VORTEX
SUBSEA SOLUTIONS

STORM
3-INCH dredge

Dredge Equipment Operations manual.

PATENTED

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Your safety is your responsibility. Please ask if you are unsure about anything.

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Introduction

The Vortex STORM 3-inch is characterized by the following advantages:

- No depth limitations
- Quick mobilization
- Easy operation

The STORM 3-inch dredge Is designed for higher capacity hydraulic supplies that enable a dredge Inlet vacuum up to 29.5 in/hg (100 kpa) at 206 bar and 39lpm. The Vortex STORM ROV 3-inch is designed for Subsea excavation and disposal of seabed materials up to 75 millimeters in size. It can be mounted to any Work Class ROV and requires no ship deck space and sea fastening. The Vortex STORM 3-inch is very powerful, has no depth limitations and is quick and easy to mobilize and operate.

Dredge must **NOT** be run in air. Only in water.

The Vortex STORM 3-inch equipment can be operated and maintained by the ROV crew.

Ease of mobilization is key with supplied ROV installation bracket in the kit. The client needs to see rapid deployment of hire gear. The entire kit is shipped in one single box.

Your safety is your responsibility. Please ask if you are unsure about anything.

Introduction continued

Operating Limits

The operating limit for the Vortex STORM 3-inch , will be the responsibility of the Senior ROV person on-site. The limitation being the ability to safely deploy and recover the ROV system with the Vortex STORM 3-inch attached. Care must be taken whilst during launch and recovery operations to prevent damage to all components of the dredge system and the ROV.

Risks - Normal Operations

All personnel involved in deck operations shall be aware of the potential risk described hereafter.

- Crane Handling (possible danger of e.g. heavy falling object)
- Launch and recovery of equipment over the side of the vessel
- Personnel working over open sea (typical personnel working with launch and recovery of equipment from vessel deck or moon pool)
- Object falling down from height (rocks following the equipment when recovering)
- Working with equipment under pressure (hydraulics or water)
- Hydraulic oil spillage

Safety

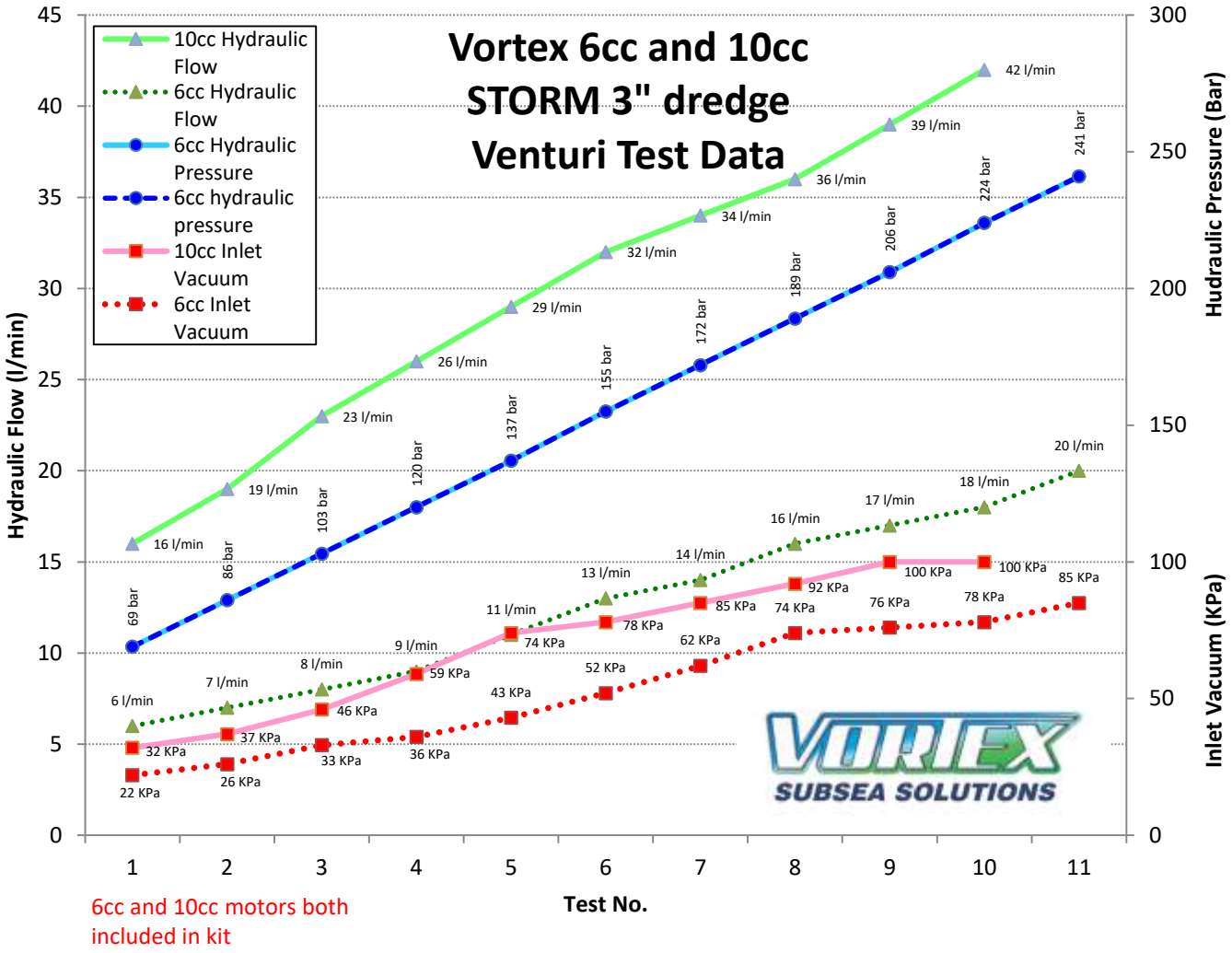
Personal protection equipment recommended for use when working on ship/platform deck

- Hard Hat
- Safety glasses
- Gloves
- Safety Boots
- Overall

Vortex STORM 3-inch Introduction

The Vortex STORM 3-inch is designed for Subsea excavation and disposal of sediments and gravel up to 75 millimeters. It is easily mounted to the ROV and requires no ship deck space and sea fastening. The Vortex STORM 3-inch requires no specialist operator or additional cables between ship and sea floor.

Vortex STORM suction performance.



6cc and 10cc motors both included in kit

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Performance and removal rates

Vortex STORM 3-inch Dredge Capacity

*Based on iron sand and rocks at 2.375 kg per liter

6 cc motor: Debris Removal rates (ton/hr) *22 ton per hour plus

6 cc motor: Debris removal rates (mtr3/ hr) *9 cubic meter per hour *10% solids by volume

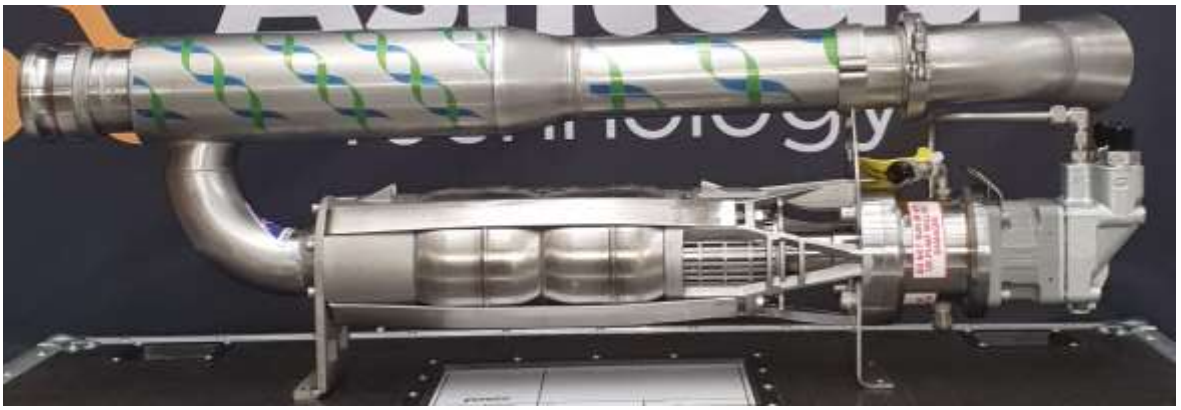
10 cc motor: Debris Removal rates (ton/hr) *25 ton per hour plus

10 cc motor: Debris removal rates (mtr3/ hr) *10.5 cubic meter per hour *10% solids by volume

Rated Maximum stone size	75 mm
Actual Maximum stone size	75 mm
Inlet suction hose length	3800 mm standard to custom length
Hydraulic flow required	**6 cc motor:** 13 lpm minimum (3.4 gpm minimum) OPTIMUM FLOW IS 17 lpm (4.5 gpm) **10 cc motor:** 32 lpm minimum (8.4 gpm minimum) OPTIMUM FLOW IS 39 lpm (10.3 gpm)
Coupling compensator	NO
Hydraulic pressure required	6cc = 155 bar minimum (2250 psi minimum) 10cc = 155 bar minimum (2250 psi minimum) OPTIMUM PRESSURE IS 3000 psi (206 bar) (4500 psi max)
Operating depths	Unrestricted
Operate pump in air	NO. DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER
Available suction at inlet	**6 cc motor:** 22.4 in/hg (76 kpa) at 206 bar and 17 lpm **10 cc motor:** 29.5 in/hg (100 kpa) at 206 bar and 39 lpm

Main Components Weights and Measures

Pump weight in air	32 kg (complete pump unit)
Pump weight in Seawater	24 kg (complete pump unit)



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User Checklist Before Dive

To prevent any damage to the equipment this checklist must be followed

Project: ..... Dredge No: .....

Item	Description	Checked	Comments	Date
1.	Ensure ROV can and does supply optimal hydraulic flow and pressure.		DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER	
2.	All fittings are checked for leakage			
3.	All hose clamps are checked			
4.	Pumps are fastened, no loose screws			
5.	Suction hose is fastened			
6.	Dredge is fastened, no loose ends			
7.	All hoses are fastened and in proper condition			
8.	Filter for induction is mounted in clean water			
9.	No hoses are squeezed or bent			
10.	Inlet nozzle is mounted correctly			
11.	Case drain and coupling are filled with clean oil			
Comments:				

.....

.....

.....

Dredge is checked by: .....

Date: .....

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User Checklist Before Dive

To prevent any damage to the equipment this checklist must be followed

Project: ..... Dredge No: .....

Item	Description	Checked	Comments	Date
1.	Equipment used in the sea must be properly cleaned with fresh water		DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER	
2.	All fittings are checked for leakage			
3.	All hose clamps are checked			
4.	Pumps are fastened, no loose screws			
5	Suction hose is fastened			
6.	Dredge is fastened and in proper condition			
7	All hoses are fastened and in proper condition			
8.	No hoses are squeezed or bent			
9.	Hydraulic motor and coupling is filled with clean oil			
10.	Broken parts are reported to vortex			

Comments: .....

.....

Dredge is checked by: .....

Date: .....

What were the positives? .....

What were the negatives? .....

Suggestions to make this kit better for you to use in the field:

.....

POST DIVE:

Ensure all parts subject to sea water are washed down with fresh water and dried before placing into shipping box.

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Vortex STORM 3 - inch Hydraulics

DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER

Motor / pump Hoses and Connectors

1/2” Pressure	Hydraulic Hose - 8	JIC Female fittings 4 mtr long
1/2” Return	Hydraulic Hose -8	JIC Female fittings 4 mtr long
3/8” Case Drain	Hydraulic Hose -6	JIC Female fittings 4 mtr long

Hydraulic Motor Requirements

Hydraulic flow required 6 cc motor: 13 lpm minimum (3.4 gpm minimum)
OPTIMUM FLOW IS 17 lpm (4.5 gpm)
10 cc motor: 32 lpm minimum (8.4 gpm minimum)
OPTIMUM FLOW IS 39 lpm (10.3 gpm)

Hydraulic pressure required 6cc = 155 bar minimum (2250 psi minimum)
10cc = 155 bar minimum (2250 psi minimum)
OPTIMUM PRESSURE IS 3000 psi (206 bar) (4500 psi max)

Vortex STORM 3 - inch Pump and Motor

The pump must be mounted on the ROV with ample room for both hydraulic and water hose connections.

Hydraulic connections seen at the top. Fill hydraulic motor with clean oil before start up.

Vortex STORM 3 - inch installation to ROV

The dredge is easily fixed to the ROV using supplied aluminum bracket.

Suction Hose and Handle

The suction head comes equipped with a fish-tail style handle for ROV manipulator. Other handle versions can be supplied.

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Vortex STORM 3 - inch Hydraulics

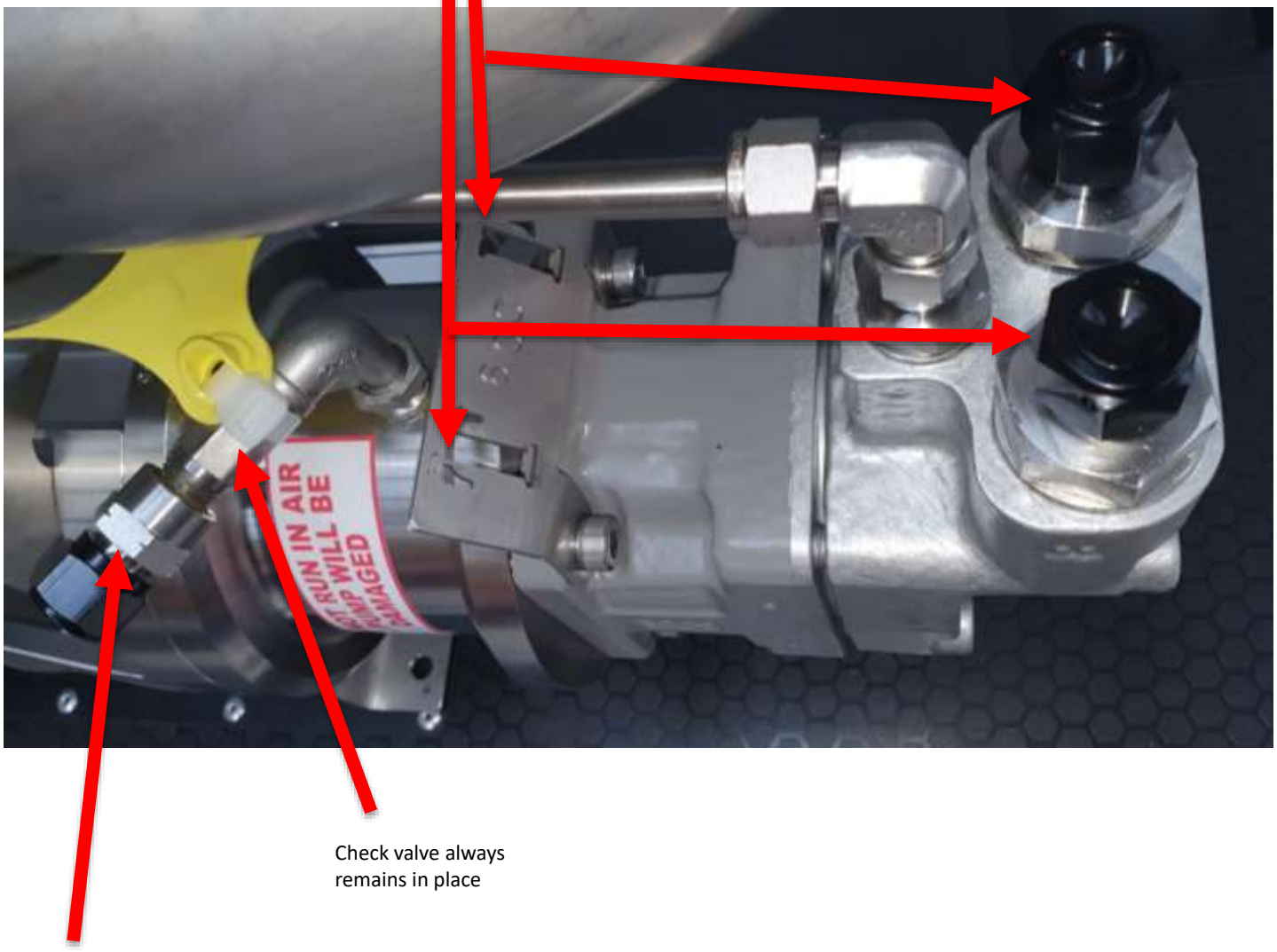
DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER

Hydraulic Schematics

Vortex STORM 3 - inch Hydraulic Hoses

- Hydraulic hoses for pump/motor connections.
- Two 4 mtr lengths ½" hoses
- One 4 mtr length 3/8"

Pressure and tank return clearly marked.



Check valve always remains in place

Case drain to tank

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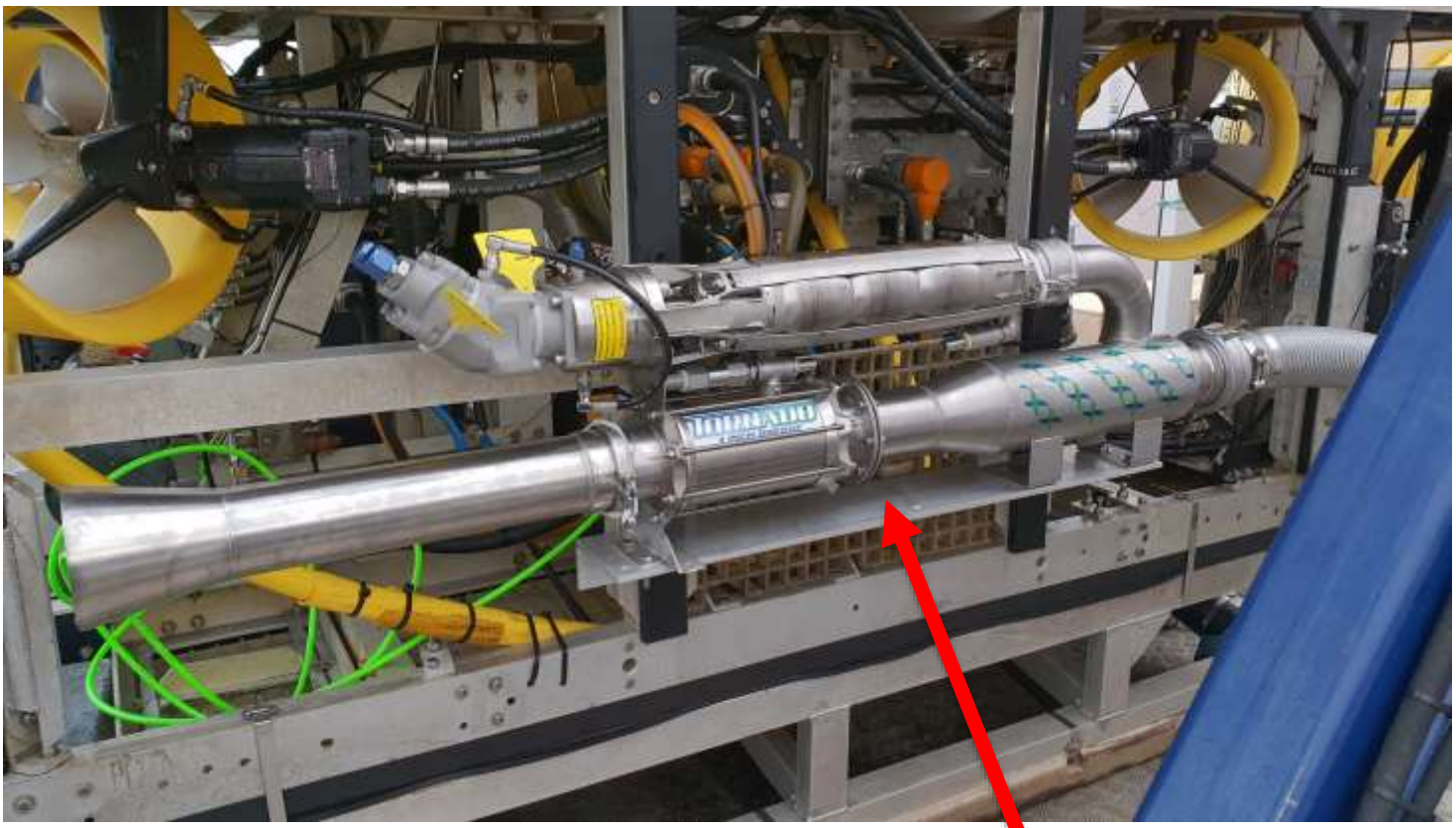
Installation



Dredge shown mounted to ROV using supplied aluminum angle. Drill supplied angle to suit.

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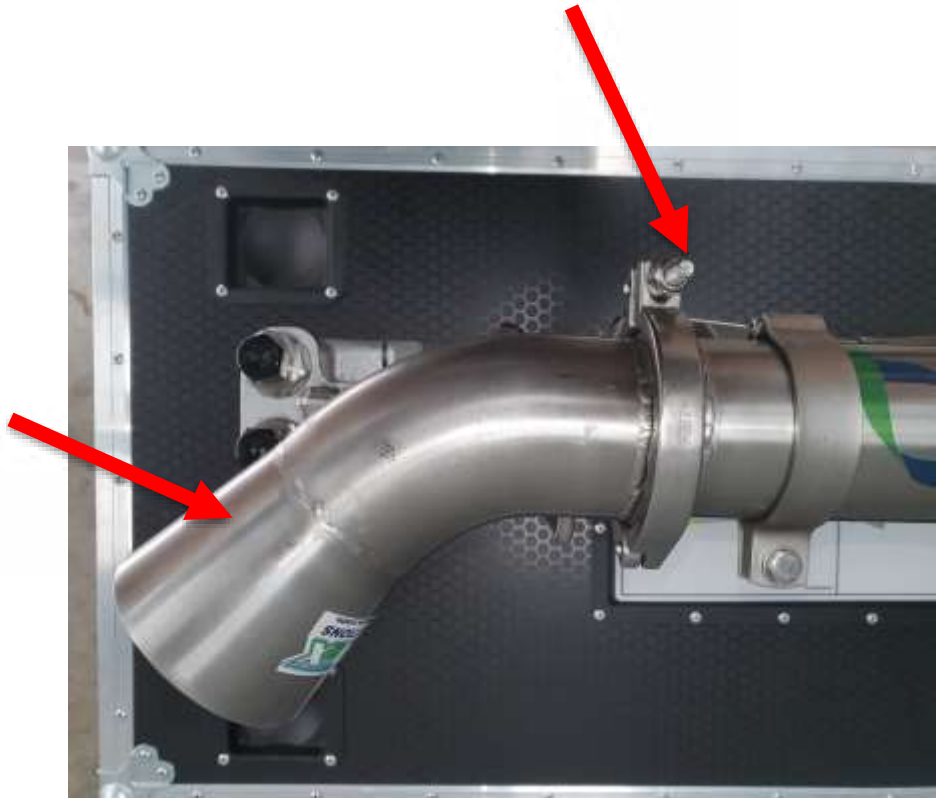
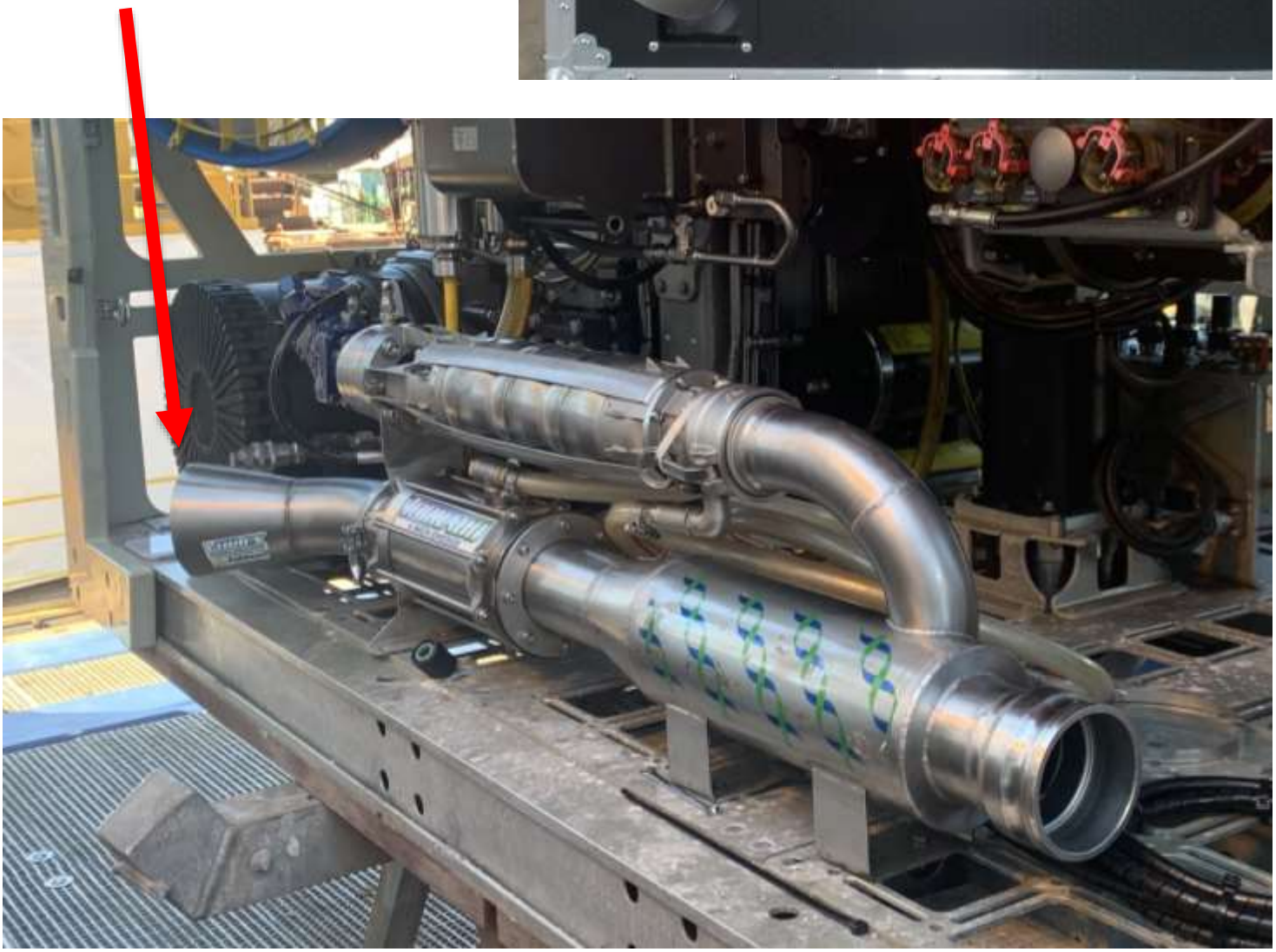
Installation

Loosen clamp here to rotate exhaust cone.
Always double nut and check gasket is in place.

Exhaust cone can be rotated to allow dredge to be installed inside ROV frame and deflect debris away from the ROV





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Installation – Hose Connections

3 inch suction head and ROV manipulator handle.

Inlet hose with suction head and ROV manipulator handle.

Exhaust

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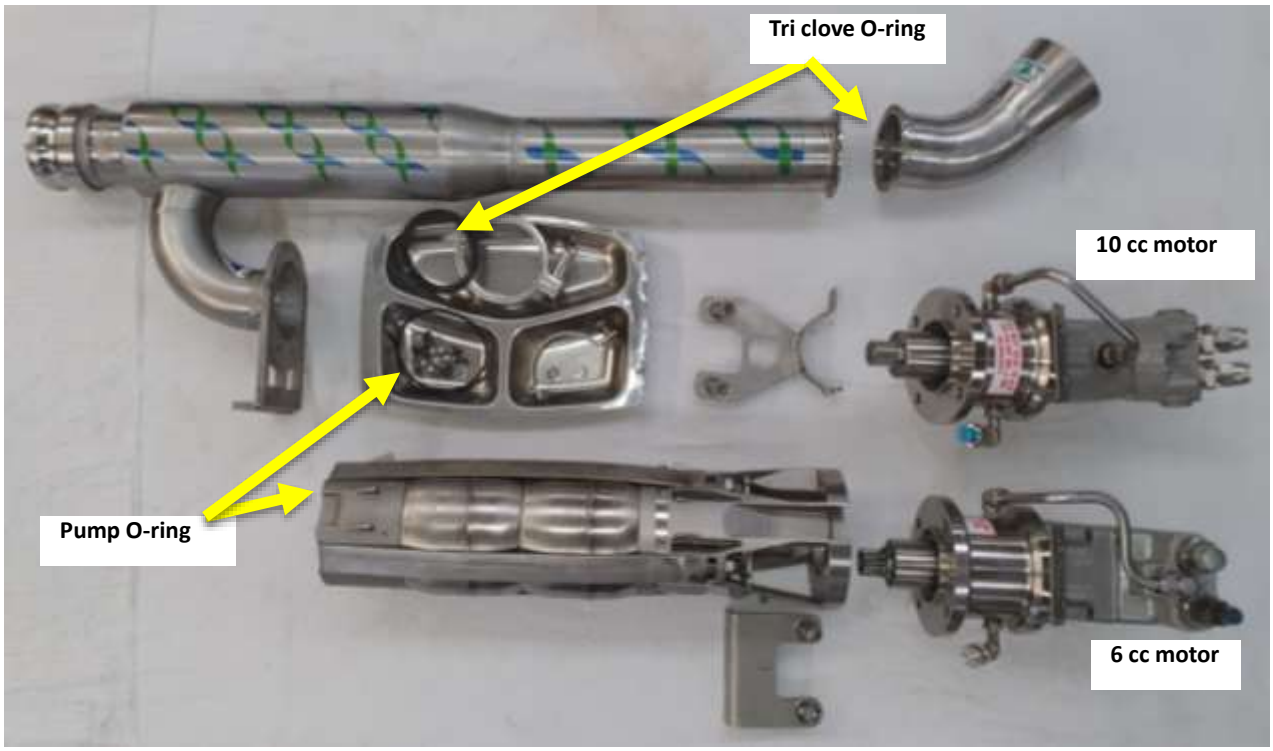
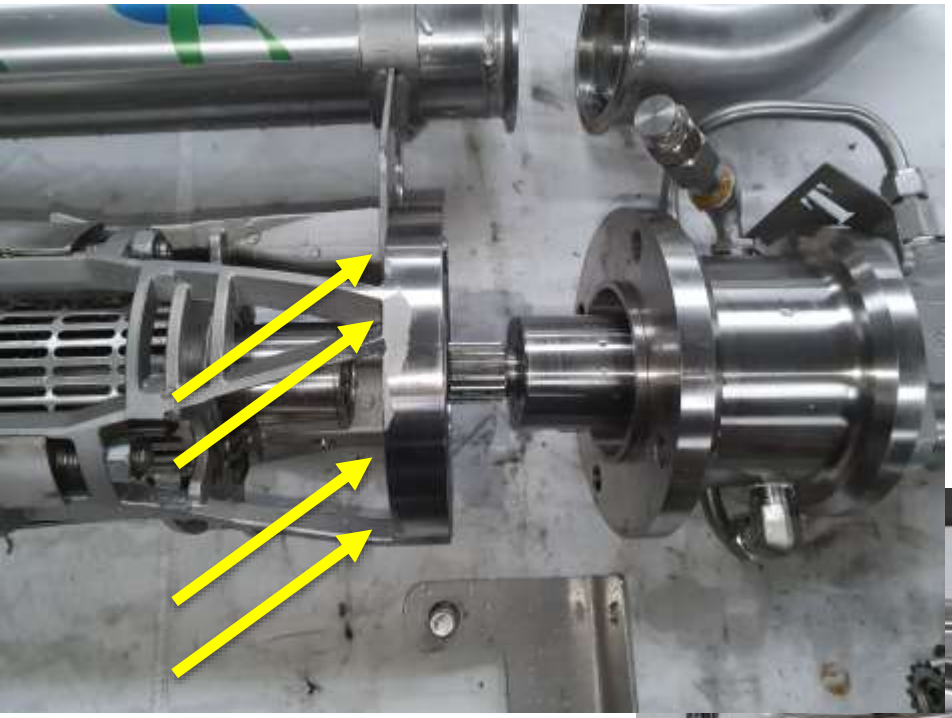
Operation – Changing hydraulic motors





Remove four M12 – Adaptor bolts.
Remove motor.

No O-rings are present or needed.

Slide in new motor.
Secure four M12 – Adaptor bolts.
Torque to 20 Nm

No O-rings are present or needed.

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Shipping box placement of components.

3 inch suction nozzle and manipulator handle. With 45 degree elbow

Spares kit.

3 inch female to hose tail cam lock with three x 85 to 91mm hose clamps for suction hose

3 mtr long 3 inch suction hose

Hydraulic hoses.

- Two x 4mtr pressure and return hoses with -8 jic female swivel fittings. 90 degree elbow at one end of each hose.
- One x 4mtr case drain hose with -6 jic female swivel fittings. Straight both ends.

9mm x 75mm x 150mm x 1100mm long alloy Dredge to ROV mounting plate.
Drill to suit your application.

Manuals

Vortex water pump spares kit.

- Shaft seal.
- One x Mech. seal rotor # 10185
  One x Mech. seal seat # 10180
- Four x M10 x 40 bolts, nylocks and washers to mount aluminium bracket to ROV.
- Four x M8 x 30 bolts, nylocks and washers to mount dredge to aluminium bracket.
- Second motor is stored here.
  Kit has two motors in total:
  One x 10cc motor
  One x 6cc motor

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Inventory

- **3 inch dredge unit**
- **Two x 4mtr long -8 Jic female swivel P and T hoses (90 degree elbow at one end of each hose)**
- **One x 4mtr long -6 jic female swivel case drain hose**
- **1100 x 75 x 150mm alloy, dredge to ROV mounting plate**
- **One x 3 inch female camlock with 3 inch hose tail. For suction hose**
- **Ove x 3 inch stainless tube with 45 degree elbow with ROV manip handle. For suction hose**
- **One x generic spares kit as shown below**
- **One x water pump spares kit as shown below**

  1 x Mech. seal rotor # 10185

  1 x Mech. seal seat # 10180
- **One x operations manual**
- **Two hydraulic motors in kit – one fitted on dredge and one store in case.**

  10 cc motor complete ready to bolt on

  6 cc motor complete ready to bolt on.

9mm x 75mm x 150mm x 1100mm long alloy Dredge to ROV mounting plate. Drill to suit your application.

- 117 cm long x 58 cm wide x 74 cm high.
- 140 kg weight

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Axial pump repair procedures

Mechanical seal replacement:

1. Remove pump suction screen
2. Remove M12 bolts holding aluminium motor adaptor to stainless pump terminal and remove drive assembly
3. Holding motor in a vice with shaft pointing vertical upwards, unfasten motor cap screws and remove aluminium adaptor from motor assembly, taking care to avoid contact between seal stationary seat and shaft surface.
4. Remove circlip and seal seat retainer from motor adaptor. Remove seat and replace with new item from service kit. Refit retainer in same orientation as when removed and replace circlip.
5. Slide mechanical seal rotor from shaft and fit replacement seal rotor hard back against rear shoulder of sleeve using light hydraulic oil as a lubricant.
6. Clean both seal face using a lint free cloth and clear gasoline (or equivalent) – lubricate rotor face with a drop of clean hydraulic oil.
7. Assemble parts in reverse order using torque settings as laid down in torque chart in this instruction set.

Hydraulic motor replacement:

1. Disassemble unit per steps 1-3 in “Mechanical seal change” instruction
2. Fit plastic protecting sleeve from service kit to shaft spline, holding firmly with vice-grip, and using a 5mm allen key, remove the shaft retaining cap screw. Using slide hammer with a 12mm thread remove the shaft from the hydraulic motor.
3. Lubricate the replacement hydraulic motor shaft with a light Moly disulphide paste, refit spacer and key and slide on the splined stub shaft. If necessary use a hollow drift onto the slide end shoulder to drive the shaft hard down against the spacer.
4. Clean up the 6mm shaft fastening cap screw and apply a light coating of “BlueMax” or equivalent silicone sealant to the underside of the head and torque the cap screw to 8 nm.
5. Replace the seal rotor and reassemble the pump set all per steps 4-6 in the “Mechanical seal replacement” description.

Torque settings:

M6 – shaft retainer cap screw	8nm
M10 – motor retaining cap screw	12nm
M12 – Adaptor bolts	20nm

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Axial pump repair procedures

Remove shaft - using slide hammer if necessary

fit shaft with hollow drift

Apply Blue Max ” or equivalent silicone sealant to underside of cap screw

Torque sleeve fastening cap screw

Lubricate shaft with light hydraulic oil as a lubricant

Push seal onto shaft with silicone grease

fit O-ring - seat - retainer ring and circlip

fit O ring into adaptor recess

fit adaptor to motor

fasten motor to adaptor

Air test mechanical seal - 20psi

Apply grease to spline

Fasten pump affixing cap screws

Slide joint section to remove screen from pump

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Trouble Shooting

Symptom: Water pump not operating

Remedy:

1. Ensure that the hydraulic hoses are connected as per manual drawings and match connection labels.
2. Check that recommended hydraulic supply can be seen directly at the Vortex water pump hydraulic motor.
3. Check any quick connect fittings you may have in the circuit as they can sometimes be faulty.
4. Are your thrusters using most of the available system flow and starving your circuit feeding the Vortex water pump?
5. Ensure the Vortex case drain is connected directly to tank. It is preferable to connect as close as possible to the reservoir and not run any hoses through quick connects.

Symptom: Debris removal slow

Remedy:

1. Check the caged nozzle of inlet hose is not blocked. Stop hydraulic flow to water pump to allow rocks and debris to be cleared.
2. Check that all cam locks are fastened and secured correctly.
3. Check all cam lock O-rings are in place and in good condition.
4. Use steady and consistent movements when plunging suction hose inlet into seabed. Try side to side and up and down movements of suction hose inlet. Differing conditions may require changing methods.
5. Check all hydraulic remedies as seen in “water pump not operating” section of trouble shooting.
6. Check inlet and exhaust hoses are not bent or blocked.

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