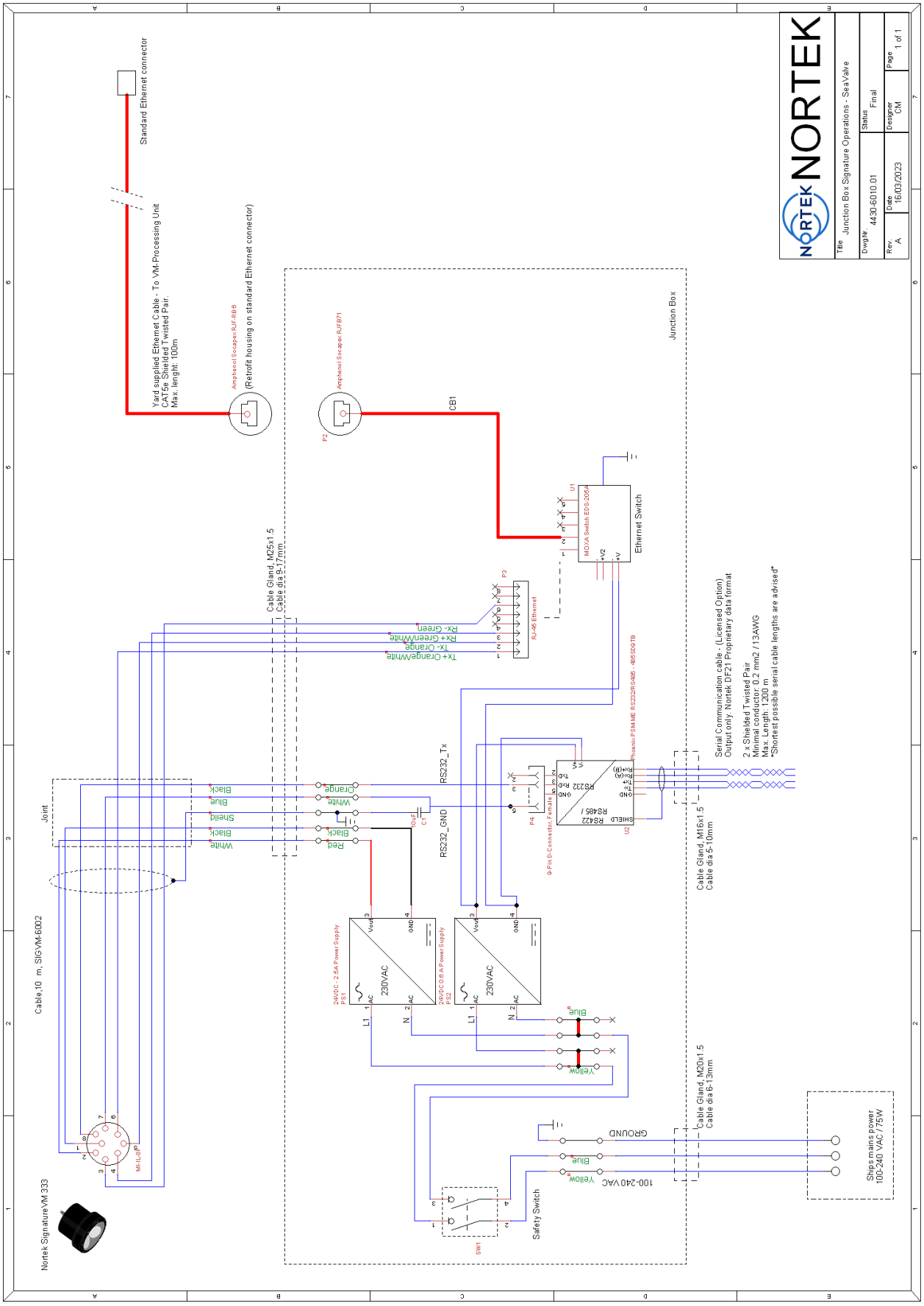


Figure 5. 4430-6010.01 Junction Box VM Operations

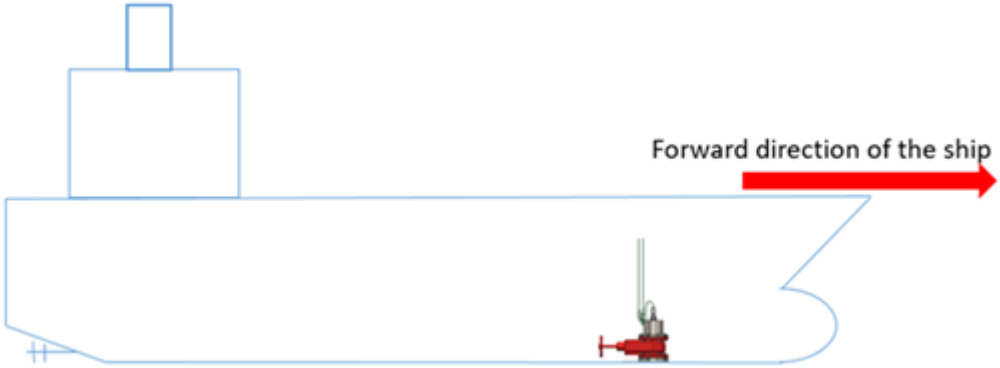


3.1 Placement of Bottom Penetration & general instructions

The Nortek VM Operations is based on the Doppler principle and must be completely submerged in water and should be installed in an area with minimal acoustic noise. The sensor head should not be installed close to the bow thruster propeller outlets, or other hull installations (outlets, vents or other protruding details), this to avoid unnecessary aeration or even cavitation and turbulence. Avoid locations where air may be trapped in heavy weather.

⚠ The sensor head is to be installed in the ship centreline, or as close to the centreline as possible, in a horizontal plane that is not subject to turbulence or aeration.

In most hull designs the optimal location will be in the fore part of the ship, however there may be cases where other locations are preferred, please inquire your local naval architect for the best option(s). Nortek can provide engineering support on location for the VM Operations upon request.



The sensor head itself should be handled with caution during installation and assembly. As an option, Nortek can provide a service engineer to install the instrument itself after the bottom flange and gate valve are installed. Please check agreed purchase order scope for installation before proceeding. All items identified in this document as part of assembly will be delivered by Nortek. Please check Nortek shipment box(s) for parts.

Note that the welding to hull structures and structural support of the items may be subject to separate approval by classification societies for each installation on board a ship.

⚠ The active surface of the sensor must be installed with the sensor head at a maximum of +/-1 degree to the ships horizontal plane.

If a flat, horizontal section is not available for instrument fitting, the yard must construct a suitable landing.

⚠ Welding seams or any other sharp objects in the direct area of the transducer head should be removed, smoothed and/or rounded off, in order not to create turbulence or aeration in front of the sensor head while at speed.

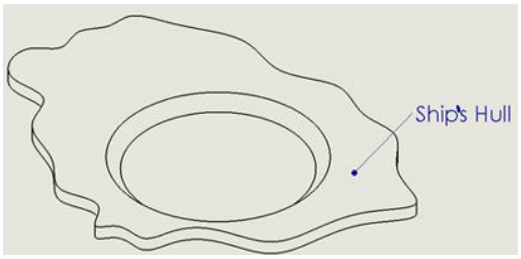
Nortek will deliver a DNV class approved Bottom Penetration. See enclosed data sheet and GA for details of the Bottom Penetration. When handling the Bottom Penetration assembly, all lifting devices must be attached on the outside of the valve. The Bottom Penetration assembly should be placed in a service accessible place, large enough for installation/ disassembly/maintenance of the sensor head and the gate valve.

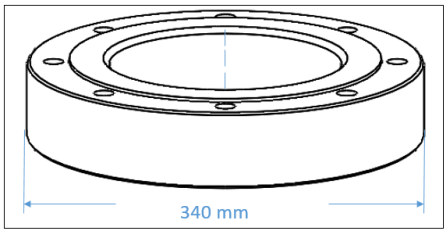
⚠ Protect the active element of the transducer/sensors during transport and installation, and do NOT paint the surface.

⚠ Please note that the sensor head is filled with purified water and requires protection from frost.

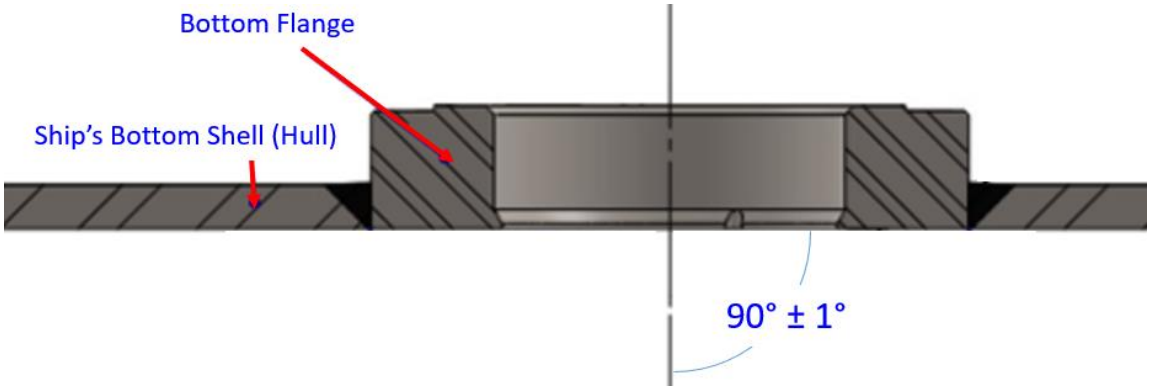
4. NSO SB Flange welding

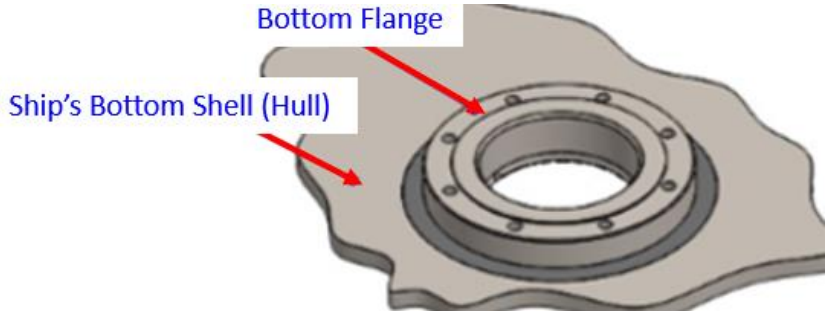
- Cover the threaded holes and protect the inside the NSO SB Flange (item 2, drawing no. 2043-053) before welding. Handle with care!
- Cut a hole with a diameter of Ø 342mm in the ship's hull.





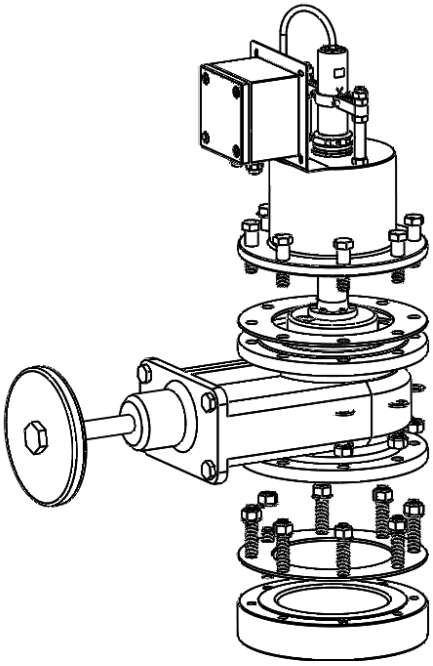
- Please consider the positioning of the flange before welding. The 8 mounting holes determine the mounting of the bottom penetration assembly on top (22.5 degree intervals)
- The flange shall be welded with the bolt holes facing upwards (for access from inside the vessel).
- Weld the flange to the ship's bottom shell.
- The flange bottom must be flush with the ship's bottom shell.
- Remove all welding seams after welding to make a smooth bottom surface.
- Flange is to be coated according to yard standard after welding to hull. Please note that the sensor head has a diameter of 196mm when applying (antifouling) coat on the inside of the flange.

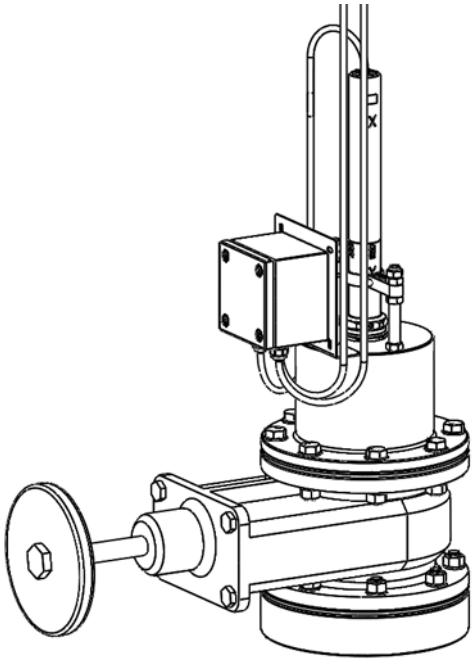




5. Assembling

This chapter provides instructions for assembly. It first introduces the breakdown of subassemblies and then gives instructions on how to install each subassembly.



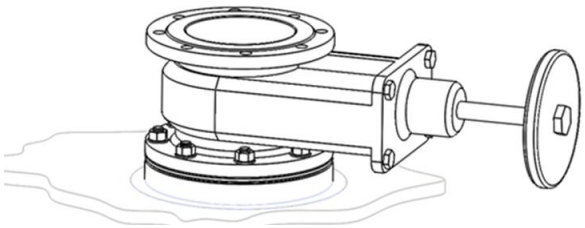
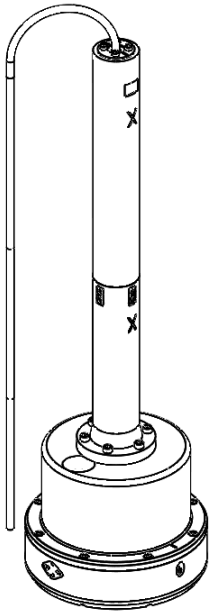
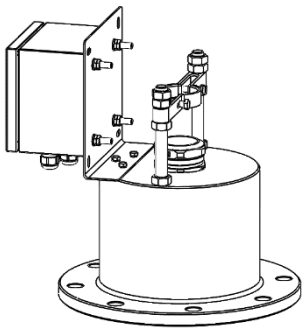


5.1 Subassembly

There are 3 main subassemblies:

- NSO SB Flange and Gate Valve
- NSO Assembly for SB (Drawing no. N2043-040)
- NSO Bell Housing Assembly (Drawing no. N2043-065)

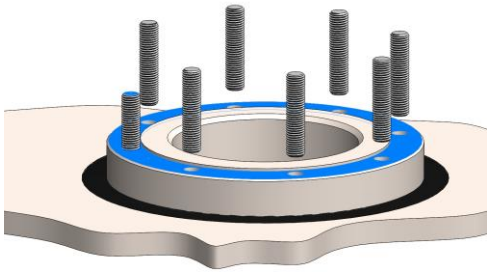
Otherwise see the main drawing (Drawing no. N2043-053) for item numbers / inventory numbers.

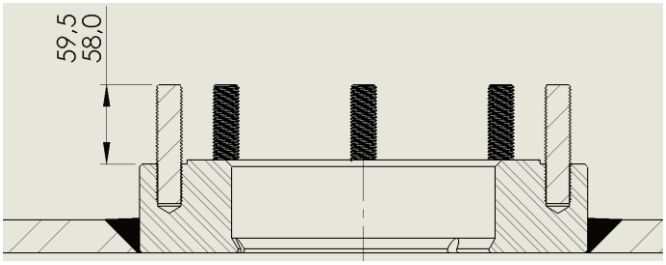
Description	Figure
NSO SB Flange and Gate Valve	
NSO Assembly for SB & (Drawing no. N2043-040)	
NSO Bell Housing Assembly (Drawing no. N2043-065) Please note that the dimensions of the junction box differ and do not comply with drawing N2043-065, see chapter 5.6 JB Cable connections	

5.2 NSO SB Flange and Gate Valve

AFTER welding of flange to ships bottom shell.

- Inspect flange and ensure it is free from any defects and debris.
- Mount the threaded rods M20x90 (8x) item 7 in drawing no. N2043-053
- Glue the threaded rods into the bottom flange by using Loctite (strong, green 270), that is included in the Nortek shipment.
- The top of the treaded rods should protrude 58,0mm - 59,5mm when measured from the surface of the flange area (NOT from the top of the Gasket surface area).

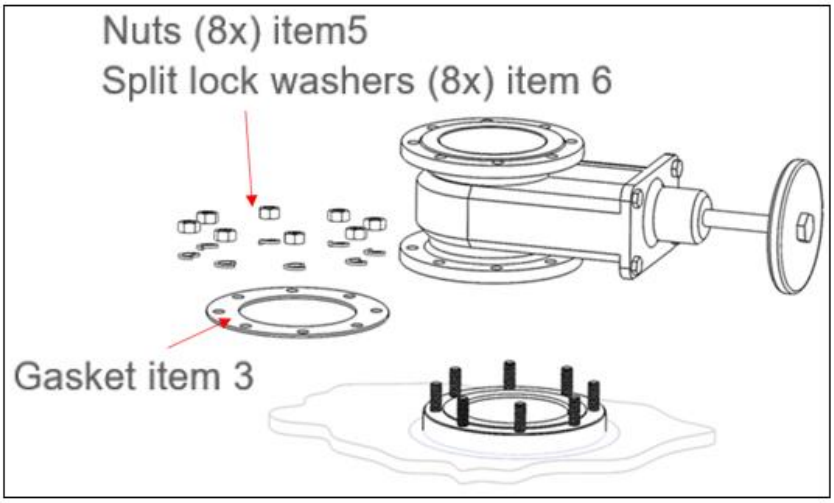




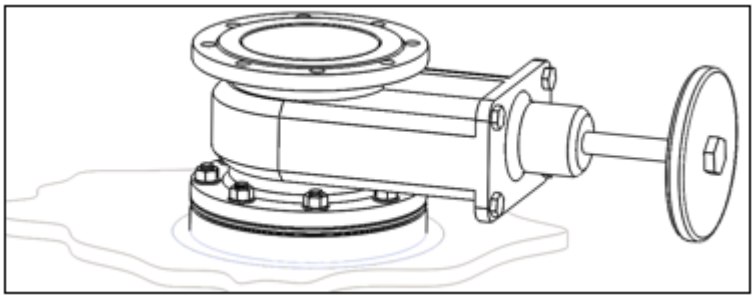
⚠ Loctite cures fully in 24 hours!

5.2.1 Mounting Gate Valve to NSO SB Flange

See drawing no. N2043-053 for relevant item numbers.



- Place the Gasket on the top of the bottom flange, then lower the Gate Valve (approx. 85 kg) (with open gate) using appropriate lifting gear.
- Use split lock washers (item 6) and nuts (item 5).
- ⚠ Align parts before tightening the nuts!
- Close the gate when it is done.

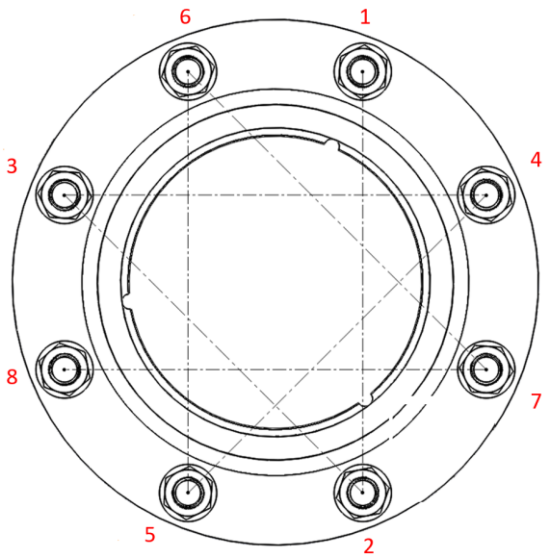


Use the (star) method of tightening the nuts as shown in the figure.

For each torque setting, repeat the star method until all nuts are tightened to that torque. Only then go to the next torque setting, and again, repeat the star method until all nuts are tightened to that torque.

Tighten all nuts in three steps; Tighten nut 1,2,- 8 with 25 Nm torque, then 37 Nm and lastly to 45-50 Nm torque.

[18 lb-ft, 27 lb-ft, 37 lb-ft // 220 lb-in, 332 lb-in, 443 lb-in]



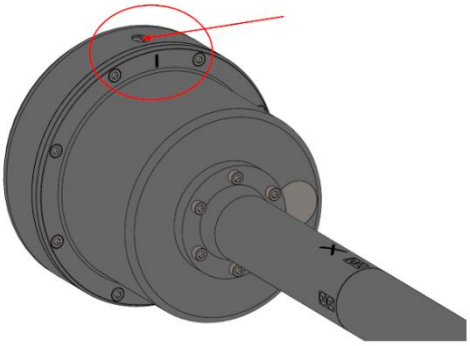
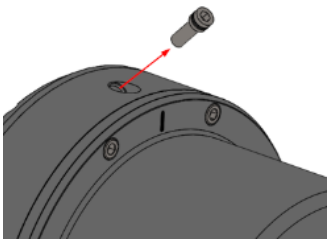
5.3 Preparing the Sensor Head for use

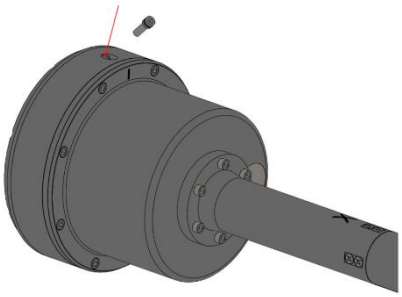
If the unit was not filled on arrival, the transducer chamber should be filled with distilled water, leaving a minimal amount of air in the transducer chamber. It can help to rotate the sensor to allow the larges air bubbles to escape and to allow the tiny air bubbles flow upwards to the filling hole overnight.

5.3.1 Filling distilled water into the Sensor Head chamber

The instrument may have been shipped in "dry condition" (verify your delivery agreement). If your instrument is delivered in "dry condition" filling the chamber with distilled water is essential for the instrument to work. Follow the instruction below, you will need about 310ml of distilled water to fill the chamber completely.

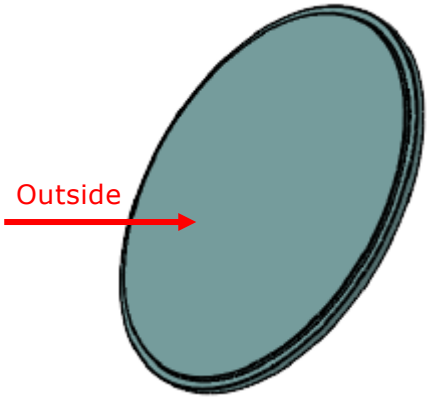
⚠ Its very important to use distilled water since this is an acoustic neutral liquid. Take necessary measure with extreme heat or cold (below 0 degrees Celsius) when in drydock, transportation or in storage. Or, alternatively, delay filling the transducer chamber until after launching the vessel.

Place the instrument in a clean environment on a horizontal plane with the bolt, that closes the transducer chamber, on top.	
Unscrew the bolt and verify the small gasket on the bolt is still intact.	

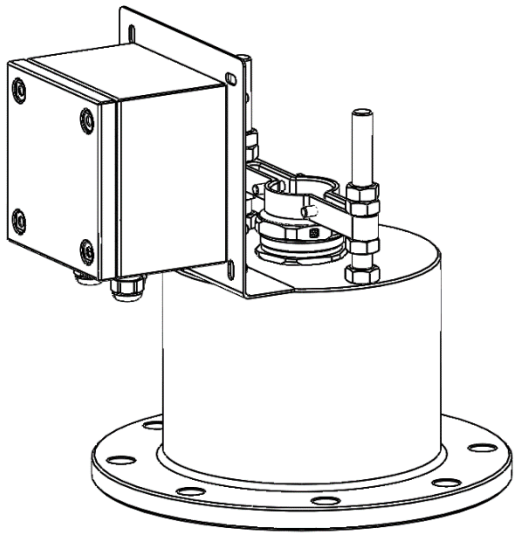
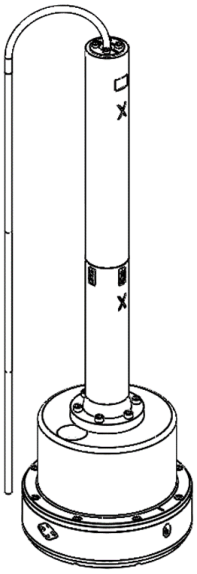
Use a funnel and a small bottle or a syringe or a laboratory wash bottle. Fill till the camber completely without injecting any air. Keep the transducer opening open to allow air to escape. When the chamber is clos to full keep injecting water into the water of the transducer chamber while carefully retrieving the outlet. Wait a few minutes and manually try to move the unit to collect all air in one bubble and ensure that its is escaped. Top the unit up with extra distilled water at the end. Tiny air bubbles may take up to 24h to form into a larger bubble that is able to escape to the opening. When the sensor head is facing downwards a marginal amount of air is allowed to stay in front of the central bronze temperature sensor, however can better be avoided. When the transducer chamber is filled, tighten the bolt at approximately 1,1 Nm, hand tight. The instrument is now ready to be assembled into the bell housing.	 

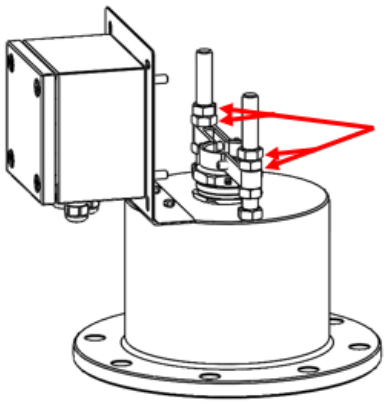
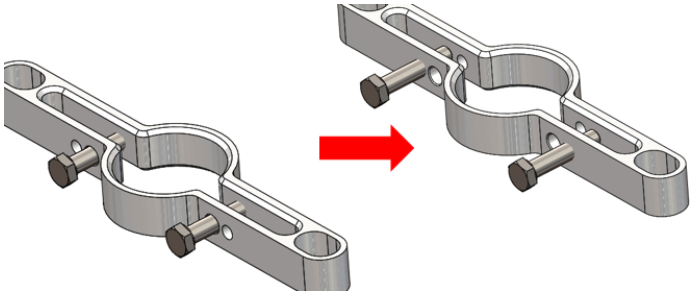
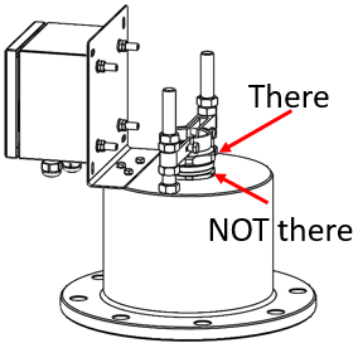
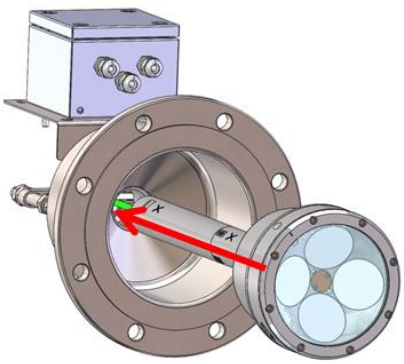
Remove the plastic protection foil in case this is still present on the front window.	

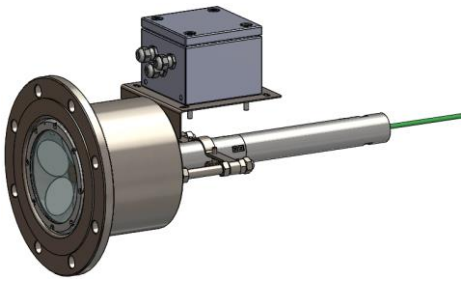
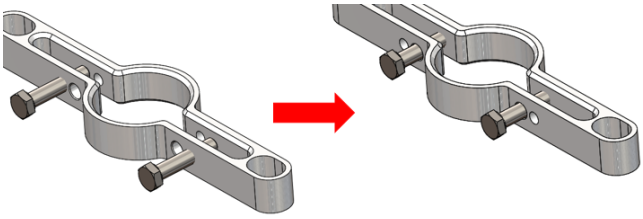
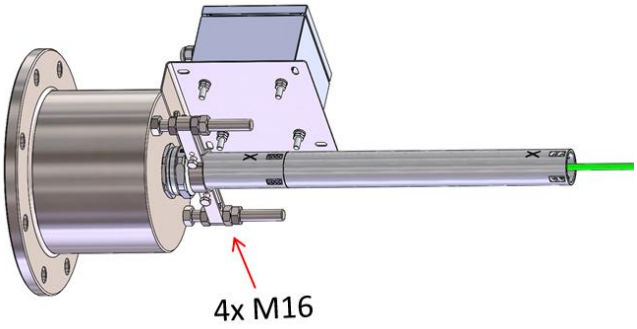
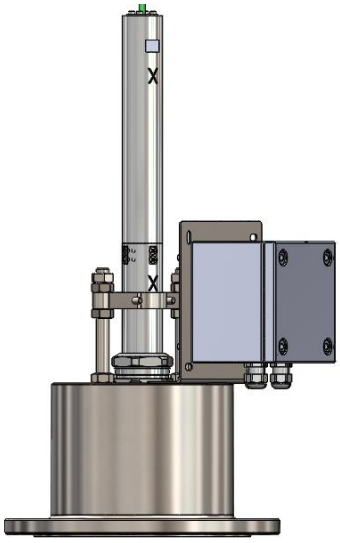
5.3.2 Replacing the Polycarbonate Front Window

Tighten and untighten the 8 screws using the star method as in 5.4. Clean the surface and check the status of the O-ring. ⚠ Replace the window and mount it with the small surface diameter towards the outside. Tighten screws “hand tight”	

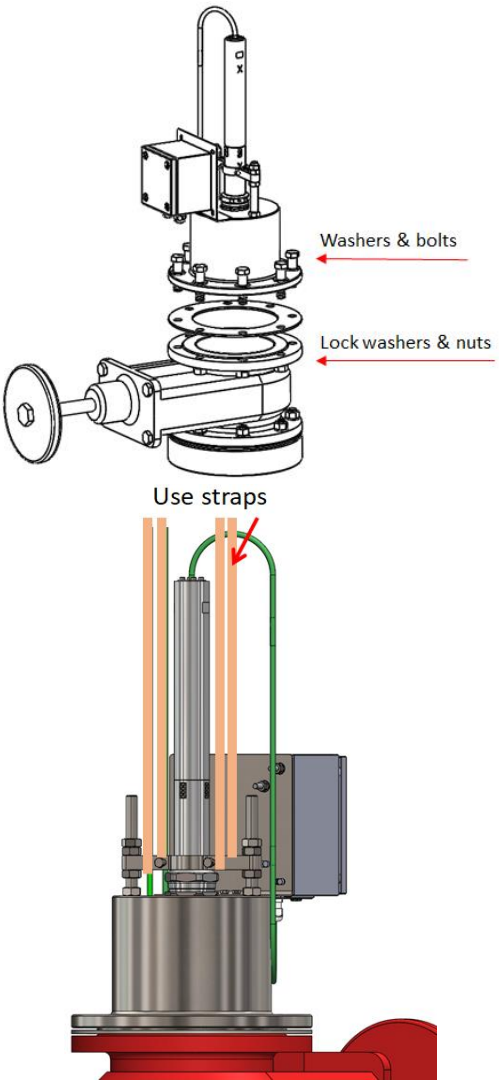
5.4 Combine the Subassemblies

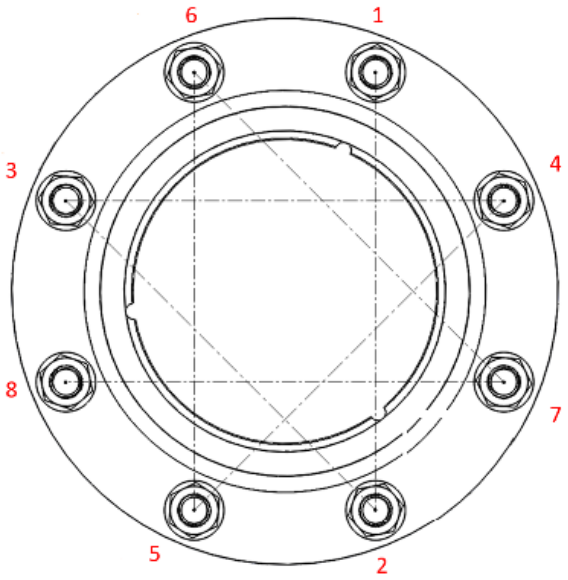
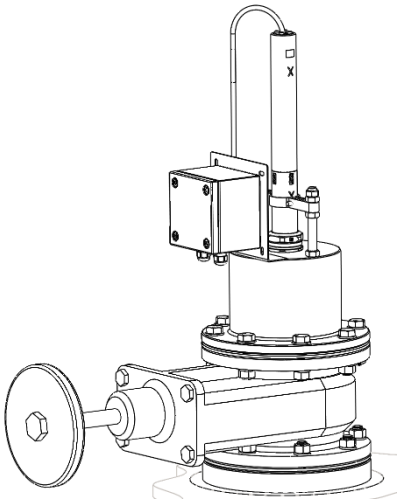
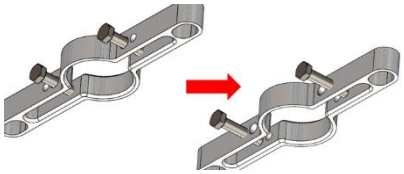
NSO Bell Housing Assembly drawing no. N2043-065 Please note that the dimensions of the junction box differ and do not comply with drawing N2043-065, see chapter 5.6 JB Cable connections.	
NSO Assembly for SB drawing no. N2043-040 Please note that the sensor head requires to be filled with distilled water before use. This requires to have the transducer head outside the bottom penetration assembly. See chapter 5.3.1 for information about filling the transducer head.	

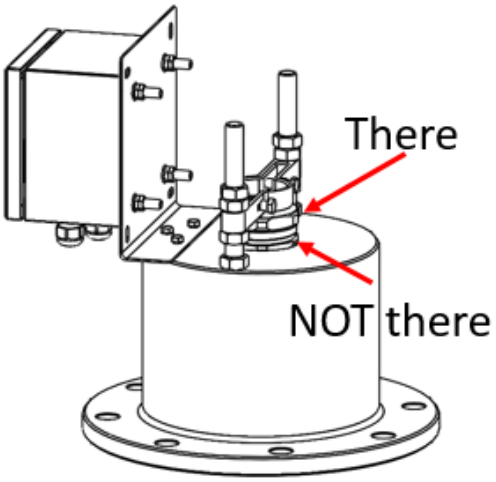
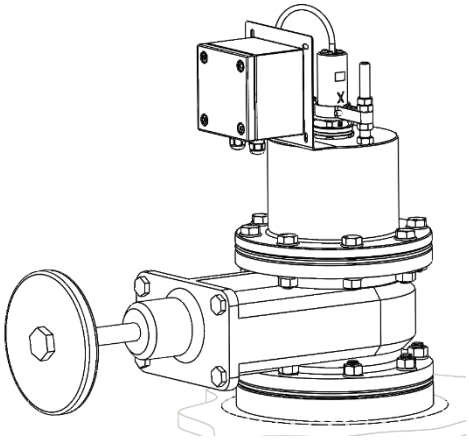
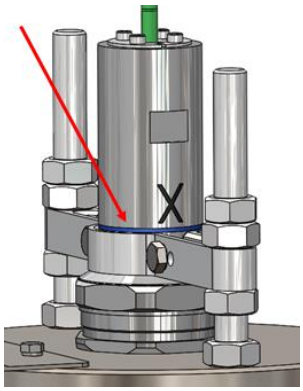
Loosen the four M16 nuts on top of the clamp. Item 3 in drawing no. N2043-065.	
Unscrew the two M8 bolts item 5 of drawing no. N2043-065 and screw them into the next holes to open the clamp item 4 of the drawing no. N2043-065	
Loosen the Skindicht, item 8 drawing no. N2043-065 carefully! Only loosen the top nut and avoid rotating the whole Skindicht. Please use the Nortek supplied thin wrench for this. See the arrows in the illustration. Loosen the top nut enough to allow the extension pipe to pass through the Bell Housing.	
Do NOT pull up the sensor by the cable! Use the extension pipe instead. Lay the Bell Housing on its side for easier assembly.	

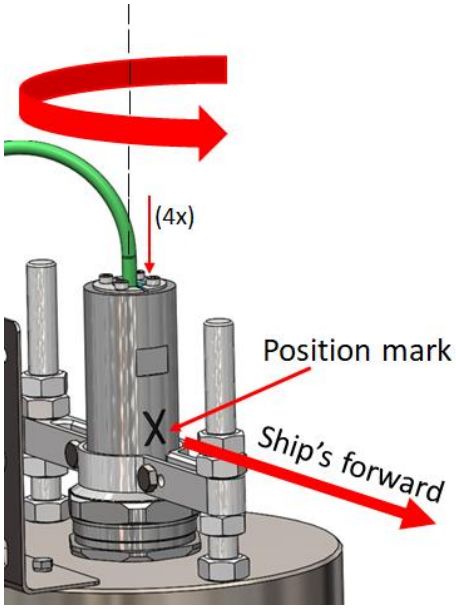
Thread and pull the extension pipe all the way through, so that the transducer window is flush with the flange of the bell housing. If possible, pull the instrument so that the transducer window is just inside the bell housing. Ensure that cable is protruding from top of extension pipe.	
Then move both M8 screws, item 5 in drawing no. N2043-065 back in the other treaded slots and tighten the clamp in order to fix the sensor head inside the Bell Housing. Tighten the Skindicht.	
And tighten four M16 nuts, item 3, on top of the clamp drawing no. N2043-065. Handle the transducer window with care. It must be free of defects and blemishes. Then turn the Bell Housing right side up.	 

5.5 Install the Bell Housing including the NSO assembly for of the SB on the Gate Valve

The Gate Valve must be closed! Place the gasket, item 3, in drawing no. N2043-053 on the Gate Valve. Place the arrangement assemblies on top of the Gasket. Use proper lifting gear to position the arrangement without damage. Please note that the Bell Housing may be lifted by using straps on either side of the clamp Mount washers (item 9), bolts (item 10), lock washers (item 6) and nuts (item 5) drawing no. N2043-053.	

⚠ Align parts before tightening the nuts! Use the (star) method of tightening the nuts as shown in the figure. For each torque setting, repeat the star method until all nuts are tightened to that torque. Only then go to the next torque setting, and again, repeat the star method until all nuts are tightened to that torque. Tighten all nuts in three steps; Tighten nut 1,2,- 8 with 25 Nm torque, then 37 Nm and lastly to 45-50 Nm torque. [18 lb-ft, 27 lb-ft, 37 lb-ft // 220 lb-in, 332 lb-in, 443 lb-in]	
Open the gate valve Unscrew the two M8 bolts (item 5, drawing N2043-065). Put them into the two holes further from the centre of the clamp (item 4, drawing N2043-065). Tightening them in the outer threaded holes will force open the clamp the Hold the extension pipe securely.	 

Loosen the Skindicht (item 8) drawing no. N2043-065 to allow the extension pipe to pass through the Bell Housing	
Using the extension pipe, lower the pipe (instrument arrangement) carefully all the way until the transducer lands on the bottom of the flange edge. It must be flush with the ship's bottom hull! Check and verify that the instrument has been lowered completely. When in dock, verify underneath the vessel if the sensor head is flush!	
Make a mark (line) with a permanent colour marker on the extension pipe which indicates the landing position.	



Before tightening the clamp and Skindicht, the transducer direction must be fixed. Turn and adjust the position mark toward the ship's forward direction.

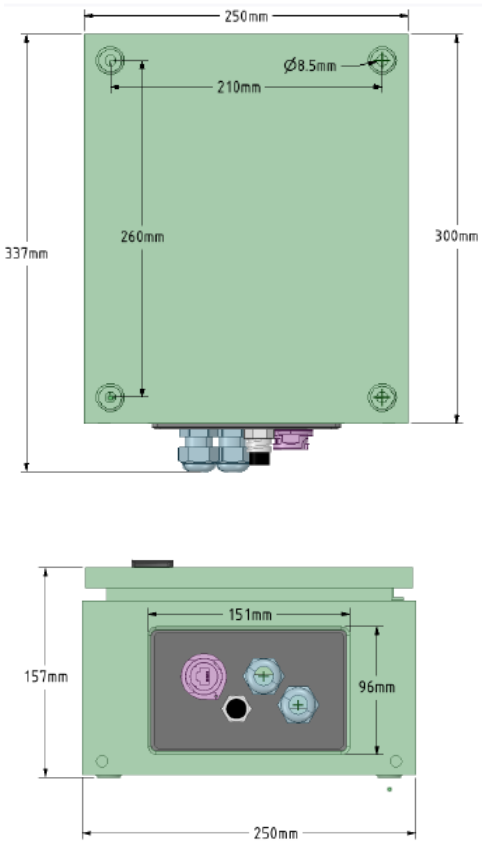
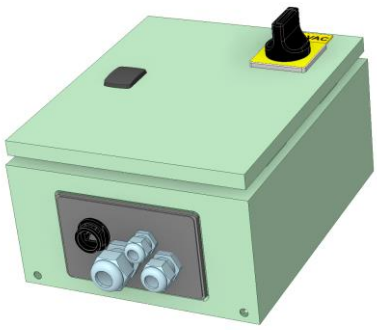
Then tighten the Skindicht and the clamp without changing the orientation of the extension pipe and instrument. Make a mark with a permanent colour marker on the top of Bell Housing (item 1) drawing no. N2043-065 which indicates the forward position of the ship.

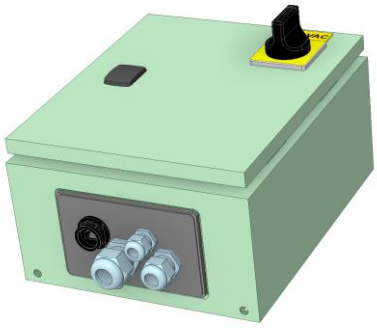
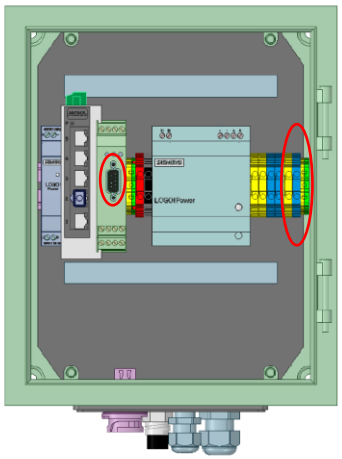
Take a picture of the completed installation showing the top part of the extension pipe in the Bell Housing and a picture from below the vessel, showing the transducer window being flush with the hull. Please send the pictures to Nortek Netherlands B.V. for documentation of the completed installation.

⚠ The instrument should not be left flush with the hull unless the vessel is in water.

If the vessel is in dry dock the instrument should be lifted up slightly in the shaft in order to protect the transducer window. After the vessel launch the instrument must be lowered again in the correct position to be flush with the hull.

5.6 JB Cable connections

The dimensions of the junction box (JB) do not correspondent to those in drawing N2043-065. The correct design and dimensions of Nortek junction box model 4430 are noted in the figure to the right. The cabinet is in accordance to the specifications of the Nvent_Hoffman, type MAS0352515R5. The cabinet can be installed on the bell housing bracket, or wall mounted in its close surrounding, provided the length of the supplied cable allows for this.	
The outside of the JB has a switch on the outside to turn the power on or off without opening the cabinet. The cabinet's door can be opened and closed with an universal key.	

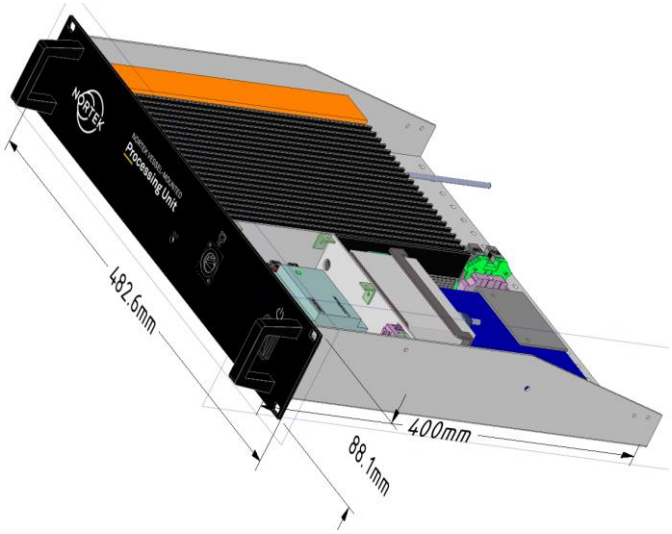
The bottom plate is fitted with three cable glands and one connector. - A cable gland for a yard standard power cable towards the yard power supply (100-240V AC / 70W) M20x1.5, cable diameter 6-13mm - A cable gland for serial output M16x1.5 with a cable diameter 5-10mm - A cable gland is fitted for the cable to the sensor head - Amphenol Socapex RJFB71 Ethernet connector towards the Processing unit. This connection requires a yard supplied Cat5e, shielded twisted pair cable.	
The junction box is pre-wired according to drawing number 4430-6010.01. A yard standard AC power cable should be fitted on the L, N and PE terminal blocks on the right. If the serial output will not be used, it is recommended to leave the serial Sub-D connector disconnected from the serial converter.	

5.7 Processing Unit

Version 4420 of the Nortek Vessel Mounted processing unit is designed to be fitted in a 19” survey rack inside a conditioned room.

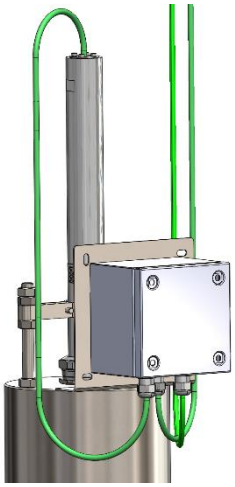
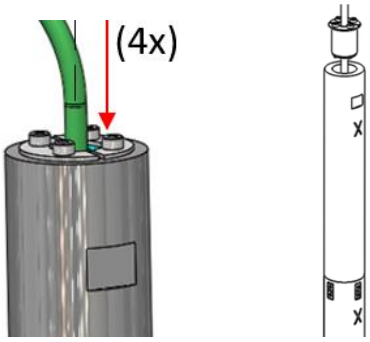
Housing	19” rack-mountable 2HE
Dimensions	482x88x400 mm
Input	100-240 V AC, 100 W Max.
Total weight	5 kg
Connections	Power, Sensor head LAN, 2x DisplayPort, 1x LAN, 1x LAN for remote desktop, 2x USB, 4x RS232|RS422|RS485 configurable port.

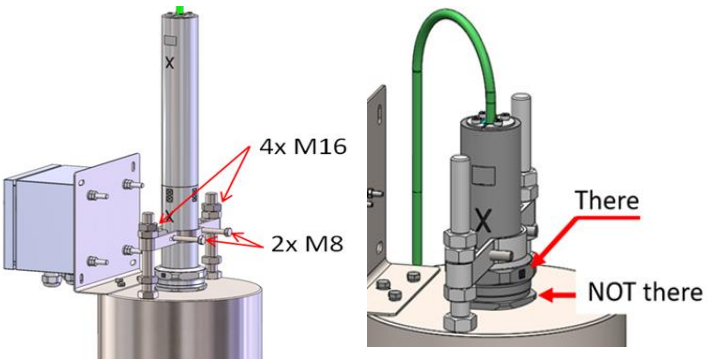
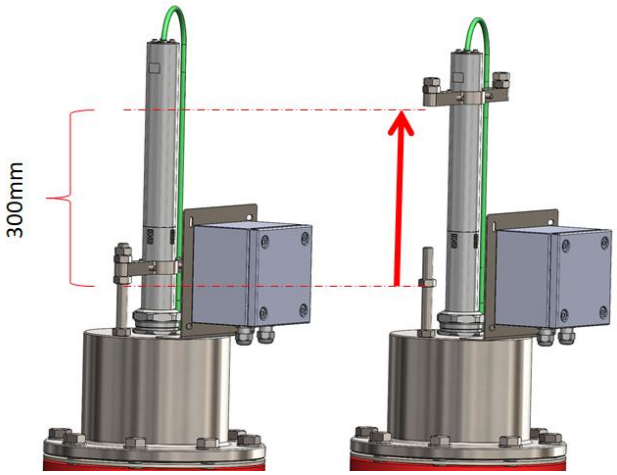
The processing unit requires input of a professional grade NMEA heading and GNSS sensor. The VM Operations version software manual gives more information about connecting the system to the junction box and its software configuration.

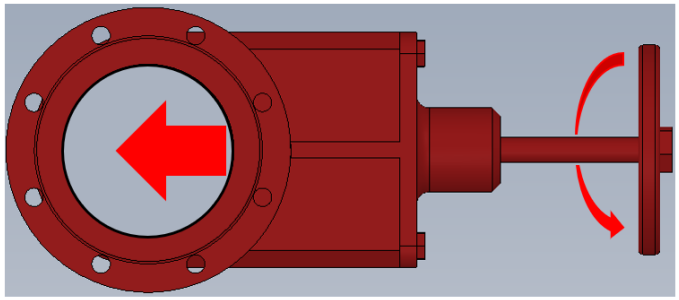
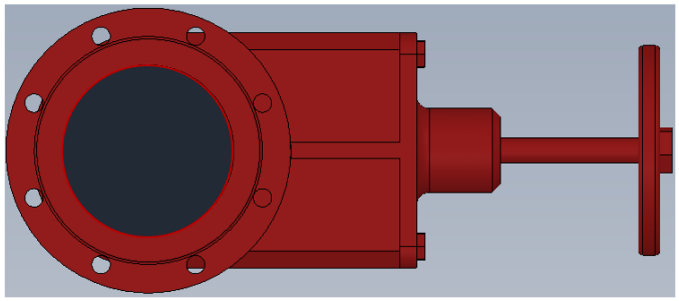
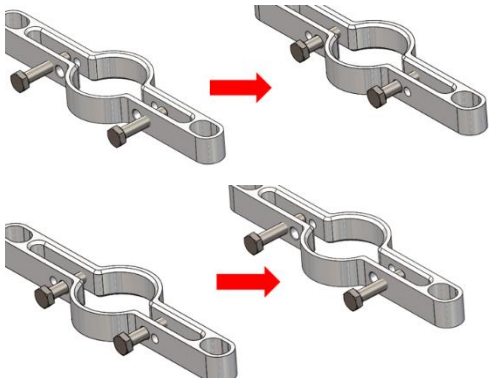
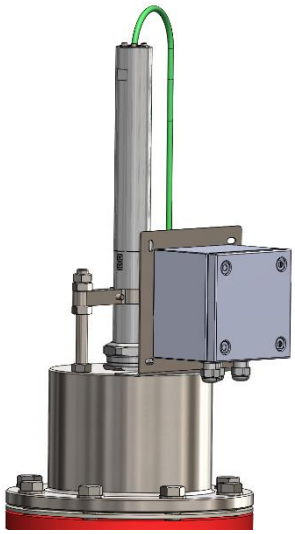


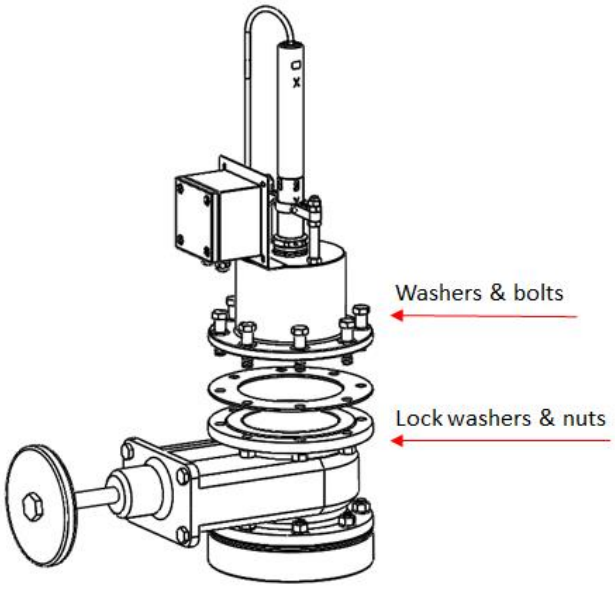
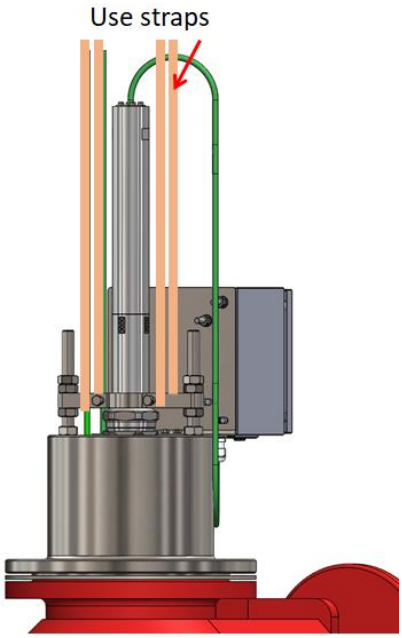
6. Disassembly

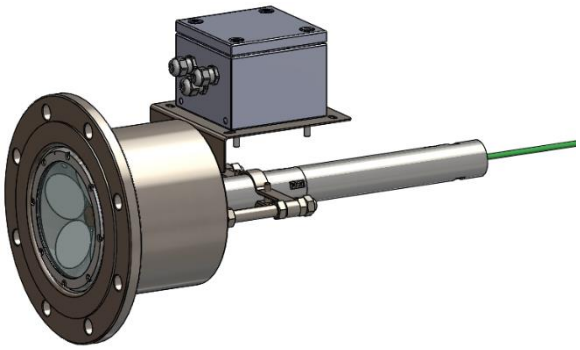
To disassemble the NSO SB assembly follow the steps bellow:

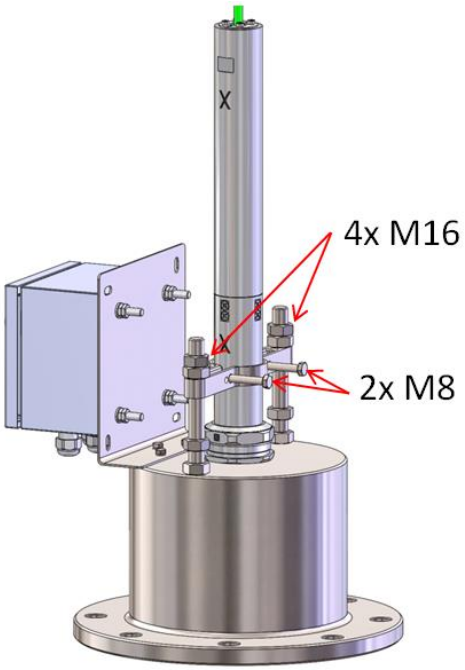
Disconnect the cable between the sensor head and the junction box (item 10) drawing no. N2043-065.	
Unscrew the screws on top of the Roxtec Seal (item 8, drawing N2043-040), to allow the cable and seal to move relative to the extension pipe.	

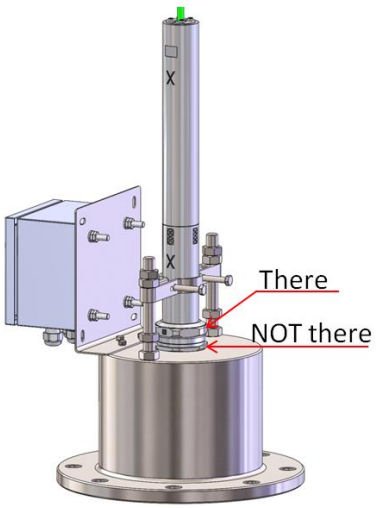
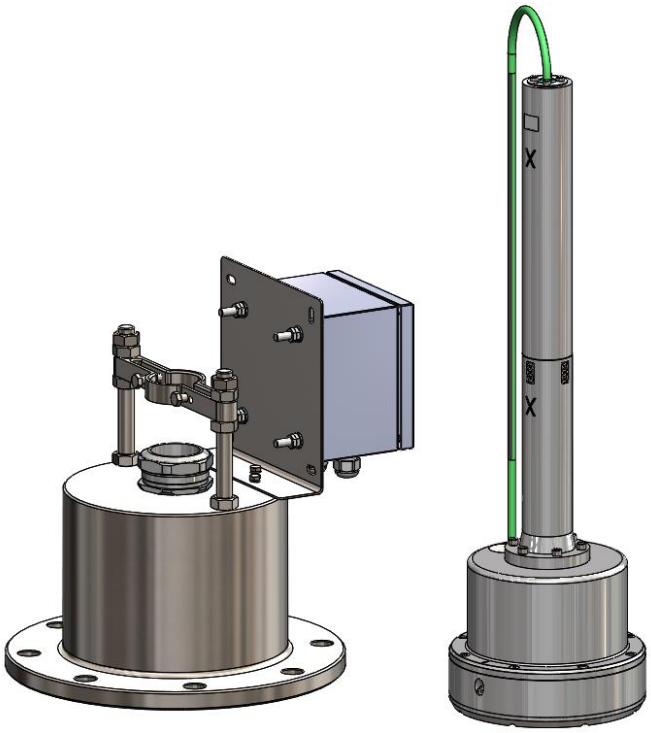
Use a permanent colour marker to mark the original pipe height and orientation before loosening the clamp. Loosen and remove the four M16 nuts (item 3, drawing N2043-065) that hold the clamp (item 4, drawing N2043-065) in place. Loosen the Skindicht carefully! Loosen the top nut of the Skindicht with the Nortek supplied wrench without moving the Skindicht itself. See the arrows in the illustration. ⚠ The seawater will flow up in between the extension pipe and the Skindicht, when the ship is in the water!	
Pull up the clamp with the instrument arrangement all the way up! (Approx. 300mm, assuming no extension pipes of 455 mm each are present) ⚠ Tighten the Skindicht	

⚠ Close the Gate Valve by turning the wheel. This should stop the seawater from flowing up.	 
Unscrew the two M8 bolts (item 5, drawing N2043-065). Put them into the two holes further from the centre of the clamp (item 4, drawing N2043-065). Tightening them in the outer threaded holes will force open the clamp.	
Lower the clamp and then move both screws M8 back and tighten the clamp in order to fix the sensor head arrangement Place the four M16 nuts (item 3) back onto the threaded rods (item 2) and tighten them to secure the clamp (item 4) in place.	

Remove the bolts (item 10), washers (item 9), nuts (item 5) and lock washers (item 6) drawing no. N2043-053. ⚠ The seawater inside instrument housing will flow out on deck. ⚠ After the gate valve is closed, the flow of seawater should stop before you loosen the bolts completely. ⚠ Measures should be taken to collect the seawater from hull bottom.	
Lift the Bell Housing assembly by attaching straps to both sides of the clamp. Lower the arrangement on a flat place. Take care not to damage the sensor head window at the bottom of the assembly (N2043-040)	

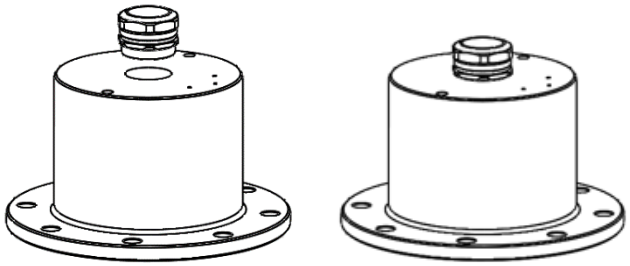
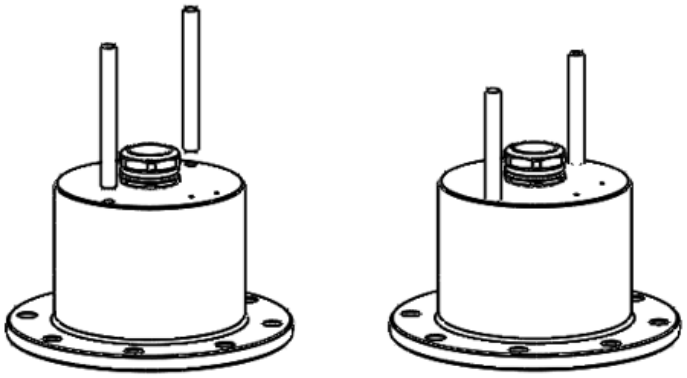
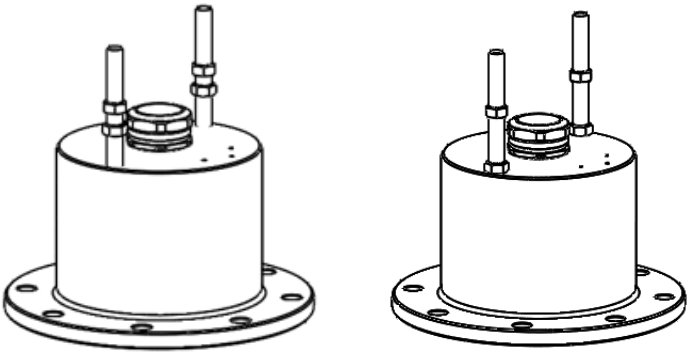
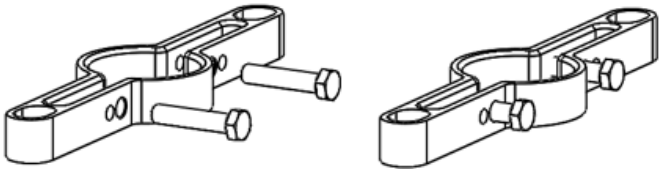
Lay the Bell Housing on its side for easier (dis)assembly.	

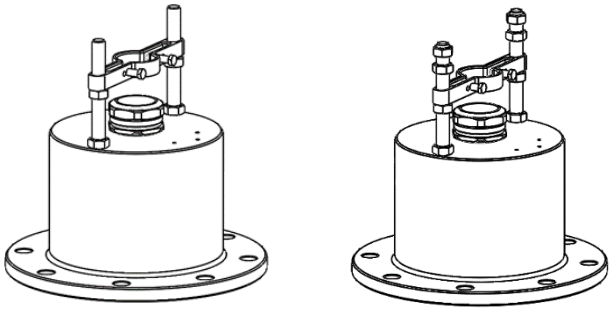
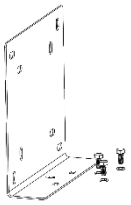
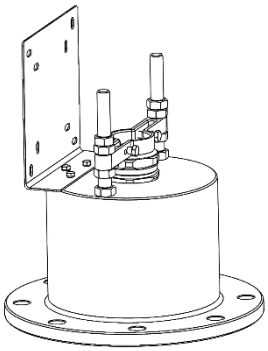
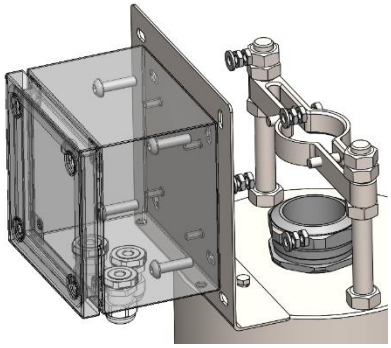
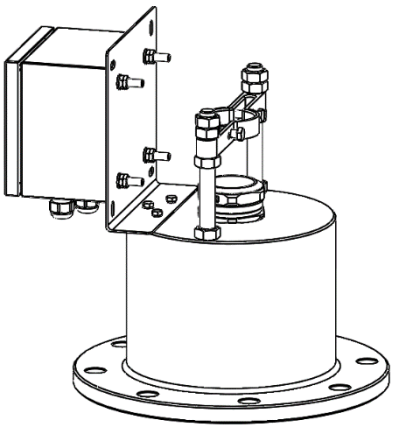
Unscrew the two M8 bolts (item 5, drawing N2043-065). Put them into the two holes further from the centre of the clamp (item 4, drawing N2043-065). Tightening them in the outer threaded holes will force open the clamp.	

Loosen the Skindicht carefully! Loosen the top nut of the Skindicht with the Nortek supplied wrench without moving the Skindicht itself. See the arrows in the illustration to allow the extension pipe to pass through the Bell Housing.	
Separate N2043-040 from N2043-065. ⚠ Take care not to damage the transducer window.	

6.1 Assembling the NSO Bell Housing

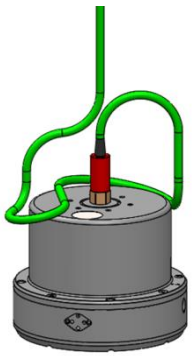
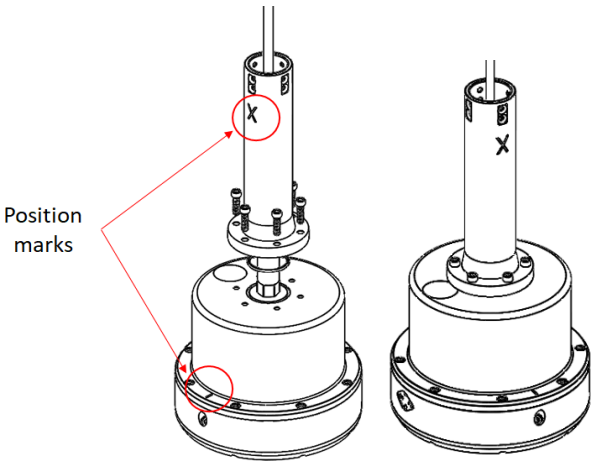
It is possible to assemble the NSO Bell Housing in a workshop.
All item numbers in this section refer to drawing no. N2043-065.

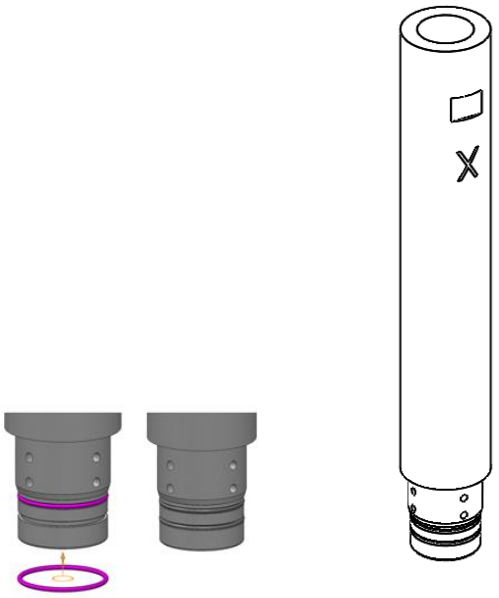
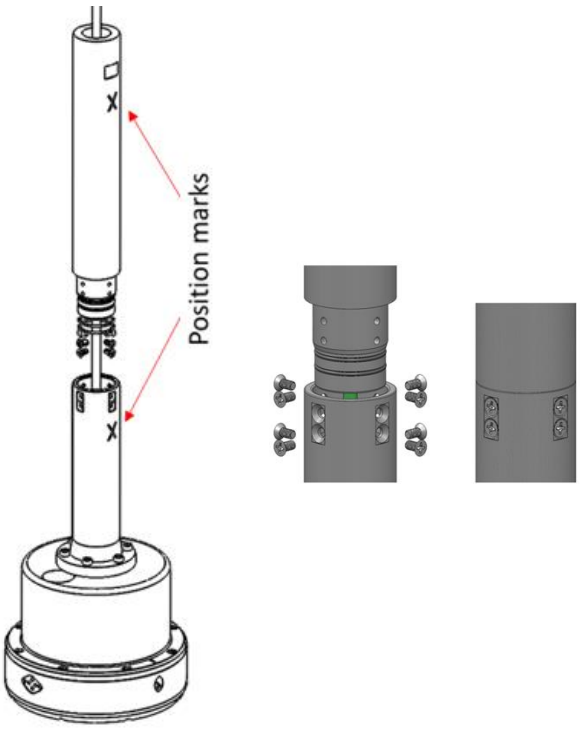
Mount the Skindicht sealing gland (item 8) carefully and ensure the hole and O-ring are clean and in proper state! Use the Nortek supplied (70mm) wrench to tighten the Skindicht on the Bell Housing	
Thread the two M16 thread rods (item 2) apply Loctite to the M16 threaded holes in the top of the Bell Housing. (Loctite secures in 24 hours) Screw in the two M16x175 threaded rods (item 2)	
Thread 2 hex nuts M16 (item 3) on each rod (item 2) Use the two lower nuts (item 3) to secure the rods (item 2) in place.	
Thread the two hex head screws M8 (item 5) in to the top clamp (item 4). Note: the two threaded holes closer to the centre of the clamp allow tightening the clamp. The two threaded holes each located a bit more towards the outside of the clamp allow forcing open the clamp.	

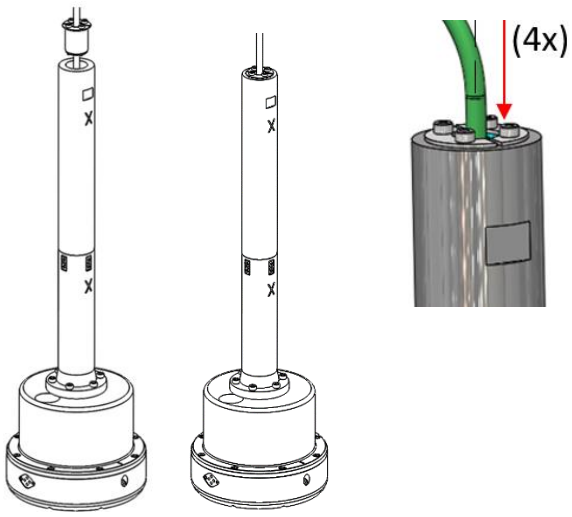
Mount the top clamp (item 4) onto the threaded rods (item 2). Thread the two hex nuts M16 (item 3) onto each rod and use these to secure the clamp in place	
Mount the bracket (item 6) for the Junction Box onto the top of the Bell Housing (item 1) with three spring washers M6 (item 9) and three machine screws M6 (item 7)	 
Mount the assembled Junction Box (item 10) using four machine screws M8 (item 11), four washers M8 (item 12), and four M8 nuts (item 13). See drawing no. N2043-065 and the sketch to the right for further details Please note that the dimensions of the junction box differ and do not comply with drawing N2043-065, see chapter 5.6 JB Cable connections	 

6.2 Assembling the Sensor Head for the SB penetration unit

The sensor head itself should be handled with caution during installation and assembly!
The transducer window must be free from all defects.
See drawing no. N2043-040 for finding item numbers!

The sensor head (item 1) supplied with 10 m cable as standard.	
Thread the cable through the O-ring (item 2) and the sensor head adapter pipe (item 3). Lubricate the O-ring with Molykote silicone, supplied in the Nortek toolbox. Place the O-ring (item 2) in the groove on the sensor head. ⚠ Align the sensor head and pipe adapter. Make sure the "X"-mark on the adapter pipe and the filling point on the transducer head face the same direction Screw in the 6x ¼"-20 x 7/8" socket cap machine screws (item 4) to attach the adapter pipe (item 3) to the instrument assembly (item 1). Note: these are imperial size titanium machine screws. Use the (imperial size) Allan driver that is supplied in the toolkit that comes with the instrument assembly.	

End extension pipe (item 6). Lubricate O-ring with Molykote silicone, supplied in the Nortek toolbox Mount the two O-rings (item 5) on the End extension pipe.	
Thread the cable through the End extension pipe. Align the pipes. Use the markings for the alignment. Screw in the eight flat head screws (item 7). Torque: 1,1 Nm, hand tight	

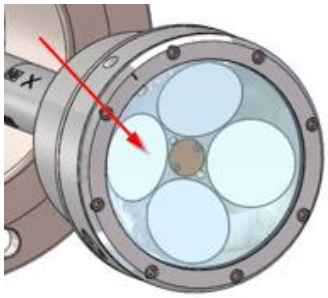
Thread the cable through the Roxtec RS31 seal (item 8) and mount it on the top. Tighten the top screws on the Roxtec seal.	

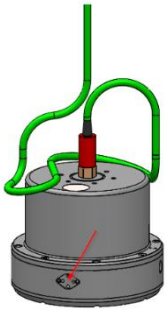
7. Maintenance of the Sensor Head

We recommend a regularly scheduled procedure which will act as a preventative measure to ensure your installed NSO assembly continues functioning as intended. The following sections can be used as a maintenance guideline for the components that may be exposed to wear and tear.

When cleaning the external surfaces use a mild detergent and pay special attention to the transparent transducer's window. When the instrument leaves the factory, the instrument window surfaces are quite smooth, and it will take some time before any growth starts. After the first cleaning, the surface is rougher, and it becomes easier for new material to grow. Typical maintenance intervals are 6-12 month, but the growth rates vary a considerably with the geographical location, water temperature, season, and deployment depth. In general, heavy growth is seen in hot and shallow areas. Cold- and deep-water areas see very little growth so maintenance can be less frequent. To clean the instrument window, we recommend staying away from strong organic solvents such as acetone. Barnacles must be removed mechanically, but we strongly advise against using sharp objects capable of harming the instrument window.

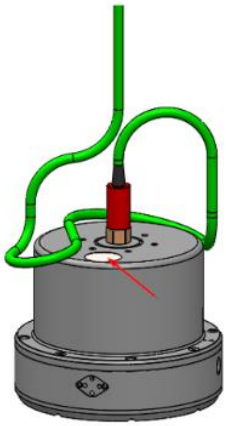
To save time cleaning the instrument window, we recommend having a spare window and distilled water onboard.





Check the pressure sensor and remove any dirt from the holes in the lid. Be careful when opening the pressure sensor cap as it is easy to dent and to damage the sensor behind.

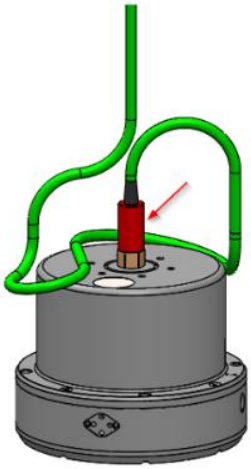
The grounding point should always be free from biofouling.



It is important to keep connectors clean and well lubricated. Before plugging in connectors, we recommend to always blast the pins with compressed air, inspect them for cleanliness and then protect the cable connector by applying a thin layer of silicone lubricating spray on the pins before you plug it into the instrument. We recommend the 3M Silicone Spray.

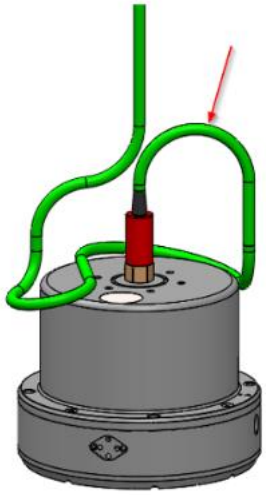
Before deployment:

- Disconnect/disengage the connector set
- Flush the connector set with fresh water or compressed air, remove dirt. Remember to check the female connector, too.
- Check that both connectors are dry. If not, let them air-dry.
- Inspect for damage, corrosion and cuts.
- Apply a thin film of 3M Silicone Spray or equivalent.
- Couple the connector set and check if they are properly mated.



Instrument cable care

- Do not pull on the cable to disconnect connectors.
- Avoid sharp bends at cable entry to connector.
- Ensure that the cable is fixed to the mounting fixture to avoid mechanical stress to the connection.



O-rings are the critical component that keeps water out of the housing and thus the instrument dry and functioning. If the instrument has never been opened, O-ring inspection is not necessary. However, when changing instrument window, you can inspect and change the O-rings if necessary. If O-rings are replaced:

- Using properly greased O-rings will help maintain sealing integrity and minimize O-ring degradation. Use enough grease to lubricate the O-ring thoroughly, but not so much that it will attract additional debris.
- Check the O-rings and the O-ring grooves for grit, hair, lint, sand, or anything that could potentially breach the O-ring seal.
- Clean the groove with a lint free swab or the folded edge of a paper towel.
- After frequent deployments or if O-rings or groves appear dirty, remove O-rings and clean the groves. To remove O-rings, use finger pressure or the rounded edge of a plastic card to lift the O-ring out of the grove. Caution! Never use a metal object to remove an O-ring. It may cause damage to the O-ring or the sealing surface.
- To check O-rings for damage, place the O-ring between the middle and index finger and thumb. Then pull the O-ring through your fingers, feeling for any debris or wear.
- If O-rings are dirty, it is best to replace them. Washing dirty O-rings with soap and water is not recommended. Soap breaks down the lubricants and will compromise the integrity of the seal.