



INSTALLATION MANUAL

DELTA



**COOLING WATER/
EXHAUST GAS
SEPARATOR**

WATERLOCK



Art.nr. . 40200731

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1 GENERAL

The DELTA exhaust components are manufactured and marketed by WhisperPower.

In this manual you will find all the necessary information for the proper installation of the WhisperPower Delta Cooling Water/ Exhaust Gas Separator and Delta Waterlock. The installation directives and dimensions given in this manual are valid for WhisperPower Marine generators. For generators and propulsion engines of other brands refer to the installation-instructions of the manufacturer.

The WhisperPower DELTA Waterlock and Water/Gas separator are parts of a “wet exhaust system” of a marine diesel generator set or marine propulsion diesel engine installed on board boats and yachts.

When applying a “wet exhaust system”, water is injected into the exhaust to cool down the exhaust gas and reduce the exhaust noise. This allows the exhaust hose and other parts to be made of rubber and plastics.



WARNING

The DELTA exhaust parts and rubber exhaust hose should never be used in a dry exhaust

system and in installations with petrol engines.

1.1 Use of this manual

This manual serves as a guideline for a safe and effective installation. It also gives instructions for draining water from the waterlock

Keep this manual at a secure place!

1.2 Guarantee Specifications

WhisperPower guarantees that the parts have been manufactured in accordance with the legally applicable standards and specifications. The period and conditions of the guarantee are laid down in the general conditions of delivery as registered with the Chamber of Commerce and Industries for the North of the Netherlands number 01120025 and are available on request. The guarantee period is two years. Guarantee does not cover failures that are caused by misuse, neglect or a faulty installation.

Faulty installation; the ingress of seawater is the most common cause of damage to combustion engines in boats (both to propulsion and generator engines). The entry of water must be avoided under all circumstances. Be aware that the conditions in blue water sailing can be extreme. Refer to this installation manual for instructions but, remember, these are for guidance only as many factors influence the installation of an engine. The ultimate responsibility will always be with the owner to ensure a safe and compliant installation. If in doubt ask!

To prevent the ingress of water under circumstances on sea when the generator is not running, it could be necessary to shut down the valve of the water drain of the water/gas separator. Heavy weather conditions could even make it impossible the use the generator or propulsion engine.



WARNING

A sea cock has to be placed in the pipe that drains the water below the waterline (figure 7, reference 1).

On the other hand a shut down valve in the gas pipe (figure 7, reference 2) is very uncommon and very risky. Starting the engine while the valve is closed will cause a huge pressure in the exhaust lines and the DELTA parts, the exhaust hose and other parts in the exhaust will burst.

Water and exhaust gasses will flow freely into the engine room



WARNING

Water in the cylinders will cause serious damage to the engine. Besides corrosion, a bent piston rod or a cracked cylinder head are possible.

In fact water in the cylinders is the main cause of engine damage in pleasure craft



WARNING

Damage caused by the ingress of water into the engine is never covered by guarantee.

1.3 Quality

During the production and prior to their delivery, all our products are exhaustively tested and inspected.

1.4 Liability

WHISPERPOWER can accept no liability for:

- consequential damage due to use of the DELTA waterlock and water/gas separator,
- possible errors in the manuals and the results thereof.

1.5 SAFETY

The exhaust system is a critical part of the installation. When leaking or damaged, seawater can enter the boat. Leakages can also bring carbon monoxide into the boat.



WARNING

The exhaust lines must be absolutely free of leakages. Exhaust fumes contain carbon monoxide and are extremely dangerous. Carbon monoxide (CO) is an invisible odourless gas. Inhalation produces headache, nausea, or death.

2 TECHNICAL DATA

2.1 Specifications

The Delta parts are developed to fit in the exhaust hose of WhisperPower generator sets but can be used in the installation of generators and propulsion engines of other brands as well. Refer to the installation manual of the manufacturer of any non-WhisperPower equipment for specific instructions.



The WhisperPower Delta parts apply to the US ABYC regulations. This standard is similar to the CE regulations that apply to rubber exhaust hose for marine engines (ISO 13363). The Glass Reinforced Polyester (GRP) employed in the Delta designs is a very high tech material that is non flammable and can withstand a running dry situation for at least two minutes. In this two minute period the alarm system should cut in and stop the engine.

Although the Delta parts can withstand a much higher temperature a wet exhaust system should not exceed a continuous temperature of 70° Celsius (158° F).



WARNING

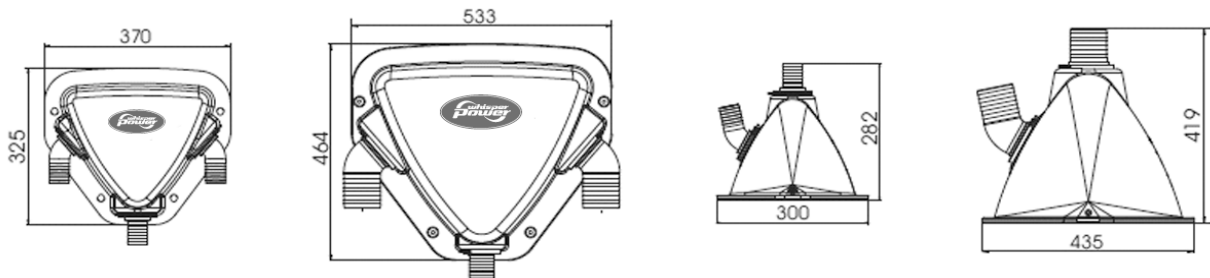
A wet exhaust system must be protected against running dry by means of a high exhaust temperature alarm (propulsion engines) or a shut down device (generators). All WhisperPower generators are protected with a high exhaust temperature shut down device



WARNING

The exhaust hose applied in a wet exhaust system should comply with ISO 13363.

Overview of available models



Water/Gas Separator	Water/Gas Separator L	Waterlock	Waterlock L
p/n 40230097 p/n 40230098	p/n 40230193 p/n 40230194 p/n 40230195	p/n 40230093 p/n 40230094	p/n 40230190 p/n 40230191 p/n 40230192
See section 2.1.1	See section 2.1.2	See section 2.1.3	See section 2.1.4

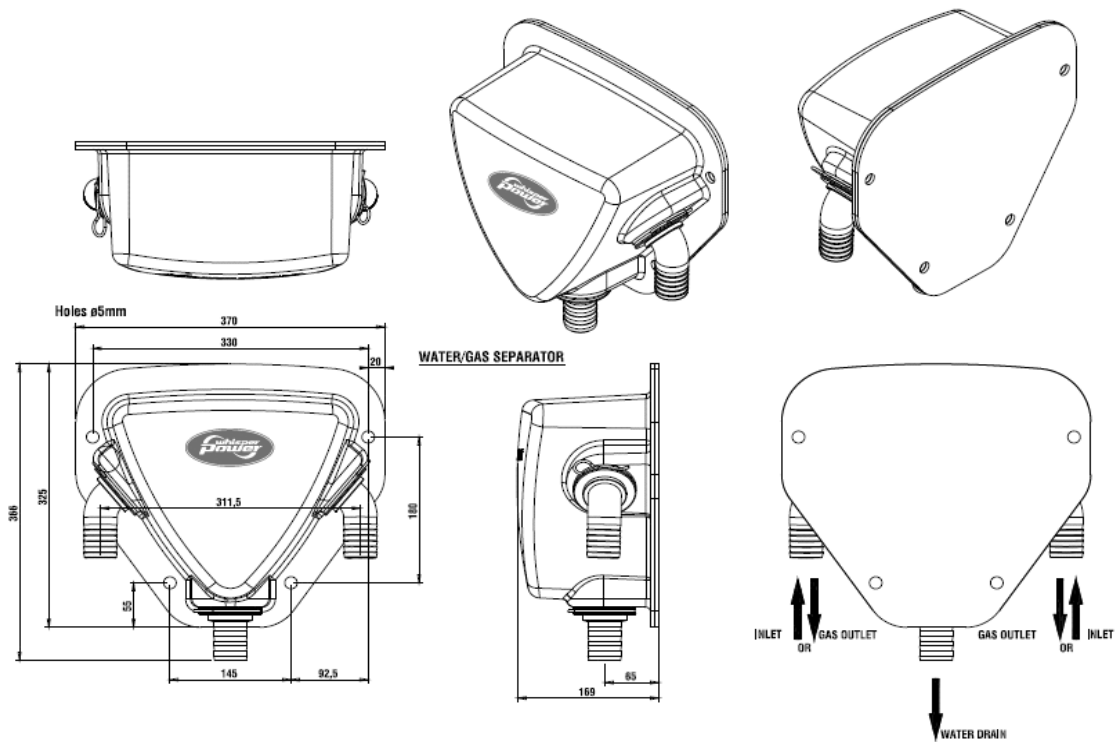
2.1.1 Specifications Water/Gas Separator Delta


Figure 1: Dimensions Water/Gas Separator Delta

Model Water/Gas Separator	40/40/40MM DELTA	51/40/51MM DELTA
Part number	40230097	40230098
Hose connection size	40-40-40mm (1/5/8" - 1/5/8" - 1/5/8")	51-40-51mm (2" - 1 5/8" 2")
Type of connectors	2x bend, 1x straight	2x bend, 1x straight
Material hose connectors	Stainless Steel 316	Stainless Steel 316
Material body	Glass Reinforced Polyester (GRP)	Glass Reinforced Polyester (GRP)
For 3000 rpm Whisper models	W-SC 3,5 / 6 / 8 / 10 / 11	
For 1500rpm Whisper models	W-SQ 6 / 7	W-SQ 8 / 9,5 / 10 / 11 / 12 / 15 / 16 / 20
Max. continuous operating temperature	70° Celsius (158° F)	70° Celsius (158° F)
Dimensions WxDxH (incl. fittings)*	370x169x366mm 14,6x6,7x14,4 inch	370x169x366mm 14,6x6,7x14,4 inch
Weight	5.2 kg (11.5 lbs)	5.2 kg (11.5 lbs)
Compliance	CE and ABYC	CE and ABYC

* See figure 1

2.1.2 Specifications Water/Gas Separator Delta L

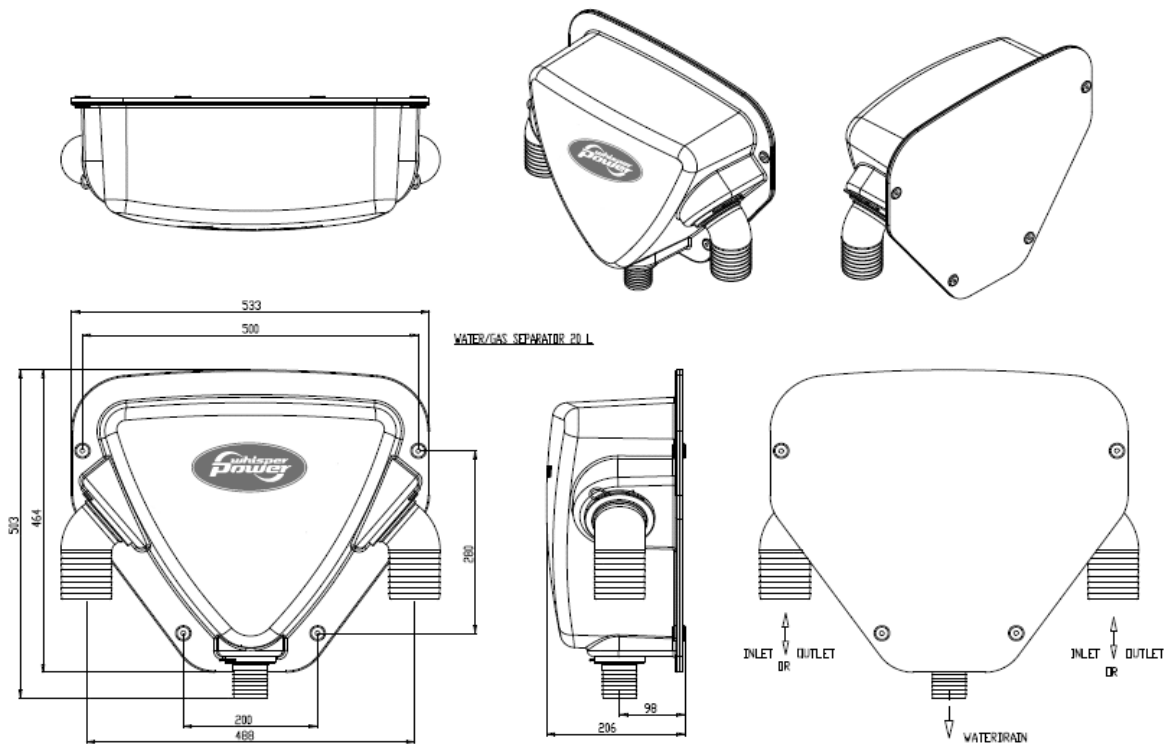


Figure 2: Dimensions Water/Gas Separator Delta L

Model Water/Gas Separator	51/40/51MM DELTA L	63/51/63MM DELTA L	76/51/76MM DELTA L
Part number	40230193	40230194	40230195
Hose connection size	51-40-51 mm (2" - 1 5/8" 2")	63-51-63 mm (2 1/2" - 2" - 2 1/2")	76-51-76 mm (3" - 2" - 3")
Type of connectors	2x bend, 1 x straight	2x bend, 1 x straight	2x bend, 1 x straight
Material hose connectors	Stainless Steel 316	Stainless Steel 316	Stainless Steel 316
Material body	Glass Reinforced Polyester (GRP)	Glass Reinforced Polyester (GRP)	Glass Reinforced Polyester (GRP)
For 1500rpm Whisper models	W-SQ 16 / 20	W-SQ 25 / 30	---
Max. continuous operating temperature	70°C Celcius (158° F)	70° Celsius (158° F)	70° Celsius (158° F)
Dimensions WxDxH (incl. fittings)	540x206x503 mm 21,2x8,1x19,8 inch	552x206x503 mm 21,7x8,1x19,8 inch	565x206x503 mm 22,2x8,1x19,8 inch
Weight	11 kg (24 lbs)	11.5 kg (25 lbs)	11.5 kg (25 lbs)
Compliance	CE and ABYC	CE and ABYC	CE and ABYC

* See figure 2

2.1.3 Specifications Exhaust Silencer / Waterlock Delta

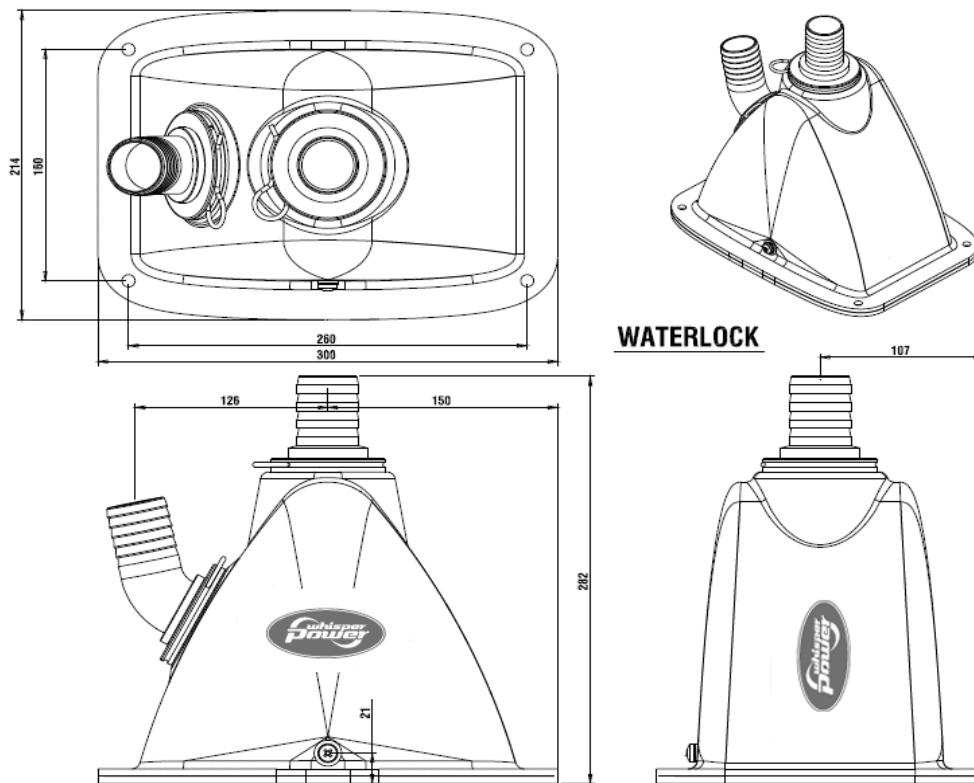


Figure 3: Dimensions Exhaust Silencer / Waterlock Delta

Model Exhaust Silencer/ Waterlock	40MM DELTA	51MM DELTA
Part number	40230093	40230094
Hose connection size	40-40mm (1 5/8")	51-51mm (2")
Type of connectors	1x bend, 1x straight	1x bend, 1x straight
Drain screw	M6	M6
Material hose connectors	Stainless Steel 316	Stainless Steel 316
Material body	Glass Reinforced Polyester (GRP)	Glass Reinforced Polyester (GRP)
For 3000 rpm Whisper models	W-SC 3,5 / 6 / 8 / 12	
For 1500 rpm Whisper models	W-SQ 6 / 7	W-SQ 8 / 9,5 / 10 / 11 / 12 / 15 / 16 / 20
Max. continuous operating temperature	70° Celsius (158° F)	70° Celsius (158° F)
Dimensions WxDxH (incl. fittings)	300x214x270mm (11,8x8,4x10,6 inch)	300x214x270mm (11,8x8,4x10,6 inch)
Volume of waterlock	4 liter (1 gallon)	4 liter (1 gallon)
Weight	3.5 kg (7.7 lbs)	3.5 kg (7.7 lbs)
Compliance	CE and ABYC	CE and ABYC

* See figure 3

2.1.4 Specifications Exhaust Silencer / Waterlock Delta L

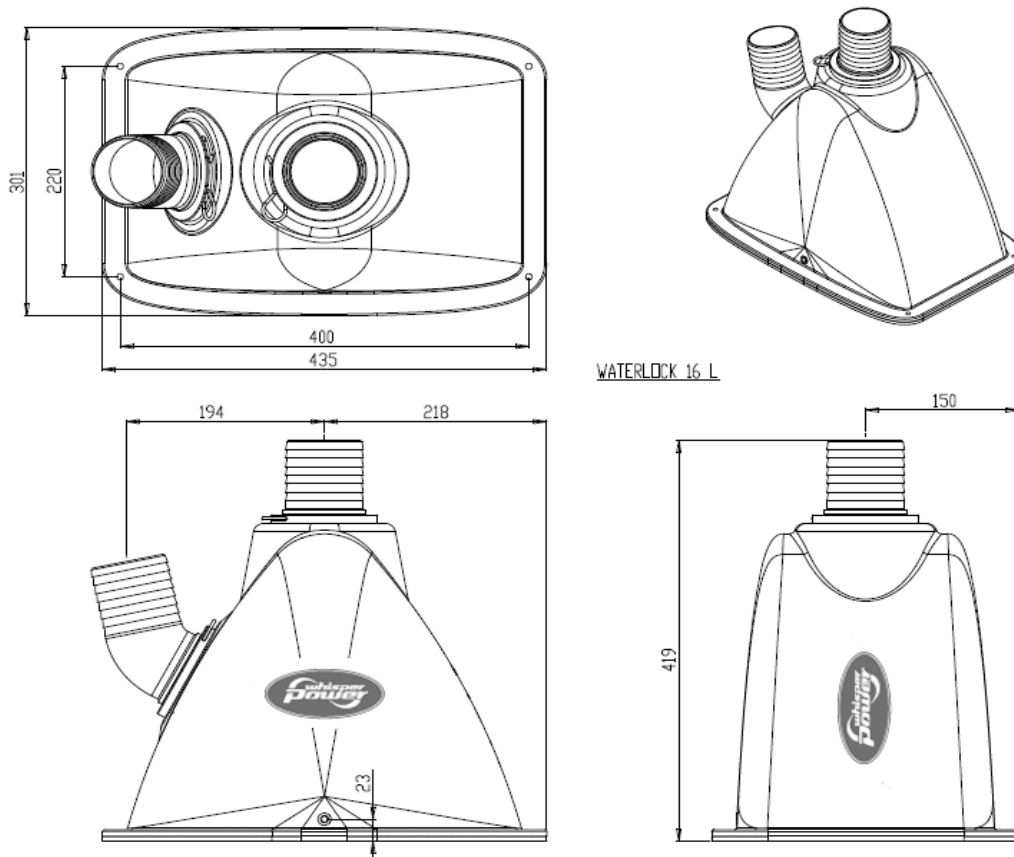


Figure 4: Dimensions Exhaust Silencer / Waterlock Delta L

Model Exhaust Silencer/ Waterlock	51MM DELTA L	63MM DELTA L	76MM DELTA L
Part number	40230190	40230191	40230192
Hose connection size	51-51mm (2")	63-63mm (2 1/2")	76-76mm (3")
Type of connectors	1x bend, 1x straight	1x bend, 1x straight	1x bend, 1x straight
Drain screw	M6	M6	M6
Material hose connectors	Stainless Steel 316	Stainless Steel 316	Stainless Steel 316
Material body	Glass Reinforced Polyester (GRP)	Glass Reinforced Polyester (GRP)	Glass Reinforced Polyester (GRP)
For 1500rpm Whisper models	W-SQ 16 / 20	W-SQ 25 / 30	---
Max. continuous operating temperature	70°C Celcius (158° F)	70° Celsius (158° F)	70° Celsius (158° F)
Dimensions WxDxH (incl. fittings)	435x301x419 mm (17,1x11,9x16,5 inch)	439x301x419mm (17,1x11,9x16,5 inch)	446x301x419 mm (17,6x11,9x16,5 inch)
Volume of waterlock	16 liter (4.2 US gallon)	16 liter (4.2 US gallon)	16 liter (4.2 US gallon)
Weight	9.5 kg (21 lbs)	10 kg (22 lbs)	10 kg (22 lbs)
Compliance	CE and ABYC	CE and ABYC	CE and ABYC

* See figure 4

3 INSTALLATION

3.1 General

A waterlock is a container that holds the water still in the exhaust line when the engine is stopped, preventing it flowing back into the engine. Therefore the waterlock must be below the engine on the lowest point in the system. When starting the engine again the construction of the waterlock causes the water to be blown out of the container. The exhaust gas lifts the water up to the transom or hull side. For this reason the “waterlock” is also known as a “water lift” in the USA. The waterlock is also an effective silencer that reduces the exhaust noise.

The water/gas separator separates the water from the exhaust fumes to drain it below the waterline. The fumes are released above the waterline. In this way there are no splashing or gurgling noises. The separator also has the function of a goose neck and should therefore be mounted 60 cm above the waterline. In addition the water gas separator is a silencer that reduces the exhaust noises even further.

3.2 Low backpressure

To understand the installation instructions it is important to know that the transport of the cooling water by the exhaust gas causes backpressure. When the backpressure is too high this brings trouble for the engine. To keep the backpressure within acceptable limits the length and the height of the up going exhaust line (lift) must be kept within the specifications of the engine manufacturer. The specifications mentioned below refer to Whisper Generating Sets and are similar to the specifications of other manufacturers. Most of the warnings and instructions below (for example to avoid bends) are intended to achieve a reduction of backpressure in the system.

3.3 Fittings

The DELTA parts are equipped with snap-in fittings that make the installation an easy job. The straight and bent fittings can be rotated and are exchangeable from one connection to another and from the separator to the waterlock. In this way the best routing of the hoses can be achieved. The hose should be fixed to the fitting first. Then the fitting can be connected to the body in seconds and secured by the circlip.

Besides the DELTA parts, Mastervolt supplies all necessary accessories to install generator-sets such as stainless-steel hose clamps, elbows, and rubber exhaust hoses (in accordance with ISO 13363) These accessories are available in individual items or in complete kits .

The hose clamps supplied by WhisperPower in the exhaust installation kits are of a high quality stainless steel and designed one clamp to hold the hose in all circumstances. However ABYC and CE standards prescribe the use of 2 clamps for each connection when the connection is below the waterline. See our web page www.whisperpower.eu for an extensive overview of all kinds of generator parts.

3.4 Exhaust hose

It is absolutely necessary to use proper exhaust hose of good quality



WARNING

The exhaust hose applied in a wet exhaust system should comply with ISO 13363

WhisperPower strongly recommend the use of corrugated hose that is flexible and internally smooth. The hose should be routed in a way that no stress is transferred to the connectors of the exhaust parts. Exhaust hose supplied by WhisperPower is a very flexible corrugated hose that complies with ISO13363 and is certified by LR and DNV.

3.5 Exhaust diameter



WARNING

Only use exhaust hose and fittings with correct diameter as specified by the engine (generator) manufacturer

The Delta series are available for exhaust diameters as specified in section 2.1 and following. Do not reduce any of this these hose diameters.

Sometimes plastic transoms, fittings and valves as used on aluminum boats have a much smaller inner diameter. In this case one should select oversized fittings to compensate for the smaller inner diameter. **Too small a diameter** will cause a too high back pressure.

Using **too wide a hose** causes the emulsion of gas and water to break down. Then the gas goes up and the water drops down to build up in the hoses and waterlock. The gas is then forced through the water and the result is too a high back pressure. When the system is filled up with water, water can get back into the outlet ports of the engine when the engine is stopped. This water will damage the exhaust valves and valve seats.

Too high back pressure will also reduce the power of the engine, it causes overheating of the engine and can cause the exhaust to be choked by carbon deposits (soot).

3.6 Positioning of the parts



WARNING

All dimensions should be calculated with a fully loaded boat being valid in all circumstances. Else extra valves must be installed in the exhaust system to protect the engine in extreme circumstances.

The waterlock must be installed just below the generator or engine, but not too low, because when the waterlock is positioned too low, the way up again is also longer and that means extra backpressure. On the other hand the waterlock may not be positioned too high, else water might run from the waterlock back into the outlet of the engine when the ship heels. Refer to section 3.10.

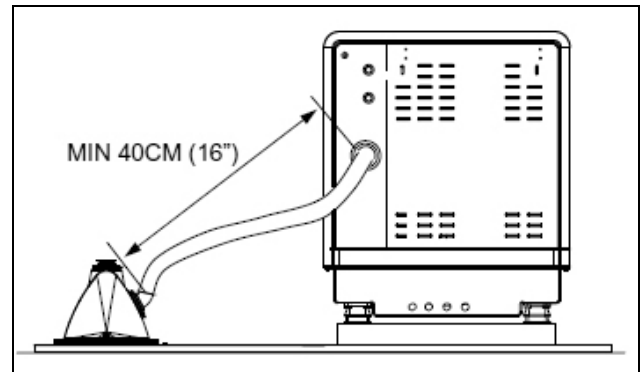
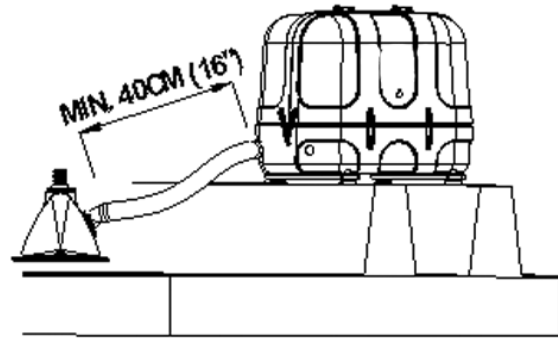


Fig 5. Waterlock min. 40cm (16") from the generator.

See figure 5. Mount the waterlock at a distance (minimum 40 cm or 16") from the generator to keep the water away from the outlet of the engine. When too close, strong movements of the ship or even condensation can cause water still being in the waterlock to get into the outlet ports of the engine.

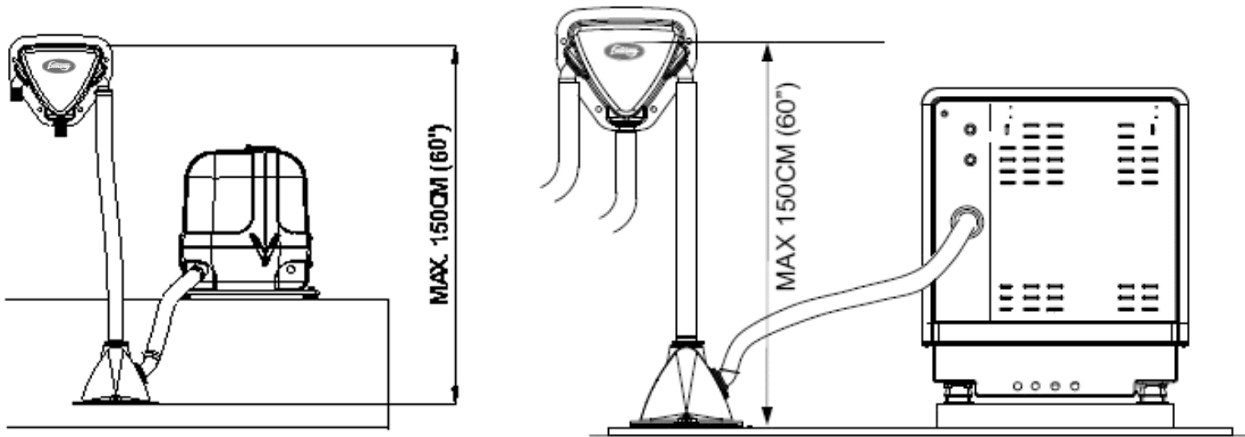


Figure 6. Maximum lift of the water/gas emulsion: 150cm (60")

See figure 6. The water/gas separator must be installed vertically. The separator replaces the goose neck that prevents water from the outside to enter into the exhaust.

The highest point of the water gas separator must be at least 60 cm (24") above the waterline.
The total lift from the bottom of the waterlock to the top of the separator should not be more than 150 cm (60").

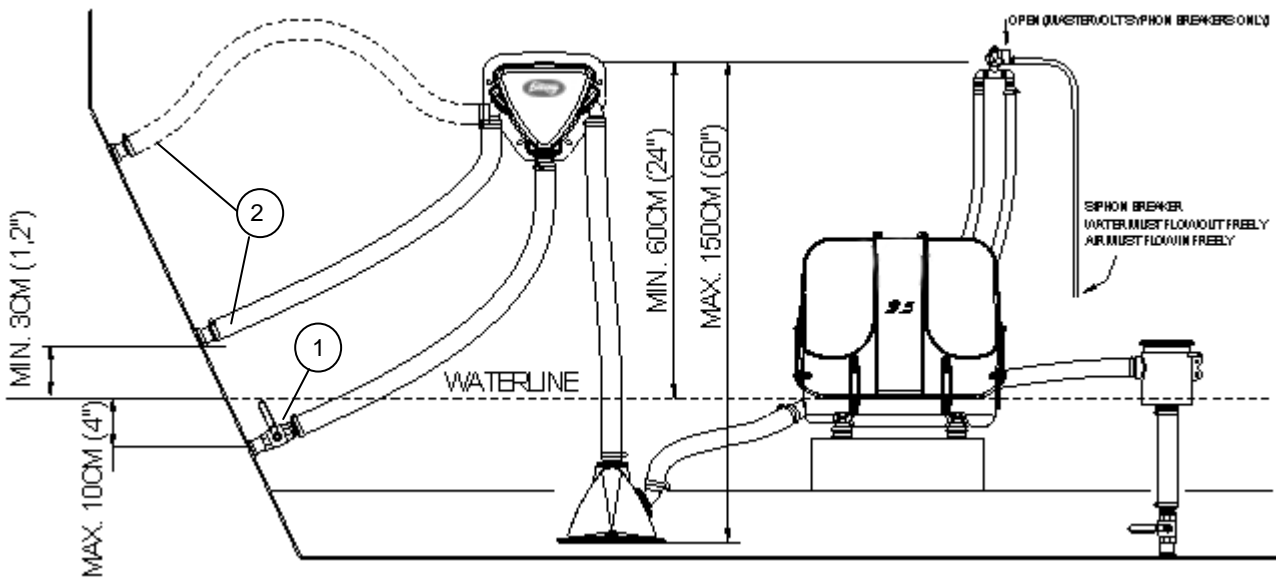


Fig. 7. Overview Water/Gas separator and Waterlock system

3.7 Length of the hoses.

The length of the hoses should be according to the instructions and drawings below. The hose before the water gas separator should be as short as possible, and no more than 3 m (10') long in total (A-B in Fig. 8).

The hoses after the water/gas separator sloping down can be up to 7m (21') long. When sloping down the transport of the water will cost less energy and length is less critical.

Long hoses containing water will be heavy and must be supported by brackets. The hoses should be prevented from swinging caused by the movements of the boat.

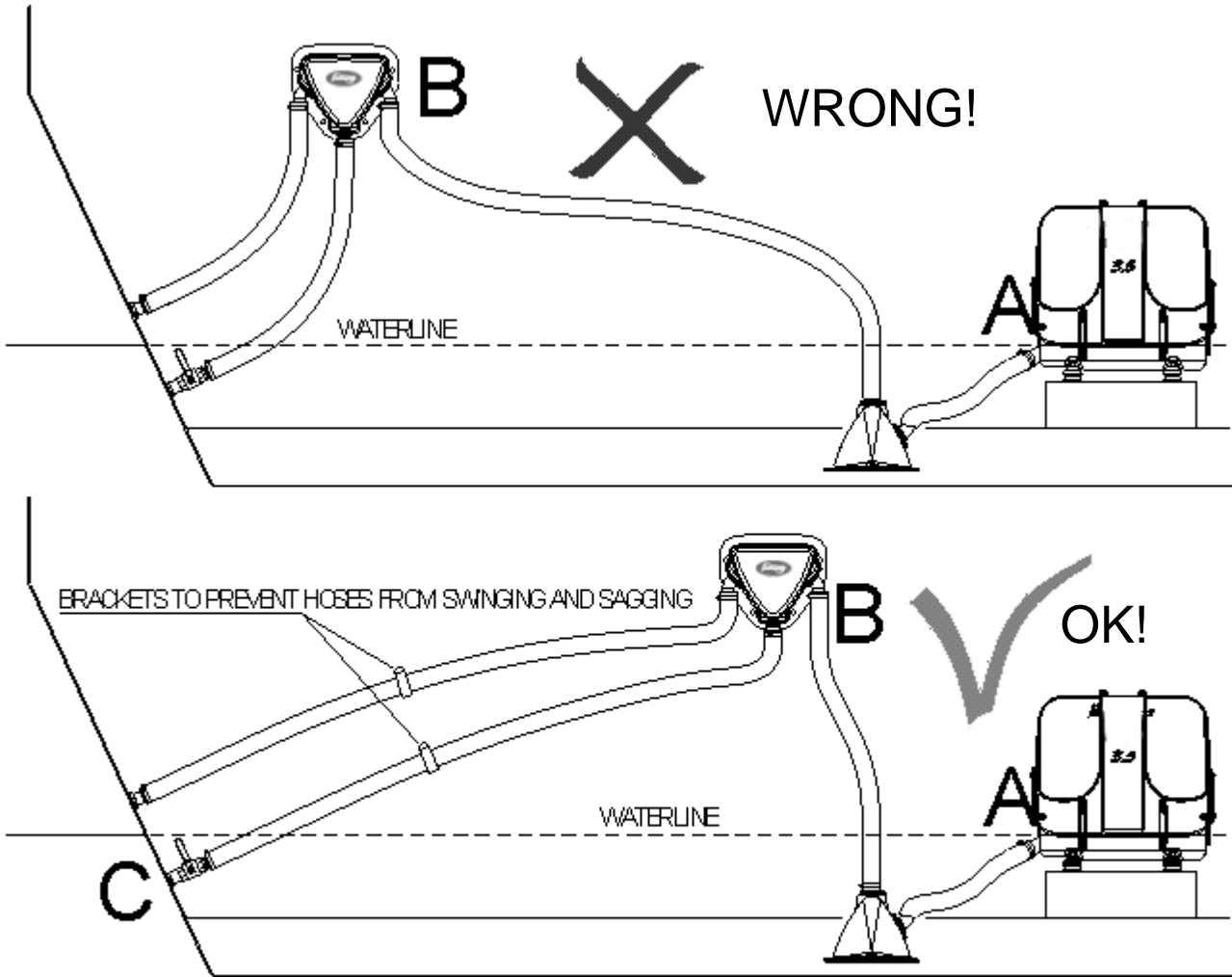


Fig. 8: Keep hose between generator and Water/Gas separator as short as possible! Max. length of line between A and B is 3 meter (10'). BC may be much longer up to 7meter (21').

3.8 Position of the water-outlet

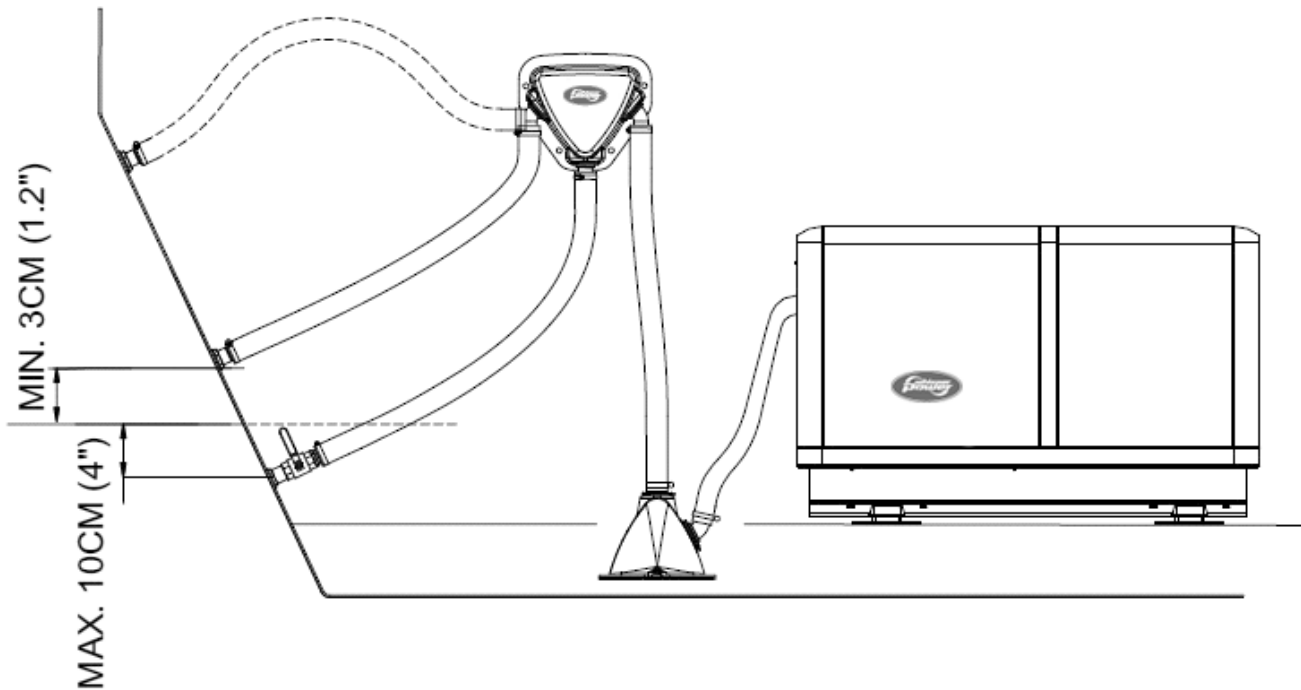


Figure 9. Water outlet max. 10cm (4") below the waterline.

See figure 9. The hose that drains the water should not be too far below the waterline. When deeper than 10cm below the waterline, the water will possibly not flow out fast enough from the water outlet, and will find its way out via the exhaust-gas-outlet. Much depends on the position of the outlet in the hull and the shape of the hull. As long as no water comes with the gas the system works well. No thrust pressure must be allowed to accumulate. If it does, water from the outside flow into the drain and could get into the engine.

3.9 Avoid bends

See figures 10 and 11. To ensure the proper drainage of the exhaust, the hose between the generator and the waterlock must be installed with a slope downwards.

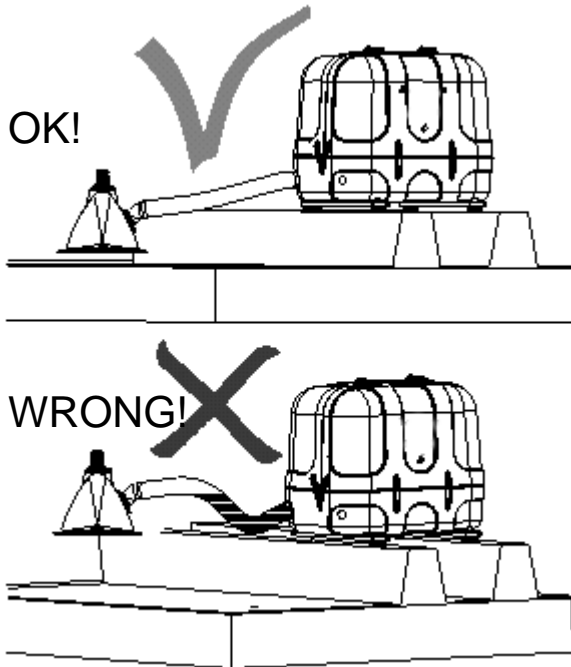


Fig. 10. Let exhaust hoses from generator to waterlock run downwards only.

Bends and especially those that go up forming a 'U' or hanging bend cause extra backpressure. In a hanging bend water will collect after stopping the engine and could possibly flow back into the engine due to movements of the ship.

Water in a hanging bend of the gas outlet hose will block this outlet and cause a too high backpressure.

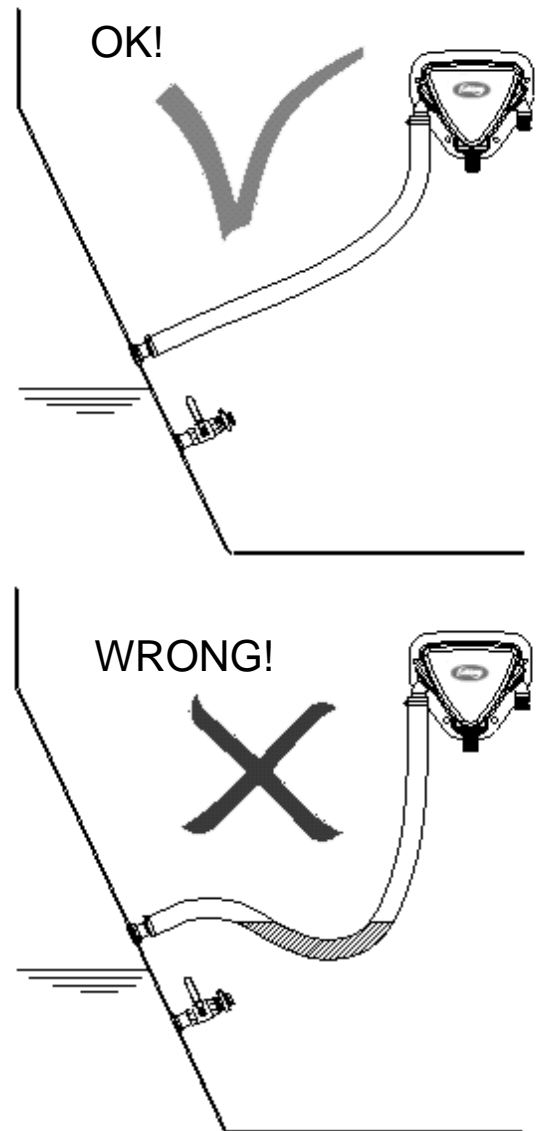


Fig 11: Water will collect in the hanging bend of the exhaust gas hose and will cause back pressure.

3.10 Heeling of the boat

See figure 12. When heeling the water/gas separator can get below the waterline and water may enter the engine. By mounting the water/gas separator close to the centre of the boat it will be above the waterline in all circumstances.

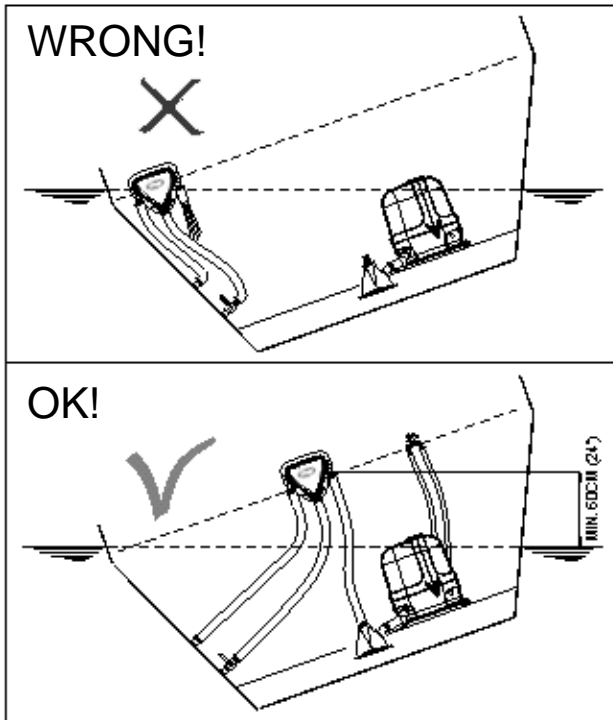


Fig 12: Siphon Breaker and Water/Gas separator min. 60cm (24") above the waterline in all circumstances.



WARNING

Prevent water getting into the engine. Water can enter the engine from the waterlock into the exhaust outlet ports for example due to rolling, or pitching heavily

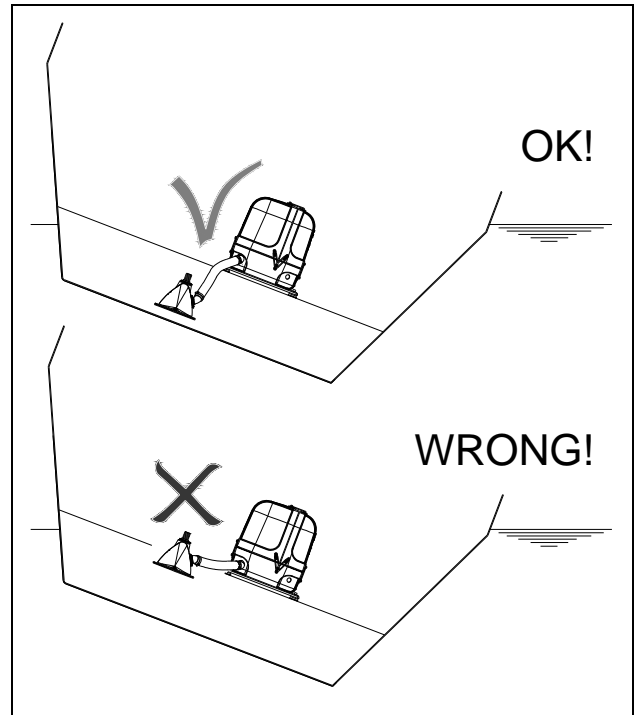


Fig. 13. When heeling, the waterlock should still be below the generator to prevent water flowing back into the engine.

3.11 Extra muffler

In general the combination of a waterlock and a water/gas separator gives an almost noiseless exhaust. However in some occasions specific combinations of sections of hoses can produce an interference of sound waves that results in too high exhaust noise. Here an extra muffler can help.

When applying an extra muffler this must be installed in the hose that slopes downwards and not in the rising line. See figure 14.

When the result is still unsatisfactory one should contact WhisperPower customer service for an expert advice.

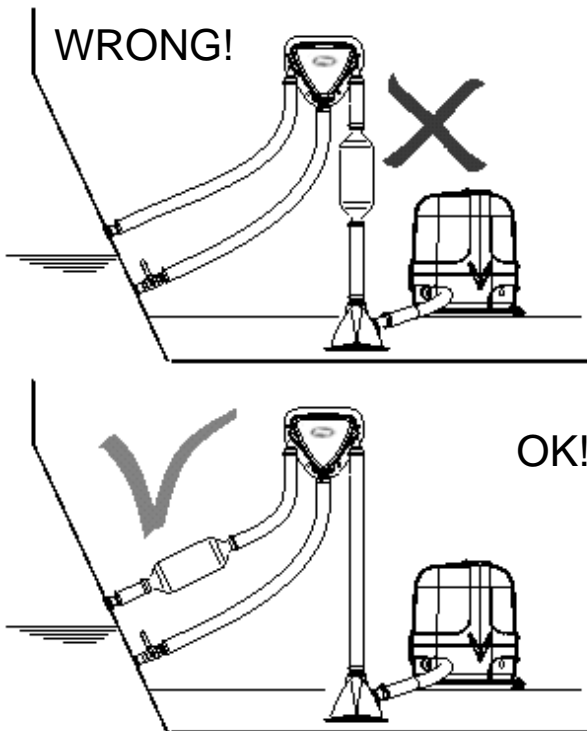


Fig. 14. Place an extra muffler in the downwards sloping hose only.

3.12 The North Sea Exhaust

The gas outlet of installations near the waterline in the hull side could, in long passage, be below the waterline for too long a period. A possible solution is the use of a two way gas outlet also known as a North Sea Exhaust. See figure 15.

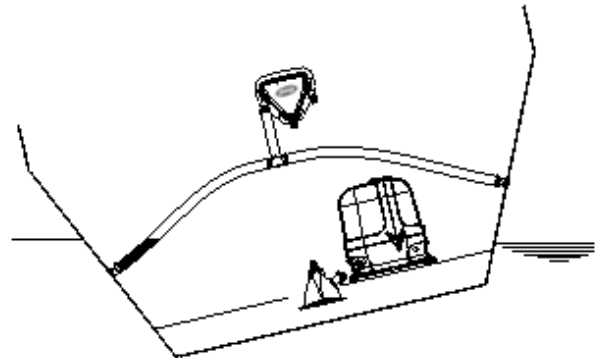


Fig. 15. North Sea Exhaust

3.13 The one time up and down routing

Most water/gas separators on the market have the gas outlet pointing down. See figure 16. Many times the connection is only little above the waterline while the hose should not go up again because the gas will be blocked by water collected in the bend.

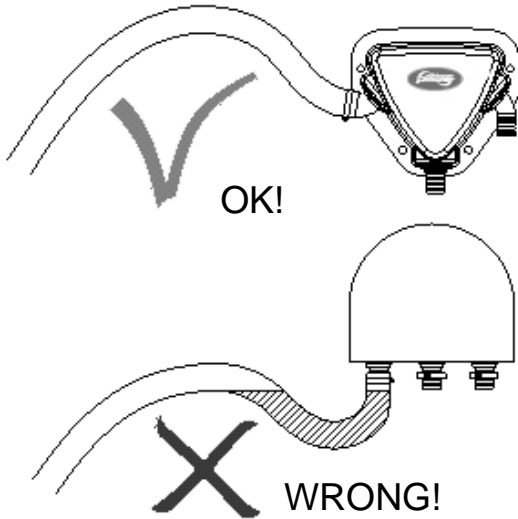


Fig. 16. The WhisperPower Water/Gas separator has a higher position of the exhaust/gas outlet than most other brands.

This feature of the DELTA water/gas separator makes it possible to let the gas hose go up one time to pass a high object or bulkhead and even to bring the outlet into the stern of the ship. See figure 17.

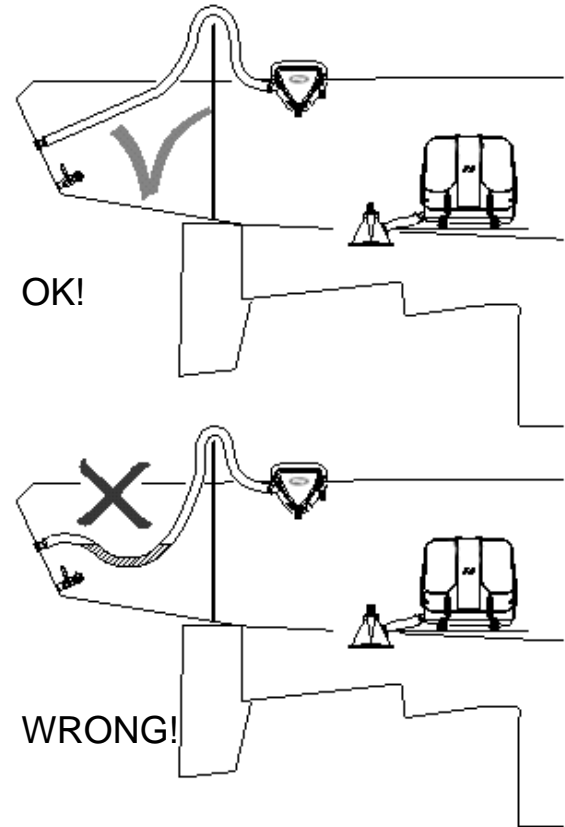


Fig. 17. The gas outlet hose may go up once and then should slope down.

4 MAINTENANCE & DRAINAGE

4.1 General

The DELTA Waterlock and Water/Gas Separator do not need maintenance. The fittings are lubricated with a long lasting silicon-grease. When necessary one can renew this grease when the fittings have to be disconnected after many years. Silicon-grease is available in shops for diving equipment.

4.2 Winter preparations

To prepare the installation for winter to protect it from frost one can drain the waterlock by removing the drain plug. See figure 18.

An other method is to fill the system with anti freeze. The Delta components are resistant to many chemicals including alcohols as used in coolants and anti freeze.

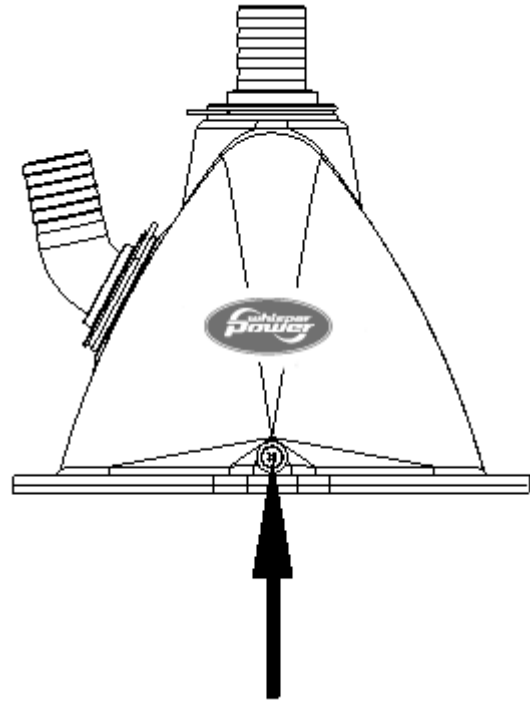


Fig. 18. Drain plug

5 PARTS LISTS

40230093 Waterlock "Delta" 40mm (1 5/8")

Qty	Part nr.	Description
1	40230128	Body waterlock
1	50230112	Elbow coupling Delta 40 mm
1	50230113	Straight coupling Delta 40 mm
1	50211124	Drain screw
1	50221671	Gasket drain screw
2	50230110	Lockspring
4	50230121	O-ring 47.22 x 3.53 mm

40230094 Waterlock "Delta" 51mm (2")

Qty	Part nr.	Description
1	40230128	Body waterlock
1	50230115	Elbow coupling Delta L 51 mm
1	50230114	Straight coupling Delta L 51 mm
1	50211124	Drain screw
1	50221671	Gasket drain screw
2	50230110	Lockspring
4	50230121	O-ring 47.22 x 3.53 mm

40230190 Waterlock "Delta L" 51mm (2")

Qty	Part nr.	Description
1	40230161	Body waterlock
1	50230152	Elbow coupling Delta L 51 mm
1	50230153	Straight coupling Delta L 51 mm
1	50211124	Drain screw
1	50221671	Gasket drain screw
2	50230110	Lockspring
4	50230160	O-ring 75.8 x 3.53 mm

40230191 Waterlock "Delta L" 63 mm (2 1/2")

Qty	Part nr.	Description
1	40230161	Body waterlock
1	50230115	Elbow coupling Delta L 63 mm
1	50230114	Straight coupling Delta L 63 mm
1	50211124	Drain screw
1	50221671	Gasket drain screw
2	50230110	Lockspring
4	50230160	O-ring 75.8 x 3.53 mm

40230192 Waterlock "Delta L" 76 mm (3")

Qty	Part nr.	Description
1	40230161	Body waterlock
1	50230154	Elbow coupling Delta L 76 mm
1	50230155	Straight coupling Delta L 76 mm
1	50211124	Drain screw
1	50221671	Gasket drain screw
2	50230110	Lockspring
4	50230160	O-ring 75.8 x 3.53 mm

40230097 Water gas separator "Delta" 40mm (1 5/8")

Qty	Part nr.	Description
1	40230129	Body water/gas separator
2	50230112	Elbow coupling Delta 40 mm
1	50230113	Straight coupling Delta 40 mm
3	50230110	Lockspring
6	50230121	O-ring 47.22 x 3.53 mm

40230098 Water gas separator "Delta" 51mm (2")

Qty	Part nr.	Description
1	40230129	Body water/gas separator
2	50230115	Elbow coupling Delta 51 mm
1	50230113	Straight coupling Delta 40 mm
3	50230110	Lockspring
6	50230121	O-ring 47.22 x 3.53 mm

40230193 Water gas separator "Delta L" 51mm (2")

Qty	Part nr.	Description
1	40230162	Body water/gas separator
2	50230150	Elbow coupling Delta L 51 mm
1	50230113	Straight coupling Delta 40 mm
3	50230110	Lockspring
2	50230121	O-ring 47.22 x 3.53 mm
4	50230160	O-ring 75.8 x 3.53 mm

40230194 Water gas separator "Delta L" 63 mm (2 1/2")

Qty	Part nr.	Description
1	40230162	Body water/gas separator
2	50230152	Elbow coupling Delta L 63 mm
1	50230114	Straight coupling Delta 51 mm
3	50230110	Lockspring
2	50230121	O-ring 47.22 x 3.53 mm
4	50230160	O-ring 75.8 x 3.53 mm

40230195 Water gas separator "Delta L" 76 mm (3")

Qty	Part nr.	Description
1	40230162	Body water/gas separator
2	50230154	Elbow coupling Delta L 76 mm
1	50230114	Straight coupling Delta 51 mm
3	50230110	Lockspring
2	50230121	O-ring 47.22 x 3.53 mm
4	50230160	O-ring 75.8 x 3.53 mm



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