VORTEX

SUBSEA SOLUTIONS

T-100 TORNADO
4-INCH DREDGE

DREDGE EQUIPMENT OPERATIONS MANUAL

PATENTED

CE

Contents

Introduction

The Vortex TORNADO 4-inch is characterized by the following advantages:

- No depth limitations
- Quick mobilization
- Easy operation

The T-100 TORNADO 4-inch dredge Is designed for higher capacity hydraulic supplies that enable a dredge Inlet vacuum up to 29.5 in/hg (100 kpa) at 2800 psi and 78lpm.The Vortex TORNADO ROV 4-inch is designed for Subsea excavation and disposal of seabed materials up to 99 millimetres in size. It can be mounted to any Work Class ROV and requires no ship deck space and sea fastening. The Vortex TORNADO 4-inch is very powerful, has no depth limitations and is quick and easy to mobilize and operate, it must NOT be run in air. Only in water.

The Vortex TORNADO 4-inch equipment can be operated and maintained by the ROV crew.

Vortex has developed a dredge kit with two primary considerations:
First priority is ease of mobilization. The client needs to see rapid deployment of hire gear. The entire kit is shipped in one single box.

Second priority is power. Our TORNADO 4-inch dredge has shown under real world conditions to provide removal rates well in excess of other 4-inch dredges and has been comparable to 6-inch dredges in performance.

We have included the option of a jetting head kit.

The Vortex TORNADO 4-inch equipment is easy to set up and use. However, if on site support is agreed in the contract, Vortex Personnel will assist during mobilization and demobilization and or support the project during the entire operation.

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

OPERATING LIMITS

The operating limit for the Vortex TORNADO 4-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 TORNADO 4-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 TORNADO 4-INCH INTRODUCTION

The Vortex TORNADO 4-inch is designed for Subsea excavation and disposal of sediments and gravel up to 99 millimetres. It is easily mounted to the ROV and requires no ship deck

Performance & Removal

VORTEX TORNADO 4-INCH DREDGE CAPACITY

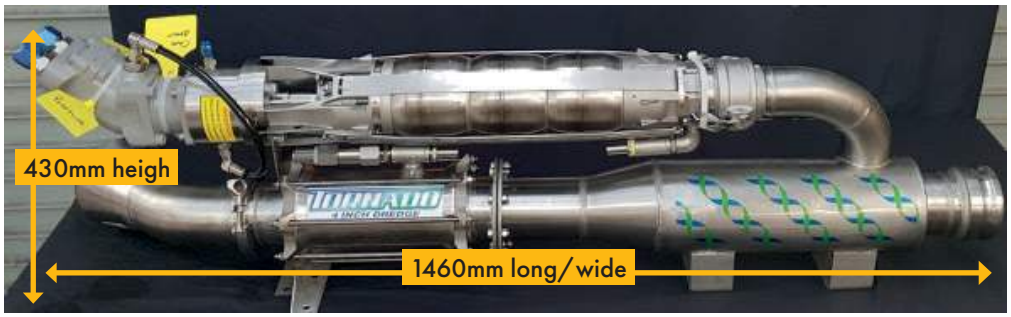
*Based on iron sand and rocks at 2.375 kg per liter

Debris Removal rates (ton/hr)	*60 ton per hour plus
Debris removal rates (mtr³/ hr)	*27 cubic meter per hour *15% solids by volume
Rated Maximum stone size	100 mm
Actual Maximum stone size	99.5 mm
Inlet suction hose length	3800 mm standard to custom length
Hydraulic flow required	78 lpm minimum (20.6 gpm minimum)
	OPTIMUM FLOW IS 80 lpm (21 gpm)
Coupling compensator	NO
Hydraulic pressure required	165 bar minimum (2400 psi minimum)
	OPTIMUM PRESSURE IS 3000 psi (206 bar)
Operating depths	Unrestricted
Operate pump in air	NO. DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER
Available suction at inlet	29.5 in/hg (100 kpa) at 3000 psi and 80 lpm

MAIN COMPONENTS WEIGHTS AND MEASURES

Pump weight in air	50 kg (complete pump unit)
Pump weight in Seawater	39 kg (complete pump unit)

All items must be accounted for upon return to avoid damage / loss charges.



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: OPTIMUM FLOW IS 80 lpm (21 gpm) OPTIMUM PRESSURE IS 3000 psi (206 bar) Follow hose directions as shown.		**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: _____

_____

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_____

Dredge checked by: _____

Date: _____

User Checklist

AFTER 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: _____

_____

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Dredge checked by: _____

Date: _____

What were the positives: _____

_____

What were the negatives: _____

_____

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

_____

_____

_____

Vortex TORNADO 4-inch Hydraulics

DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER

Motor / pump hoses and connectors

3/4" Pressure	Hydraulic Hose -12	JIC Female fittings	4 mtr long
3/4" Return	Hydraulic Hose -12	JIC Female fittings	4 mtr long
3/8" Case Drain	Hydraulic Hose -6	JIC Female fittings	4 mtr long

Reversal valve actuator hoses and connectors

1/4" suck	Hydraulic Hose -4	JIC Female fittings	3 mtr long
1/4" blow	Hydraulic Hose -4	JIC Female fittings	3 mtr long

Hydraulic Motor Requirements

Hydraulic flow / Pressure: 75 lpm minimum (19 gpm minimum)
165 bar minimum (2400 psi minimum)
OPTIMUM FLOW IS 80 lpm (21 gpm)
OPTIMUM PRESSURE IS 3000 psi (206 bar)

Reversal valve actuator hose Connectors

Hydraulic flow / Pressure: 10 lpm minimum (2.6 gpm minimum)
68 bar minimum (1000 psi minimum)

VORTEX TORNADO 4-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.
Pump can also be run in air.

VORTEX TORNADO 4-INCH PIPE WORK

Vortex pipe-work with cam locks for suction hose and pressure hose (left) and exhaust tube (right). The pipework is easily fixed to the ROV using cargo straps or ropes.

SUCTION HOSE AND HANDLE

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

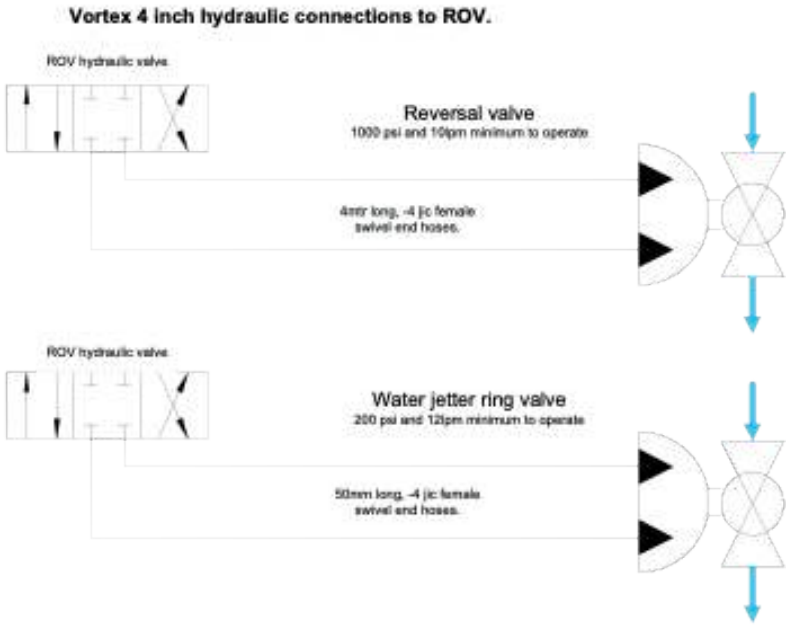
Vortex TORNADO 4-inch Hydraulics

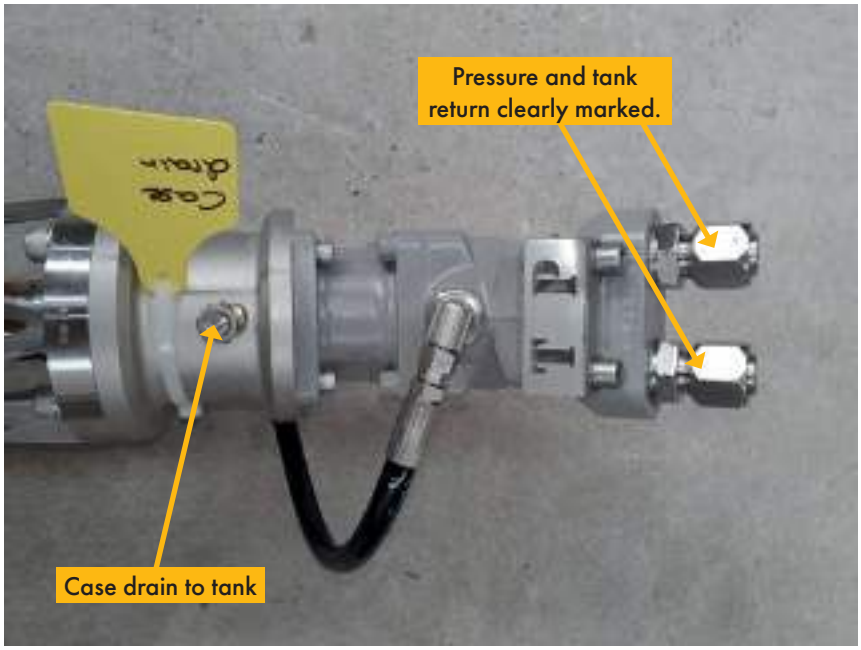
DO NOT RUN PUMP IN AIR: ALWAYS RUN IN WATER

Hydraulic Schematics

VORTEX TORNADO 4-INCH HYDRAULIC HOSES

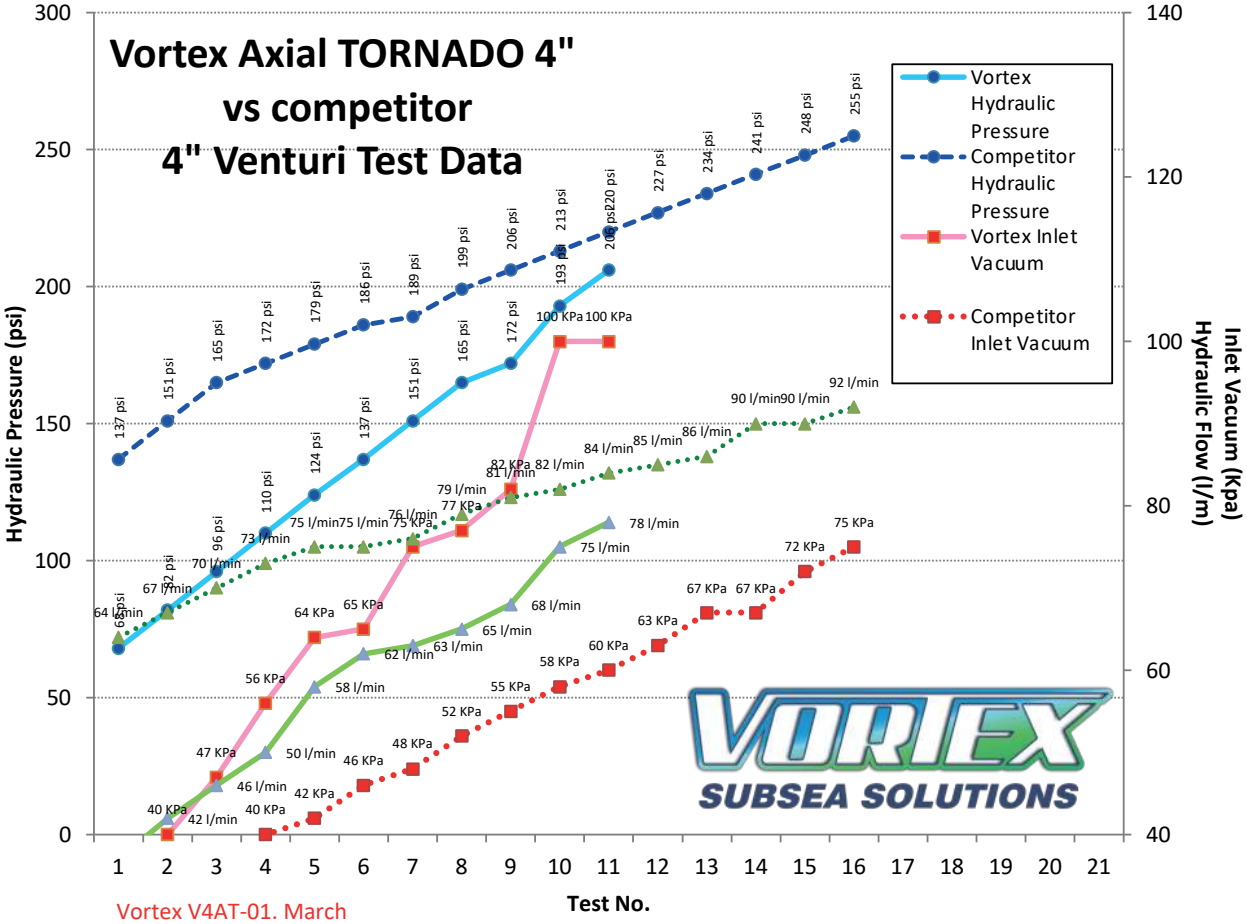
- Hydraulic hoses for pump/motor connections.
- Two 4 mtr lengths 3/4' hoses
- One 3 mtr length 3/8"





Hydraulic hoses 4 mtr long each.
4250 psi (293 bar) pressure rating.
-12 jic Pressure, -12 jic tank, -6 jic case drain.
Ensure ROV can and does supply 75 lpm min (19 gpm min) 165 bar min (2400 psi min) Before fitting dredge kit.
OPTIMUM FLOW IS 80 lpm (21 gpm)
OPTIMUM PRESSURE IS 3000 psi (206 bar)

Vortex T-100
Suction Performance



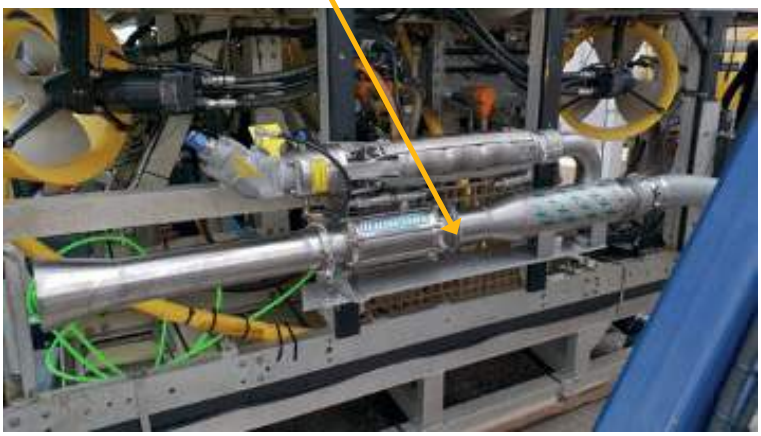
Vortex V4AT-01. March 2019.

Installation

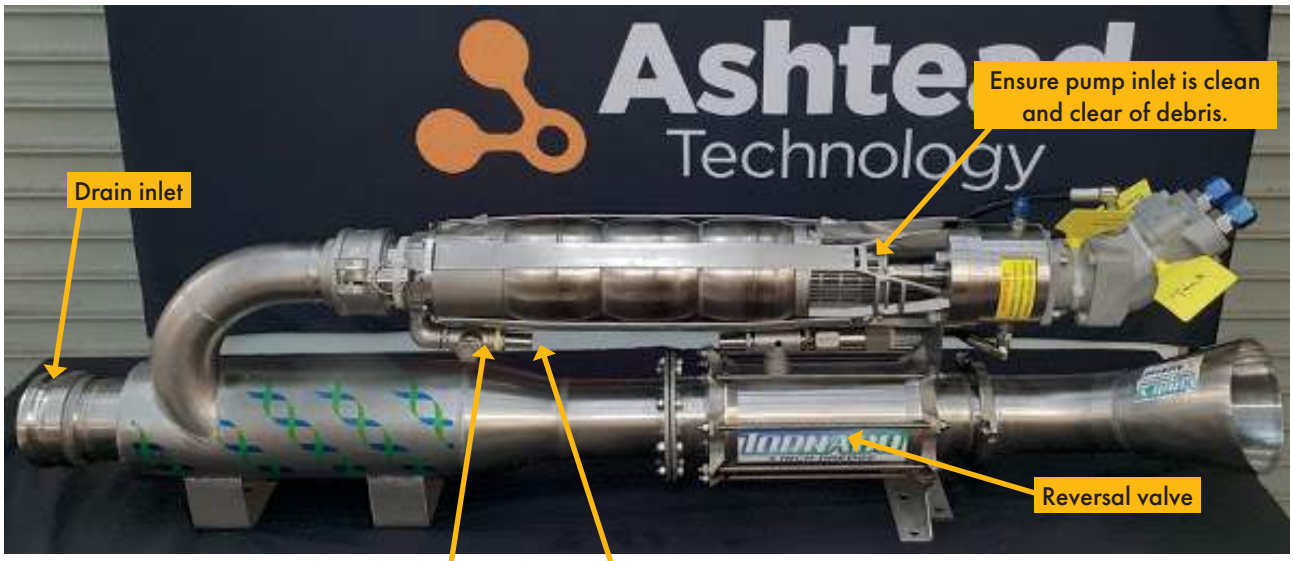
Connect ¾ inch water hoses to outlet of water pump and water control inlet of reversal valve. Opening actuator diverts water from water pump to reversal valve to actuate urethane bladder which closes / blocks flow in reversal valve and changes dredge direction and go into "blow" mode.
Closing actuator allows bladder to revert to relaxed state opening flow path allowing dredge to revert to "suck" mode.

Reversal valve actuator and hoses. Included in kit: diverter valve, hydraulic hoses, ¾ water hose goes between water pump and reversal valve.

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

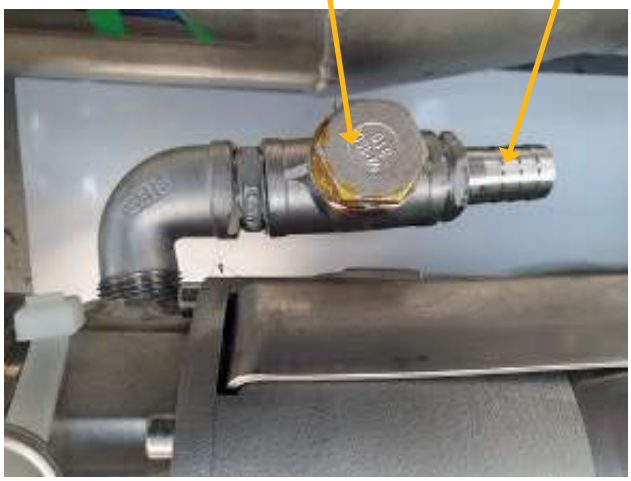


Installation



Water pump outlet to optional jetter kit

Water pump outlet to reversal valve. Blank off with ¾" plug if not using reversal valve



8.5mm bleed hole to limit pressure in reversal valve.

Installation

HOSE CONNECTIONS

Inlet hose with suction head and ROV manipulator handle.

Hydraulic hose fitted with clear markings to facilitate mobilization times. Pressure and return hoses have identical pressure rating to avoid chance of failure through incorrect assembly. Ensure ROV can and does supply 75 lpm minimum (19 gpm minimum) 165 bar minimum (2400 psi minimum) before fitting dredge kit.
OPTIMUM FLOW IS 80 lpm (21 gpm)
OPTIMUM PRESSURE IS 3000 psi (206 bar)

Optional water jetter shown left: uses water taken from the water pump outlet & shown in tests not to affect dredge suction performance. Included in kit: 'slip-on' jetter head goes on end of suction inlet, diverter valve, hydraulic hoses.

Inventory

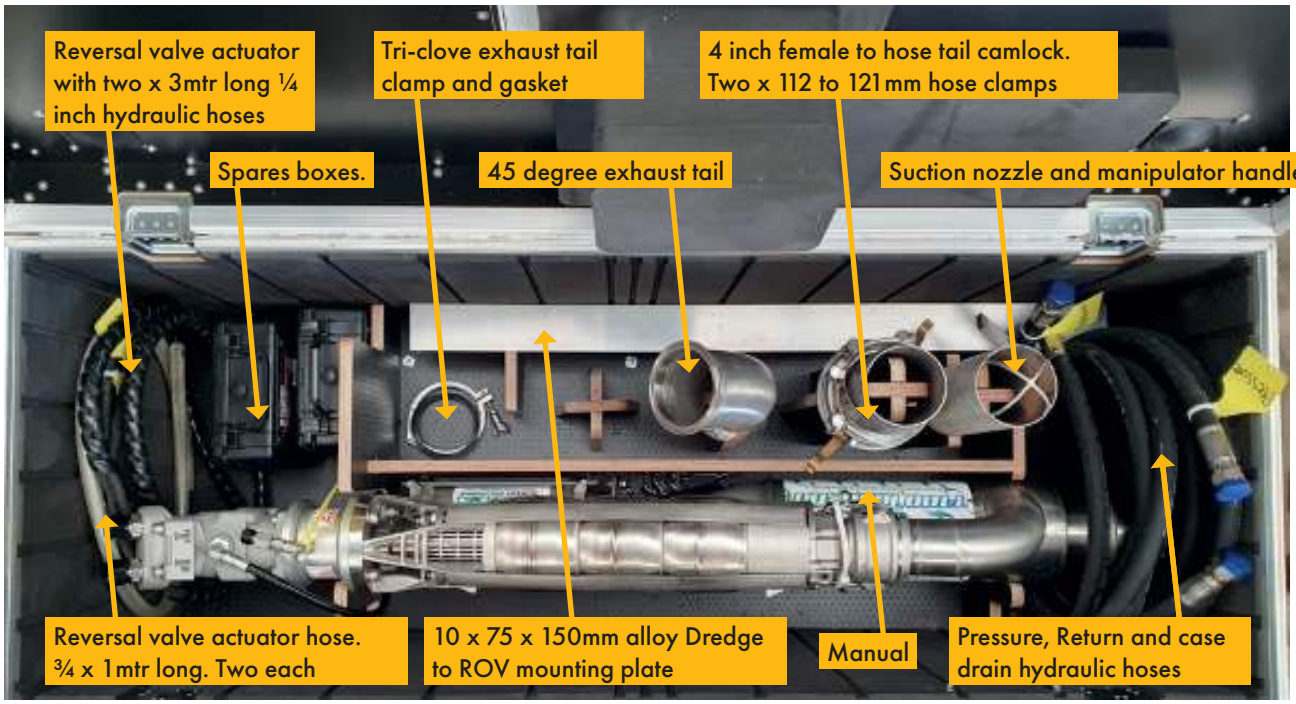
- 4 inch dredge unit with integral reversal valve
- Two x 4mtr long -12 Jic female swivel P and T hoses
- One x 4mtr long -6 jic female swivel case drain hose
- One x water reversal valve actuator with two x 3mtr long -4 jic female swivel hyd hoses
- 10 x 75 x 150mm alloy, dredge to ROV mounting plate
- One x 4 inch, 45 degree elbow with 4 to 6 inch flare on the end with triclove clamp
- One x 4 inch female camlock with 4 inch hose tail. For suction hose
- Ove x 4 inch stainless tube, 300mm long with ROV manip handle. For suction hose
- One x generic spares kit as shown below
- One x water pump spares kit as shown below1 x Mech. seal rotor # 101851 x Mech. seal seat # 10180
- One x operations manual

Size: 157cm long x 58cm wide x 74cm high

Weight: 165kg weight

Shipping Box

PLACEMENT OF COMPONENTS.



Generic spares kit

- Spare exhaust tail seal
- Two x ¾" BSPT blanking plugs
- Four M10 x 50 mounting bolts

Vortex pump spares kit

- Shaft seal

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 vise with shaft pointing vertical upwards, unfasten motor capscrews 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 vise-grip, and using a 5mm allen key, remove the shaft retaining capscrew. 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 capscrew and apply a light coating of "BlueMax" or equivalent silicone sealant to the underside of the head and torque the capscrew to 8 nm.
5. Replace the seal rotor and reassemble the pumpset all per steps 4-6 in the "Mechanical seal replacement" description.

Torque settings:

M6 – shaft retainer capscrew	8nm
M10 – motor retaining capscrew	2nm
M12 – Adaptor bolts	20nm

Axial pump repair procedures

Remove shaft - using slide hammer if necessary

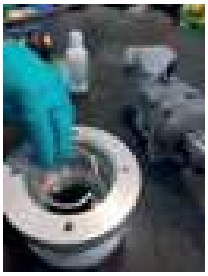
fit shaft with hollow drift.

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

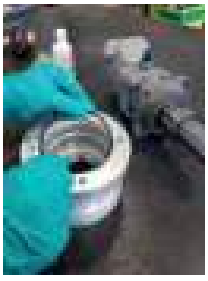
Torque sleeve fastening cap screw.

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.

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 78 lpm minimum (20.6 gpm minimum) 165 bar minimum (2400 psi minimum) can be seen directly at the Vortex water pump hydraulic motor. OPTIMUM FLOW IS 80 lpm (21 gpm) OPTIMUM PRESSURE IS 3000 psi (206 bar).
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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