



**OPERATION & MAINTENANCE
MANUAL**

for the

**“DIRTY HARRY” 2 DIVER EXHAUST VACUUM
CONTROL PANEL**

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1	23/11/00	S. Thornburgh	R. Wylie	R. Wylie	ECN 3311
2	18/12/02	F. Bain	R. Wylie	R. Wylie	ECN 4095
3	13/02/04	L. Leckie	J. Massie	R. Wylie	ECN 4780
4	17/02/10	C. Crawford	R. Wylie	S. Waddell	ECN 13253
5	23/03/10	S. McMasters	C. Crawford	C. Crawford	ECN 13343
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7					

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CHECKED BY: J. Bruce

APPROVED BY: D. Smith

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1.0 INTRODUCTION

The Divex “Dirty Harry” system for contaminated water diving utilises a helmet based on the widely used Ultrajewel Diving Helmet and benefits from its well proven design and excellent performance history.

Ultrajewel Diving Helmets were originally designed to return the diver’s exhaled gas to the surface for reconditioning and re-supply to reduce the cost of breathing heliox at depth. This style of helmet is extremely dry as the exhaled gas has no contact with the surrounding water environment. This is of great practical value in contaminated water diving operations where diver exposure to the water must be minimised.

Helmets of this type require a vacuum to draw exhaled breath away from the diver. At depths greater than 5 metres the relative vacuum between the water pressure at the operating depth and surface is sufficient. At depths of less than 5 metres, and particularly when an umbilical of 50 metres length or more is used, the vacuum must be increased.

The Divex “Dirty Harry” system provides this facility by means of an Exhaust Vacuum Control Panel.

2.0 GENERAL DESCRIPTION

Referring to the (PP 5001) arrangement drawing on page 3.

In accordance with good diving practice, two independent diver exhaust systems are provided. The vacuum pump drive air supplied to the panel is filtered and regulated to supply the vacuum pump with 87-100psi (6.0 – 6.9 bar), the vacuum pump applies a minimum of -0.5 bar (-14.75 “Hg) suction to the divers exhaust hose.

The exhaust air from the diver passes through a coalescing filter to remove moisture and any particular matter, to protect the vacuum pump. The filter bowl also acts as a volume tank, the filter bowl drains through the check valve assembly, which additionally acts as the exhaust valve at depths greater than 6 metres.

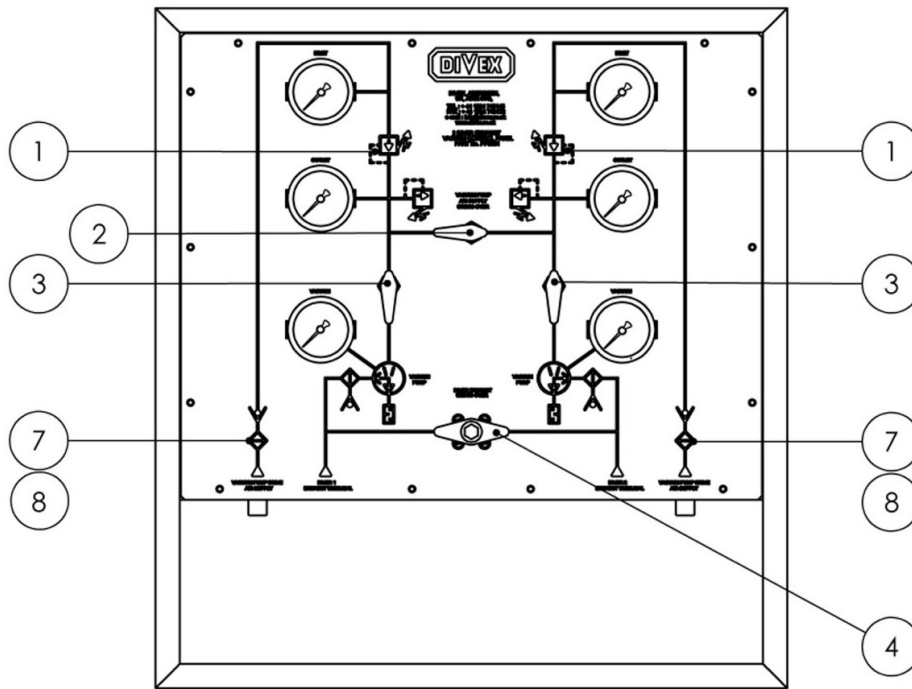
The two independent exhaust systems can be cross-connected to avoid loss of suctions:

- i) Vacuum drive air supply crossover valve (item 2) enables both vacuum pumps to be run from one supply.
- ii) Diver exhaust crossover valve (item 4) enables both divers to share one vacuum pump in the event of a pump failure.

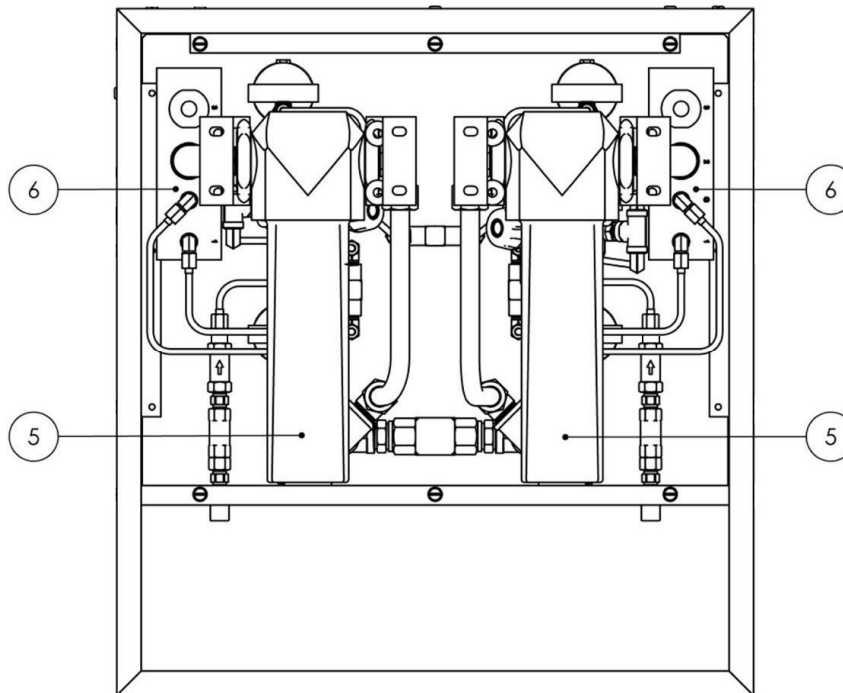
NOTE: The ‘vacuum pump drive air supply’ is not to be confused with the divers air supply. The vacuum pump drive air supply is the prime mover for the vacuum pump only.

NOTE:- The vacuum pump should not be supplied with air pressure greater than 7.0 bar.

PP5001 VACUUM PANEL - GENERAL ARRANGEMENT DRAWING



FRONT VIEW



REAR VIEW

- | | |
|--|--|
| 1. Vacuum pump drive air supply regulator | 5. Filter (Diver exhaust gas) |
| 2. Vacuum pump air supply cross-over valve | 6. Vacuum pump |
| 3. Vacuum pump drive air shut-off | 7. Filter (Vacuum pump drive air supply) |
| 4. Diver exhaust cross-over valve | 8. Check Valve |

3.0 OPERATION

3.1 Recommended Operating Parameters

Maximum recommended depth range:	0-50 msw (0 – 160 fsw)
Depth Range with vacuum pump assistance:	0 – 6 msw (0 – 20 fsw)
Depth Range without vacuum assistance:	6 – 50 msw (20 – 160 fsw)
Max. recommended exhaust umbilical length:	100 metres (328 ft)
Recommended exhaust hose diameter:	5/8"

Vacuum pump drive air supply pressure settings: 87-100psi (6.0-6.9 bar)

Air consumption of vacuum drive air with 6 bar supply = 450 SLPM
(16 SCFM) per diver.

Vacuum pump drive air supply:

- Air supply pressure range: 50 - 205 bar (725 – 3000 psi)
- Supply hose connection: No. 4 JIC male on panel

3.2 Pre Dive Procedure

Referring to the arrangement drawing on page 2, ensure vacuum pump air supply crossover valve (item 2) and the diver exhaust crossover valve (item 4) are both closed. Connect pump air supply 1/4" hose with a No. 4 JIC female connection to each 'Vacuum Pump Drive Air Supply' connection on the control panel. The 5/8" diver's exhaust umbilicals should be connected to the connections marked Diver 1 Exhaust Umbilical and Diver 2 Exhaust Umbilical, and are No. 10 JIC.

The air supply to the vacuum pump should be clean, filtered breathing quality air. This can be either HP air cylinders (205 bar/3000 psi) or HP compressor (205 bar/3000 psi). The drive air supply regulators are protected by inline filters (item 7).

The divers exhaust umbilicals are connected to the Ultrajewel exhaust regulator connections via a one metre (39 inches) long flexible whip (Part No. C1506B). To aid the divers head movement, this hose has an 'O' ring swivel adaptor to allow the exhaust hose to rotate even with full vacuum.

3.3 Diving Operation Procedures

2 Divers Operations

Open the supply valve from HP supply or supplies for the vacuum drive air supplies. The regulators are pre-set to 87-100psi (6.0-6.9 bar). The vacuum gauge should read -0.5 bar (-14.75 "Hg) minimum.

The system is now set up for diving operations from surface down to 6 metres (20 feet).

Note: If using HP air cylinders the supply pressure should be monitored during the duration of the dive so that a fresh HP cylinder can be connected in time without loss of suction.

After an extended dive at depths shallower than 6 metres (20 feet) the attendant should drain water from the filter housing (item 5). Due to the vacuum holding the check valve shut this operation is to be carried out after diving is complete.

Shut off the vacuum drive air supply and disconnect the exhaust hose at the helmet swivel connector to release the vacuum, the check valve assembly is under the filter bowl (item 5) a pull cord is pulled down for a few seconds to drain water.

Diver's exhaled breath contains moisture droplets, the coalescing filter elements in this system will remove this moisture. At depths greater than 6 metres (20 feet) the exhaust check valve will open automatically and the filter units will self-drain.

When continuously diving at depths greater than 6 metres (20 feet), the vacuum system may be shut off to save the vacuum drive air. Vacuum assistance is not required beyond 6 metres (20 feet), as the pressure differential from the diver at this depth in relation to the surface pressure is adequate to provide sufficient suction.

When the diver is returning to the surface, the attendant should turn on the vacuum system again at 6 metres (20 feet).

If a temporary loss of vacuum drive air supply to one vacuum pump is anticipated, (e.g. while changing HP cylinders) the 'vacuum pump supply cross over valve' (item 2) is opened to allow both vacuum pumps to be driven by one air regulator (note: a check valve is fitted to each drive air supply circuit so that either HP hose can be drained during diving operations).

If a loss of vacuum occurs to one of the divers during a dive and the vacuum drive air supply is still correctly set to 87-100psi (6.0-6.9 bar), then the diver exhaust cross-over valve (item 4) is opened so that both divers can share one vacuum.

1 Diver Operations

The above procedure is the same for 1 diver operations, it is good practice to leave both HP supplies connected to allow the safety feature of the cross-over valves to be used in the event of any problems occurring, additionally the system will be ready for a back-up diver to remain on stand-by.

3.4 Post Dive Checks

In clean fresh water diving conditions the two filter bowls (item 5) should be removed (unscrewed) and rinsed weekly in clean fresh water. Particular attention should be paid during seawater diving operations as the filter body is made from aluminium alloy and may corrode with prolonged seawater contact. Depending upon the diving environment this may require to be done daily.

Cleaning the panel to remove seawater spray using fresh water at the end of the days diving will help prevent corrosion – however the housing is made from stainless steel and should remain bright if kept clean.

4.0 MAINTENANCE

4.1 Filters

4.1.1 Diver Exhaust coalescing Filter (item 5)

The life of the filter elements will vary according to use. Inspect after 3 months diving. Light external contamination can be rinsed off with clean fresh water but heavier soiling will require replacement. Spare filter elements are available from Divex (FE001). Inspect the condition of the filter bowl 'O' ring seal before refitting filter bowl.

4.1.2 Vacuum Drive Air Filters (item 7)

The drive air supply inlet is fitted with an in-line filter, although the use of breathing quality air will ensure minimum contamination. The filter is fitted with a replaceable element (E12741).

4.2 Vacuum Drive Air Supply Regulators

4.2.1 General Operating

Using a 9/32" (7mm) AF hexagon key, the adjustment plug knob compresses the adjusting spring, which raises or lowers the valve from the valve seat assembly. This regulates the pressure from the regulator. The regulator is a balanced regulator with minimal change of outlet pressure due to variation in supply pressure.

To increase the flow rate rotate the adjusting plug clockwise and to decrease, rotate counter clockwise.

The regulators should be set to 87-100psi (6.0-6.9 bar). Setting above 7.0 bar reduces the efficiency of the vacuum pump.

4.2.2 Maintenance

Maintenance must only be undertaken by competent personnel.

Note: Divex recommends the use of Christolube oxygen compatible grease for 'O' ring seals (order code: SM034).

4.2.3 Periodic Checks

The regulator should be checked regularly for leaks using a soap solution. All leaks must be investigated and rectified.

Operate the control knob to ensure smooth action. Binding will indicate internal wear or damage.

4.3 Spares Ordering

Always use Divex spare parts, these are available through your local Divex agent or direct from Divex.

4.3.1 Spare Parts List, Divex Part No RK5001

<u>Part No</u>	<u>Description</u>	<u>Qty per Kit</u>
E12741	Element, Filter 10-15 micron	2
E13574	O-Ring	6
E13850	Valve, Check, 1" BSPP Fm	2
E13853	Washer, sealing	2
E13854	Washer, O-ring Support	2
E13858	Valve, Check, 3/4" BSPP Fm	2
E13876	Seal, O-ring, 1" BSPP	2
E13878	Seal, O-ring. 3/4" BSPP	2
E13879	Seal, seal, O-ring, 1/8" BSPP	4
E14557	Valve, relief, 3/8" UNF M	2
E14629	O-Ring	2
FE001	Element Filter, 1 micron	2
RK023	Kit, Vacuum Pump	2
RK024	Kit, Regulator	2
VB201	Valve, Ball, 1/4" NPT Fm	3
VK21	Kit, Valve, Check, VC201	2
VK61	Kit, Seal, Ball valve VB697	1