

# User Manual

## General Function Valve Pack Various Configurations

Superseded by manual OMM-00043 Rev 5 onwards

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## Introduction

Thank-you for purchasing this high quality product from Sub-Atlantic, the leading manufacturer of inspection ROVs, propulsion and hydraulic systems. Used correctly, this product should provide you with many years of reliable service in a sub-sea environment.

Our General Function Valve Packs (GFVP) are extremely compact and lightweight, making them suitable for Work-Class and Inspection ROVs as well as for specialised tooling applications.

Numerous configurations are available offering 6, 8, 12 and 16 valve stations, solenoid and/or proportional valves and serial or direct control. An integral pressure reducing valve (manual or proportional) sets supply the pressure while pressure and return line sensors can be fitted for remote monitoring. A topside control system and graphical user interface is also available.

Industry standard Wandfluh NG3 mini solenoid and proportional valves provide proven reliability.

The small size is achieved by building most of the features directly into the manifold body, thus avoiding many stacking 'sandwich' type valves. The heart of the system uses Sub-Atlantic's unique **Flow/PO Check Cartridge** which combines a uni-directional flow controller and a pilot operated check valve. The small size of this GFVP is also perfect for smaller electric ROVs where space and payload are at a premium.

Typical Operations include manipulator functioning, adjustable torque tools, pan & tilt units, sub-sea robotics and tooling applications, etc.

This manual is generic for all current configurations of the valve pack except for a configuration specific section in Appendix 2. Specific configurations are identified by a unique Sub-Atlantic part number generated at time of order. Refer to Appendix 2 for specific details for the scope of supply.

This manual has been devised with the intention of being simple, yet informative. The comprehensive set of quality pictorial assembly drawings show clearly how the unit is built in a step-by-step manner, allowing a technician to carry out any maintenance or repair work whilst in the field. All parts are uniquely numbered for easy identification.

Sub-Atlantic operates a policy of continual development and improvement meaning changes can be made to product without prior notice. If there are any areas of this product (or even this manual) which you believe could be enhanced or improved, we would value your comments. Every attempt will be made to include them in future product updates. The latest version of this manual can be obtained from the download section of our website. [www.sub-atlantic.co.uk](http://www.sub-atlantic.co.uk) or [www.ssaalliance.com](http://www.ssaalliance.com)

**Sub-Atlantic 2010**

Record of Revisions				
Rev	Date	By	Description	Appr
1	20/12/05	CMI	Original for revised GFVP design of Nov 2005	CMI
2	23/02/06	CMI	Electrical Schematic 1218-ELS changed to 1238-WIS	CMI
3	09/01/07	CMI	Drawing Updates	CMI
4	02/06/10	KLE	Drawing Updates	DMA

**Notices**

Whenever you see the symbols shown below, heed their instruction! Always follow safe operating and maintenance practices.

**! WARNING !**

This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.

**CAUTION**

This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of the equipment.

**NOTICE**

This note symbol indicates points of particular interest for more efficient or convenient operation.

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## 1. SPECIFICATION

<b>No of Stations</b>	6, 8 12 or 16
<b>Depth Rating</b>	The control PCB has been type tested to >6000 msw (700 bar / 10,000 PSI)
<b>Pressure &amp; Flow Rates</b>	280 Bar maximum input pressure 40 LPM maximum input flow rate Refer to Appendix 1 for individual valve flow rates
<b>Pressure Reducing Valve</b>	Option 1 Manual, externally adjustable Pressure Reducing Valve for regulating the input pressure to the direction control valves from 0 to 280 bar. Option 2 Proportional, remote adjustable Pressure Reducing Valve for regulating the input pressure to the direction control valves from 0 to 280 bar.
<b>Control Valves</b>	Option 1 Wandfluh NG3 mini 15 lpm, 4 way/3 position, 24 vdc solenoid with 'open centre motor spools'. BM4D32-G24-M35-55. Option 2 Wandfluh NG3 mini 8 lpm, 4 way/3 position, 24 vdc proportional solenoid. WDPFA03-ADB-V-5-G24-M35-55. Solenoid and proportional valves can be mixed
<b>Pilot Operated Check Valves</b>	Each valve incorporates a pilot operated check valve for leak-free load holding. They can be simply removed if a particular function is not required.
<b>Flow Controllers</b>	Each station incorporates 2 off, externally adjustable fine Flow Controllers fitted integral in the valve pack body. These provide precise flow control down to zero on each valve return line and free flow on the pressure line, allowing each function direction to be accurately set at different flow rates.
<b>Cross-Line Relief Valves</b>	Each station incorporates 2 off, externally adjustable Cross-Line Relief Valves fitted integral in the valve pack body. These provide component and hose protection when using pilot operated checks as high pressure can be generated inside hoses, for instance, by external forces on a manipulator or during deep dive recovery. Adjustable from 50 to 300 Bar (280 Bar standard setting).
<b>Pressure Sensors</b>	Pressure transmitters can be fitted in both the pressure galley (after the PRV) and in the return line gallery
<b>Water Ingress Sensors</b>	2 off probe type sensors located at each corner to accommodate all mounting orientations.
<b>Control</b>	Standard - Serial control PCB (RS485, RS232 & CAN) catering for up to 16 directional control valves. Eight of the functions are proportional allowing a mix of proportional and/or solenoid. If proportional PRV is required, this will use on proportional channel (7 proportional main valves) If more than eight proportional valves are required, two serial control PCBs can be fitted and control linked together. Option 1 – RS485 Control (will eventually be included in standard option) Option 2 - Various direct and diode Logic Control PCBs allowing valves to be controlled using +/-24vdc signal.
<b>Relief Valve</b>	Compensation oil space incorporates integral relief valve set at 1 bar
<b>Electrical Connector</b>	Various options currently available are: Sub-Atlantic ( way shell B metal shell) Burton 5500-2412 or 2420 Seacon MINM37FCR Schilling Seanet
<b>Cover Fixing</b>	Fully Captive Screw Assemblies to for fast removal and preventing losses. Manifold incorporates rugged stainless steel threaded inserts.
<b>Bleed Screws</b>	2 off bleed screws allow air to be removed from the cover area in all mounting orientations
<b>Mounting</b>	3 holes for M8 (5/16") stainless steel screws.

## 2. INSTALLATION

### Mounting

#### **Refer to General Arrangement Drawing, 3295-GA**

Attachment to supporting structure is by means of 3 off M8 or 5/16" stainless steel screws. The unit can be orientated horizontal or vertical ensuring that at least one of the cover bleed screws is uppermost.

### Hydraulic Connections

#### **Refer to**

#### **General Arrangement Drawing, 3295-GA**

#### **Hydraulic Schematic, 1239-HYS**

The following connections are required:

Function	Quantity	Size	Comments
Supply	1	9/16" UNF-6 SAE	Plastic Capped
Return	1	9/16" UNF-6 SAE	Plastic Capped
Reduced Pressure Outlet	1	7/16" UNF-4 SAE	Aluminium Plugged
Valve A & B Ports	12,16,24 or 32	7/16" UNF-4 SAE	Plastic Capped
Cover Fill & Compensation	1	7/16" UNF-4 SAE	Plastic Capped
Cover Relief	1	7/16" UNF-4 SAE	Plastic Capped

The reduced pressure connection can be used to supply other items of equipment at the reduced pressure or connection of pressure gauge.

The cover relief connection can be left open or be piped to a suitable collection point such as a flexible bladder or bag but should not have any pressure resistance which will affect the pressure setting on the relief valve.

### Hydraulic Oils

General mineral based hydraulic oils can be used. To ensure a long service life, make sure that the oil is filtered, clean and free from water.

### Cover Compensation Oil

When used underwater, the valve pack cover must be oil filled and compensated using a suitable positive pressure compensator. Suitable oils are Shell Tellus 32 or 22 Hydraulic oil or equivalent and Shell 148 Transformer Oil or equivalent. Users generally prefer to use the hydraulic oil option to minimise oil consumables.

A compensator with a maximum sprung pressure of 0.7 bar and a minimum capacity of 10% of the oil volume is recommended. The cover oil volume is stated on the general arrangement drawing. Sub-Atlantic can supply compact



sprung compensators for this purpose in corrosion resistant plastic (270cc, 380cc, 860cc, 2700cc available).

All air should be bled from the cover by using the highest bleed screw located on the cover.

### **Electrical Connections**

(Refer to General Arrangement Drawing, 3295-GA and 1238-WIS, GFVP Serial Control System 2 (RS485/RS232/CAN)  
Electrical Schematic

The valve pack can be fitted with various electrical connectors to suit customer requirements. Refer to the customer specific assembly in Appendix 2 of this manual for details.

## **3. OPERATION**

Once fully connected, operation consists of adjustment of the pressure reducing valve and the flow controllers.

### **Pressure Reducing Valve (Manual or Proportional Operation)**

#### **Manual Operation**

Use a 5 mm hexagon key to adjust, clockwise to increase pressure, counter-clockwise to reduce.

#### **CAUTION**

When the adjuster comes to a stop in either direction, DO NOT FORCE ANY FURTHER as the equipment may be damaged.

#### **Proportional Operation**

The proportional valve is wired to the control PCB. When this option is used, a pressure sensor is usually provided for feedback to control station.

## Flow Controllers

Use a 5 mm hexagon key to adjust, clockwise to reduce flow, counter-clockwise to increase. Very fine control will be achieved during the last turn of the clockwise movement. Total movement is 5 turns. The 12mm A/F hex nut is used to lock the adjuster screw. When using proportional valves, the flow controllers are generally set to fully open.

### **! WARNING !**

Do not operate the flow controller without the spiral retaining ring fitted, as this will allow it to be fully unscrewed under high pressure conditions resulting in potential injury.

### **CAUTION**

When the adjuster comes to a stop in either direction, DO NOT FORCE ANY FURTHER as the equipment may be damaged.

## Pilot Operated Check Valve Removal

(Refer to Drawing No 1234-MAS)

If the PO Checks are not required for a particular function, then they can be easily removed and replaced. Firstly, remove both **Flow/PO Check cartridges** then from the particular valve function using 18 mm socket. Dismantle and remove the three components stated on referenced drawing and re-assemble ensuring to store the removed components for future use.



## **4. CONTROL SYSTEM**

The standard control system for the GFVP is our Serial Control 2 card that provides for up to 16 control valves, 8 of which can be proportional. Other direct control versions can also be supplied such as diode logic. The following text describes the standard option although schematic diagrams for other options previously supplied are included the drawing section.

The Sub-Atlantic general function valve pack control PCB multiplexes control and data acquisition information on its RS232/RS485/CAN serial interface. The RS232/RS485 interface is a half duplex link, running at 38.4KBaud, N, 8, 1. All the



information to and from the PCB is routed via this link. The board has the following features:

- Operation from a single 24VDC supply, reverse voltage protected (a fast blow fuse or circuit breaker must be used upstream of the supply to this P.C.B.)
- High speed, 20 M.I.P.S., 16 bit microcontroller.
- 2 off RS232 channels, to 115K baud; over current and over voltage protected.
- 2 off CAN (Controller Area Network) channels, to 1M bit / second; over voltage and current protected.
- 16 off (8 valves, 16 coils), 24VDC pulse width modulated (P.W.M.) outputs with current feedback on each individual valve channel. 1amp maximum current; over current and over voltage protected.
- 16 off independent, 24VDC high side digital outputs with current feedback. 1amp maximum current; over current and over voltage protected.
- 4 off switchable 24VDC high side sensor supplies with current feedback. 1amp maximum current; over current and over voltage protected.
- 4 off 12 bit analogue inputs, software configurable, 0-5V, 0-10V, +/-10V; over current and over voltage protected.
- 4 off digital inputs, pull ups on board, contact closure to activate; over current and over voltage protected.
- On board voltage and temperature monitoring.
- 16 addresses, jumper selectable.
- 20 amps maximum @ a nominal 24VDC through the P.C.B., including nominally 250mA for the P.C.B. itself.

Within the context of the 12 function valve pack and the electrically controlled pressure reducing valve option, the PWM1 channel is used to control the pressure reducing valve. The 12 solenoid (bang/bang) valves are controlled by PWM3-PWM16, SSUP3, SSUP4 and DOUT1-DOUT8. The pressure transducer is supplied by SSUP1 and the signal from it is taken into ANIN1 (analogue input). The two water sensors, mounted in opposite corners of the valve pack, are connected to DIN1 (digital input). Please refer to 1238-WIS for an electrical schematic of the valve pack.

## **5. PREVENTATIVE MAINTENANCE**

Preventative maintenance is minimal and consists of carrying out the following checks: -

- Cover Compensation Oil - Check the body cavity for any water or air ingress. Bleed air or replace oil as required.
- Hydraulic System Oil – Check regularly for water ingress and replace as required.

## 6. SPARES

The following parts are recommended to be purchased as operational spares:

<b>Basic Spares Kit for 6, 8, 12 &amp; 16 Station GFVPs Sub-Atlantic Part No. 3287-MAS-SPK contains the following:</b>		
<b>Item</b>	<b>Part Ref</b>	<b>Qty</b>
Captive Screw M6 x 30	3267-DET	2
M6 x M9 Threaded Insert	1201-DET	2
Flow Check Housing Assembly	1234-MAS	2
0.25" Ball	MIS-0041	8
PO Check Ball Carrier	1192-DET	4
Check Spring	MIS-0046	4
Cross Line Relief Spring	MIS-0042	4
Cross Line Relief Ball Carrier	1198-DET	4
Bleed Screw	1766-DET	2
Bleed Screw O-Ring (BS-802)	SOR-178-0048-N70	4
Adjuster O-Ring (BS-109)	SOR-262-0076-N70	4
Valve O-Ring (1 x 4mm)	SOR-150-0045-N70	6
9 mm Poppet O-Ring (BS-010)	SOR-178-0060-N70	4
Anode	1763-DET	2

<b>Additional Spares specific to 6, 8, 12 &amp; 16 Station GFVPs To be ordered individually as required</b>		
<b>Item</b>	<b>Part Ref</b>	<b>Recommended Qty</b>
Cover O-Ring – 6 Station GFVP	SOR-300-2600-N70	1
Cover O-Ring – 8 Station GFVP	SOR-300-3010-N70	1
Cover O-Ring – 12 Station GFVP	SOR-300-3840-N70	1
Cover O-Ring – 16 Station GFVP	SOR-300-4670-N70	1
Wandfluh NG3 Solenoid Spool Valve	HYD-0020	As required
Wandfluh NG3 Proportional Valve	HYD-0168	As required
Control PCB – Serial 2	PCB-1216P	1

All other parts are available individually from Sub-Atlantic. Part Numbers are stated on the relevant Main Assembly Drawings.

## **7. WARRANTY**

Sub-Atlantic warrants their products on a back to base basis for a period of **12 months**. Replacement parts will not be issued until the defective items have been returned for inspection. Costs of returning defective components to Sub-Atlantic shall be at the buyer's expense. This warranty does not apply to any product that has been misused, modified or damaged by accident. The warranty does not include shaft seals or any other part subject to wear under normal operating conditions. Sub-Atlantic will not warrant any unauthorised modifications to their products and will not accept liability for such alterations. Equipment sold by but not manufactured by Sub-Atlantic such as cameras, video monitors, sonar heads and processors etc. will be warranted only to the extent and in the manner of that warranted to Sub-Atlantic by the seller and then only to the extent that the seller is able to enforce such a warranty.

## **8. SERVICE AND SUPPORT**

Sub-Atlantic operates a comprehensive sales support and technical after sales service based in Aberdeen Scotland. Most spare parts will be held in stock at our premises. When ordering spare parts, the Sub-Atlantic part number references on the drawings should be quoted.

Any technical queries should be directed to our technical department. A 24 hour helpline is normally in operation. A number will be available on the answering system after normal working hours or on our website.

Please have a system manual available before calling about technical queries, this will help our technical department to answer questions.

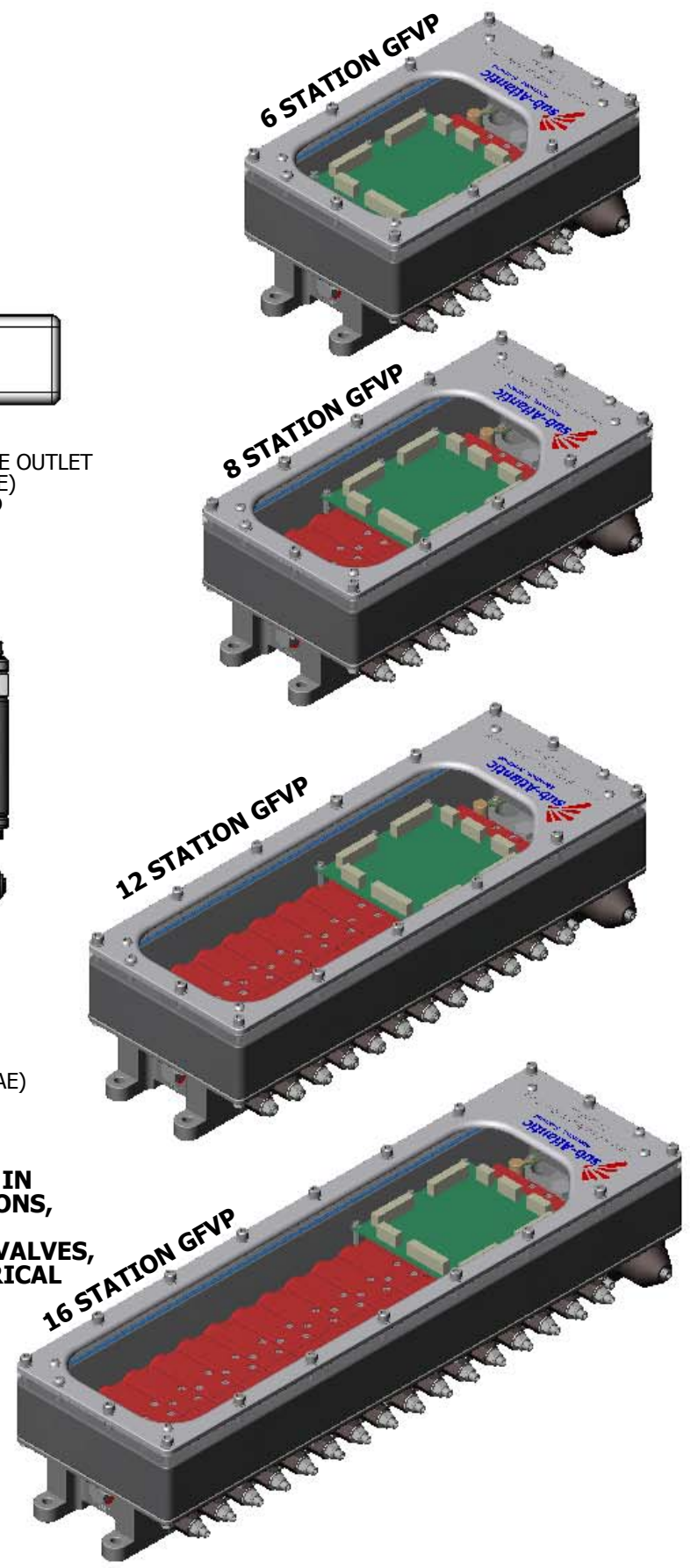
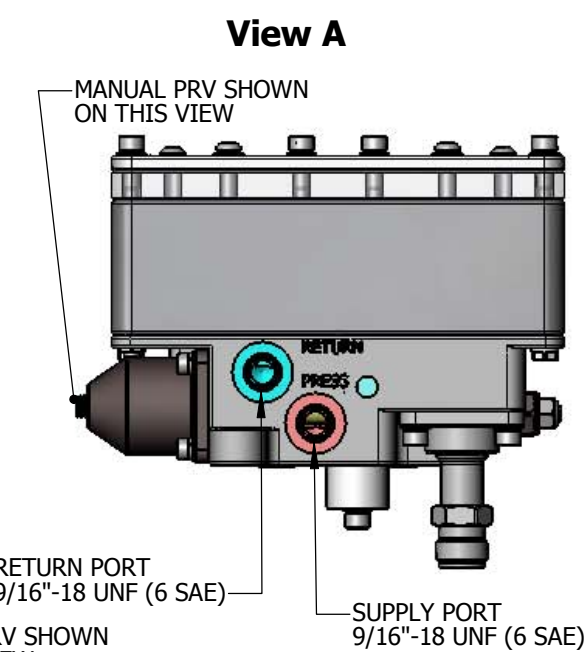
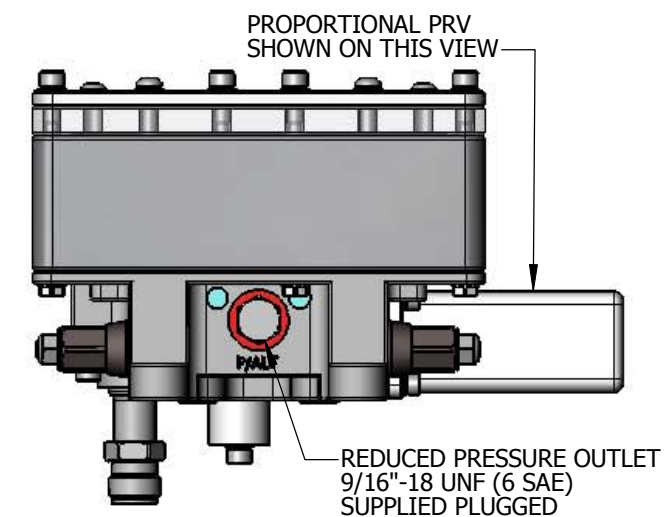
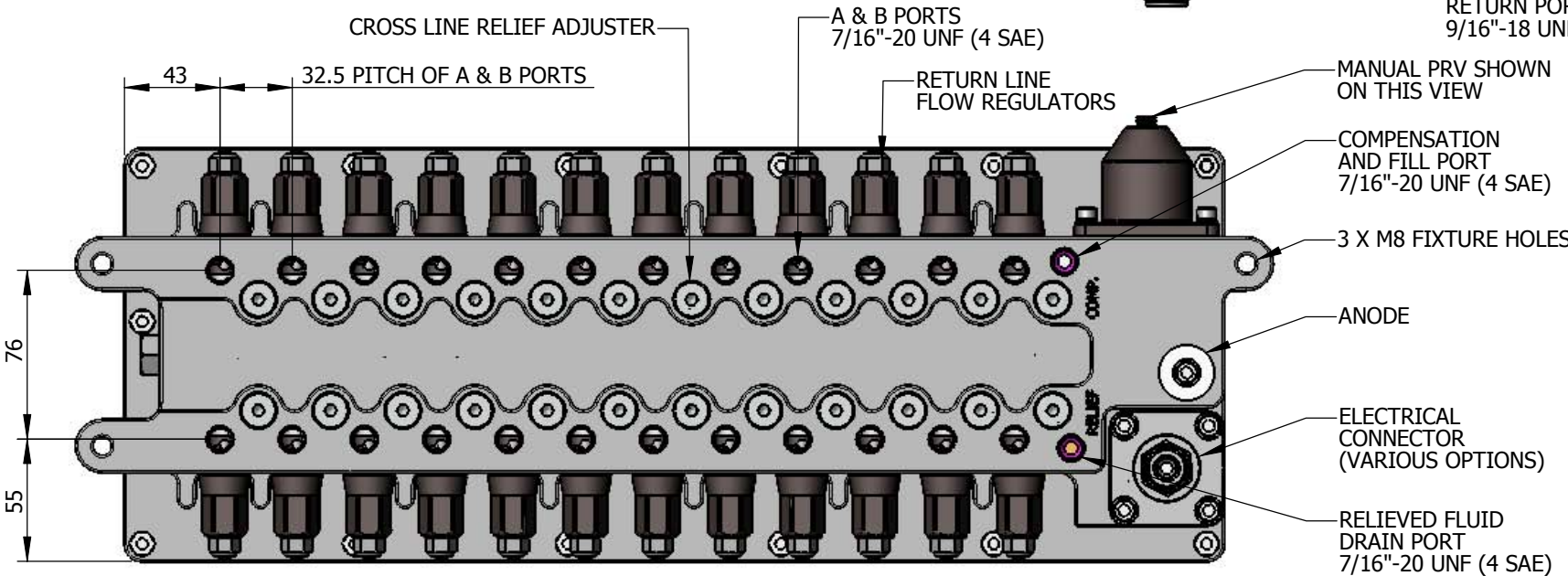
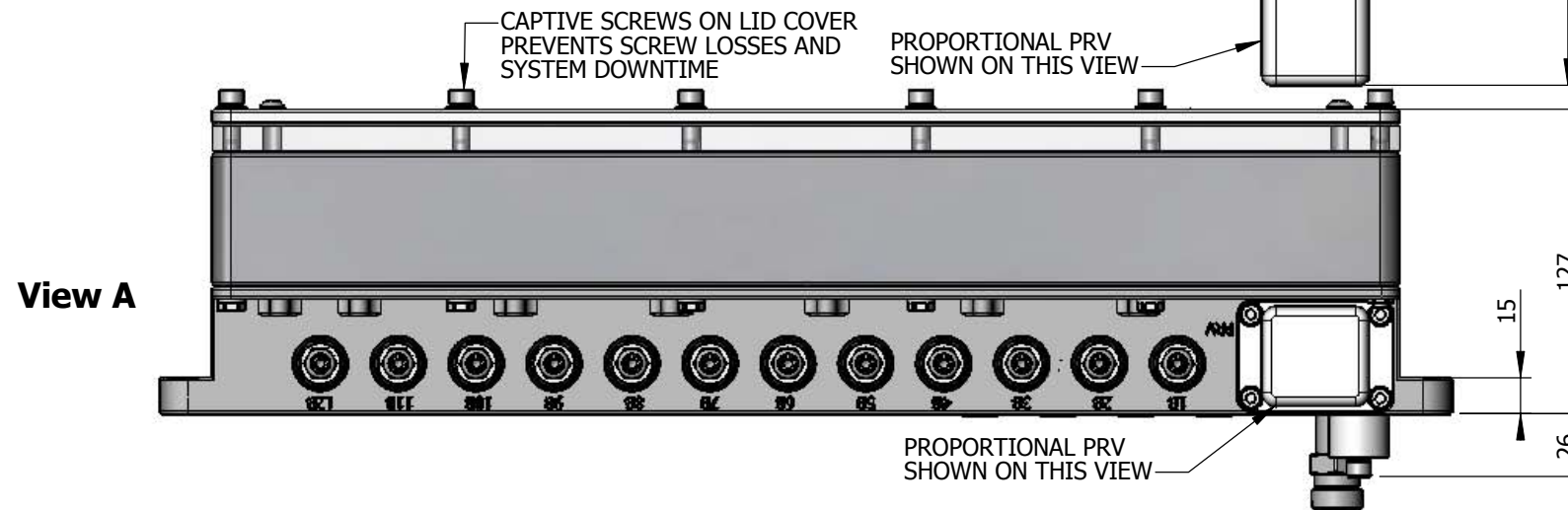
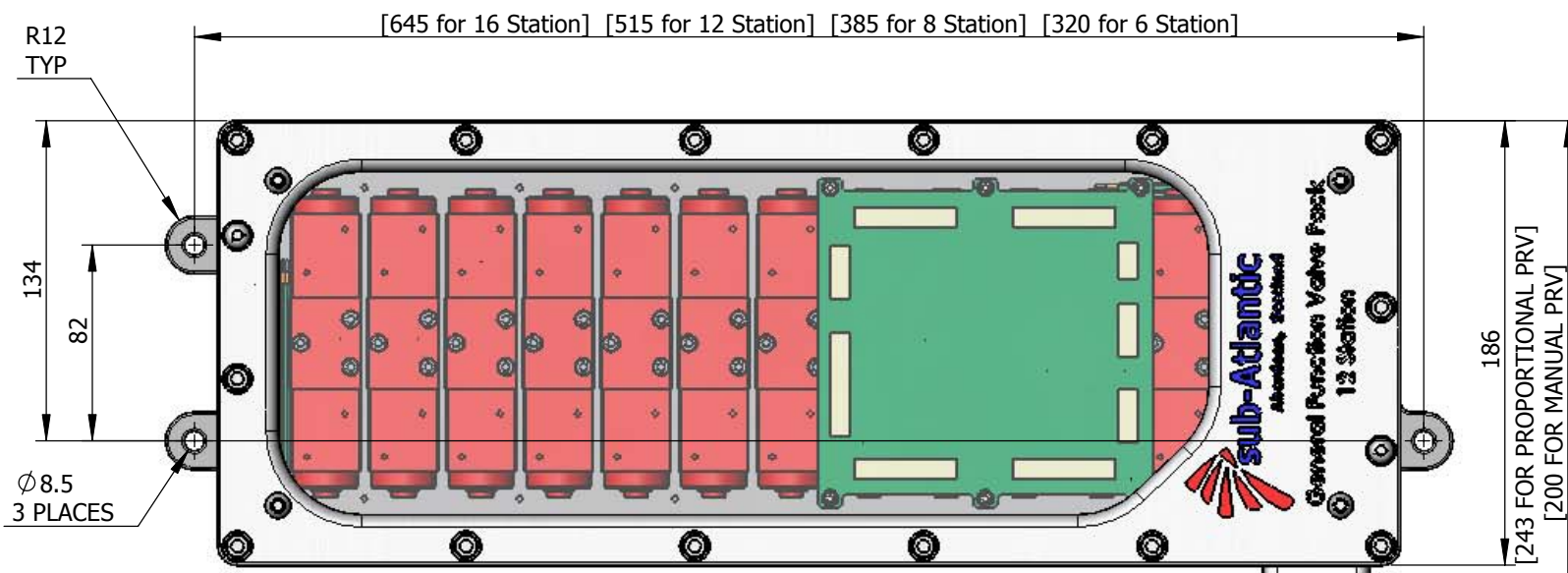
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## 9. DRAWINGS & ATTACHMENTS

The following generic drawings are attached and should be used for installation and maintenance. Customer specific drawings relating to the order specification are also located in Appendix 2

Drawing No.	Title
4089-GA	General Function Valve Pack – Typical Options General Arrangement Drawing
3287-MAS	General Function Valve Pack Base Build – 6, 8, 12 & 16 Station Main Assembly Drawing
1234-MAS	Flow/Check Housing Main Assembly Drawing
1235-MAS	Cross Relief Cartridge Main Assembly Drawing
3270-MAS	GFVP Lid Assembly – 6, 8, 12 & 16 Station Main Assembly Drawing
3271-MAS	GFVP PRV Kits (Manual Operation) Main Assembly Drawing
3272-MAS	GFVP PRV Kits (Proportional Operation) Main Assembly Drawing
3301-MAS	GFVP Connector Kit - Seanet Main Assembly Drawing
3303-MAS	GFVP Connector Kit – SA Shell A Main Assembly Drawing
2648-MAS	GFVP Connector Kit – Seacon MINM37FCR Main Assembly Drawing
3387-MAS	GFVP Connector Kit – 3/8" Hose Barb Main Assembly Drawing
1239-HYS	General Function Valve Packs Hydraulic Schematic Drawing
1238-WIS	GFVP Serial Control System 2 (RS232/RS485/CAN) Electrical Schematic (Standard Supply)
Refer to Appendix 1	Valve Data Sheets
<b>Refer to Appendix 2</b>	<b>General Function Valve Pack – Customer Specific Option Main Assembly Drawing</b>



**VALVE PACKS ARE AVIALBE IN 6, 8 12 & 16 STATION VERSIONS, EACH WITH OPTIONS FOR SOLENOID/PROPORTIONAL VALVES, PRESSURE SENSORS, ELECTRICAL CONNECTOR AND CONTROL SYSTEM.**

**REFER TO SHEET 2 FOR OPTIONS**

	6 STATION	8 STATION	12 STATION	16 STATION
WEIGHT IN AIR FULL OF OIL (kg)	14.0	17.1	23.5	30.0
WEIGHT IN AIR FULL OF OIL (lbs)	30.9	37.7	51.8	66.1
WEIGHT IN SEA WATER (kg)	8.1	10.0	13.8	17.8
WEIGHT IN SEA WATER (lbs)	17.9	22.0	30.4	39.2
DISPLACEMENT (litres)	5.9	7.1	9.7	12.2
DISPLACEMENT (US pints)	12.4	15.1	20.5	25.9
COMPENSATION OIL VOLUME (litres)	1.5	1.8	2.5	3.1
COMPENSATION OIL VOLUME (US pints)	3.2	3.8	5.3	6.6

REV	BY	DATE	DESCRIPTION	APP
1A	LZA	04/03/08	SHEET 2 UPDATED TO SHOW NEW PRESSURE TRANSDUCERS	
1	LZA	25/05/07	ISSUED FOR INFORMATION	

RECORD OF REVISIONS

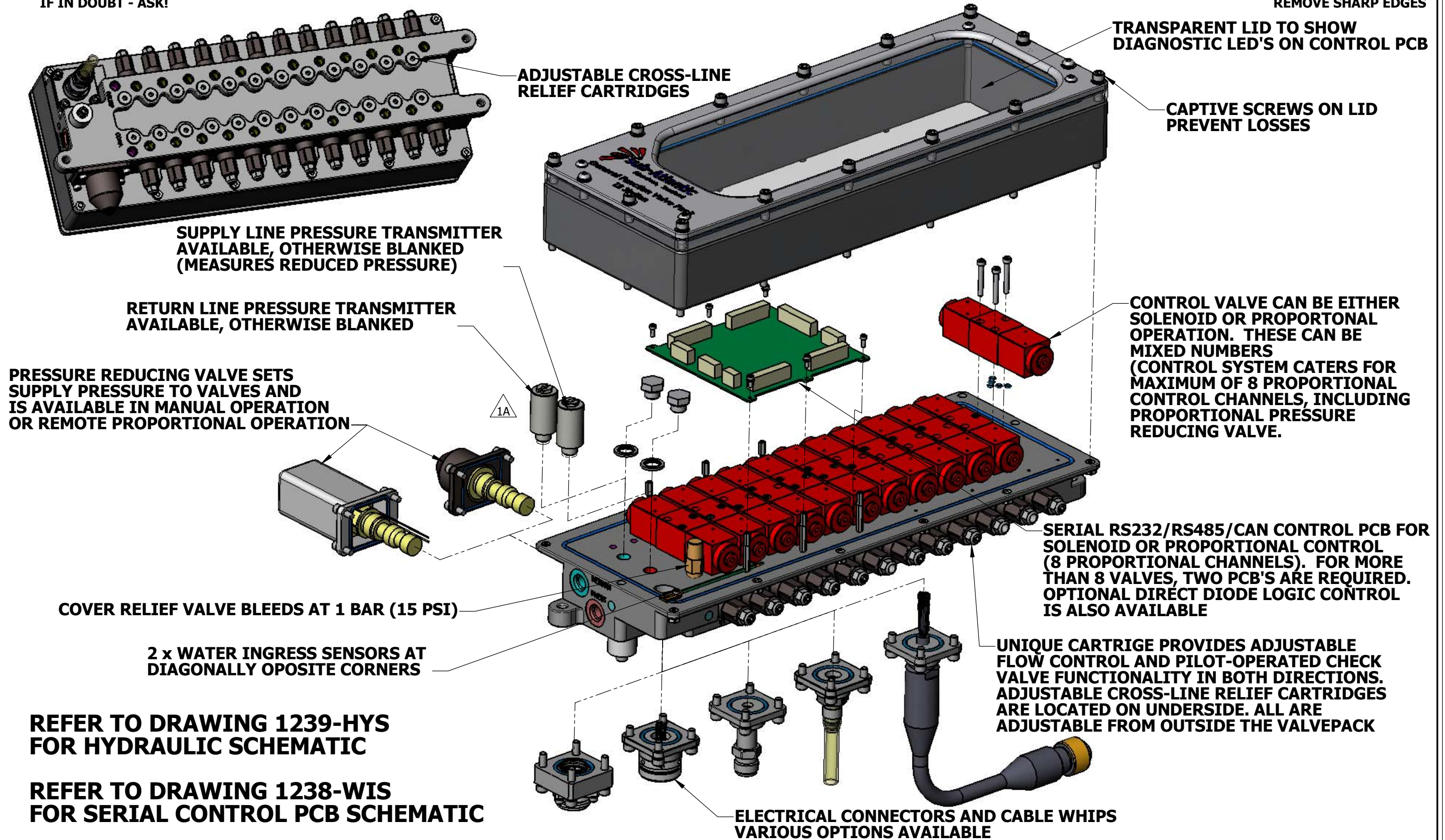
MATERIAL	HARD ANODISED ALUMINIUM ALLOY & STAINLESS STEEL	WT AIR	-	WT WATER	-
FINISH		DRAWN	LZA		
USO, TOLERANCES TO BE		DATE	25/05/07		
		CHECK	ABO		
		APPRV.	GDU		
		ENGR.	LZA		

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SCALE (USO) ORIG. SIZE  
A2

PROJECT	VALVE PACKS	
TITLE	GENERAL FUNCTION VALVE PACK TYPICAL OPTIONS GENERAL ARRANGEMENT DRAWING Sheet 1 of 2	
DOC. No.	4089-GA	REV 1A


**IF IN DOUBT - ASK!**

**REMOVE SHARP EDGES**

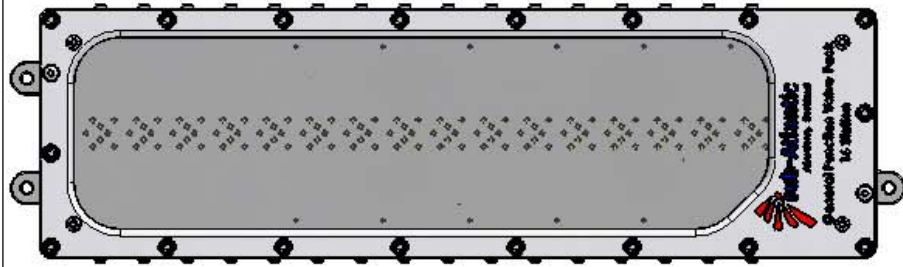


**12 STATION GENERAL FUNCTION VALVE PACK SHOWN WITH VARIOUS CONFIGURATION OPTIONS AVAILABLE. OPTIONS ARE SIMILAR FOR 6, 8, 12 AND 16 STATION VERSIONS**

**DEDICATED PART NUMBERS ARE ALLOCATED TO SPECIFIC CUSTOMER SPECIFIED CONFIGURATIONS, EACH WITH UNIQUE BILL OF MATERIALS. REFER TO UNIQUE DRAWING NUMBERS**

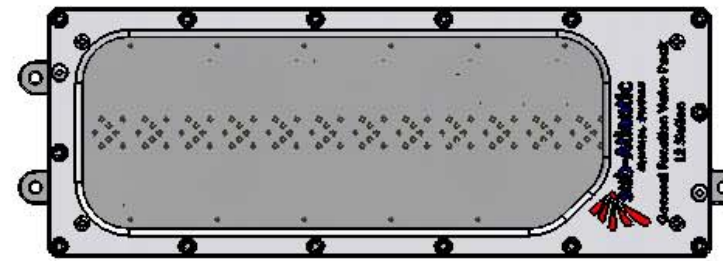
 Woodburn Road, Blackburn Business Park, Blackburn, Aberdeen. U.K. AB21 0PS Tel: +44 (0) 1224 798660 Fax: +44 (0) 1224 798661 SCALE (USO) - ORIG. SIZE A2	PROJECT	VALVE PACKS
	TITLE	GENERAL FUNCTION VALVE PACK TYPICAL OPTIONS GENERAL ARRANGEMENT DRAWING Sheet 2 of 2
DOC. No.	4089-GA	REV 1A

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Housing - 16 Station Intermediate Assembly	1233-IAS-16	
2	32	Flow-Check Housing Sub-Assembly	1234-MASZ	
3	16	9 mm Poppet	1199-DET	
4	16	O-RING 1.78 x 6.07 (BS-010)	SOR-178-0060-N70	Nitrile 70
5	32	Cross Relief Cartridge Sub-Assembly	1235-MASZ	
6	1	Plug 9~16 SAE Hex Head	HYD-0161	
7	1	GFVP Cover O-Ring - 16 Station (3.0 x 467)	SOR-300-4670-N70	Nitrile 70
8	1	O-RING 1.98 x 11.89(SAE 906)	SOR-198-0119-N70	Nitrile 70
9	1	Anode 25 x 6.3 x 18 lg	1763-DET	
10	1	Plain Washer M6	F-PW-M6-SS	Stainless Steel
11	1	Socket Head Cap Screw M6 x 30 long	F-SHCS-M6-30-A270	Stainless Gr A2-70
12	1	Spring Washer M6	F-SW-M6-SS	Stainless Steel
13	1	GFVP Lid Assembly 16 Station	3270-MAS-16	
14	6	M3 x 25 Spacer	F-HSS-M3-25-A270	Stainless Gr A2-70
15	6	M3 x 12 Spacer	F-HSS-M3-12-A270	Stainless Gr A2-70
16	2	Water Sensor	3286-DET	
17	8	Plain Washer M3	F-PW-M3-SS	Stainless Steel
18	8	Spring Washer M3	F-SW-M3-SS	Stainless Steel
19	8	Socket Head Cap Screw M3 x 8 long	F-SHCS-M3-8-A270	Stainless Gr A2-70



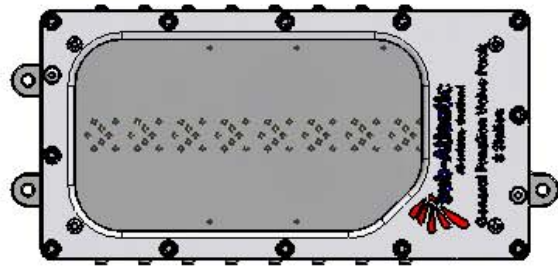
**16 STATION  
GENERAL FUNCTION  
VALVE PACK  
P/N 3287-MAS-16**

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Housing - 12 Station Intermediate Assembly	1233-IAS-12	
2	24	Flow-Check Housing Sub-Assembly	1234-MASZ	
3	12	9 mm Poppet	1199-DET	
4	12	O-RING 1.78 x 6.07 (BS-010)	SOR-178-0060-N70	Nitrile 70
5	24	Cross Relief Cartridge Sub-Assembly	1235-MASZ	
6	1	Plug 9~16 SAE Hex Head	HYD-0161	
7	1	GFVP Cover O-Ring - 12 Station (3.0 x 384)	SOR-300-3840-N70	Nitrile 70
8	1	O-RING 1.98 x 11.89(SAE 906)	SOR-198-0119-N70	Nitrile 70
9	1	Anode 25 x 6.3 x 18 lg	1763-DET	
10	1	Plain Washer M6	F-PW-M6-SS	Stainless Steel
11	1	Socket Head Cap Screw M6 x 30 long	F-SHCS-M6-30-A270	Stainless Gr A2-70
12	1	Spring Washer M6	F-SW-M6-SS	Stainless Steel
13	1	GFVP Lid Assembly 12 Station	3270-MAS-12	
14	6	M3 x 25 Spacer	F-HSS-M3-25-A270	Stainless Gr A2-70
15	6	M3 x 12 Spacer	F-HSS-M3-12-A270	Stainless Gr A2-70
16	2	Water Sensor	3286-DET	
17	8	Plain Washer M3	F-PW-M3-SS	Stainless Steel
18	8	Spring Washer M3	F-SW-M3-SS	Stainless Steel
19	8	Socket Head Cap Screw M3 x 8 long	F-SHCS-M3-8-A270	Stainless Gr A2-70



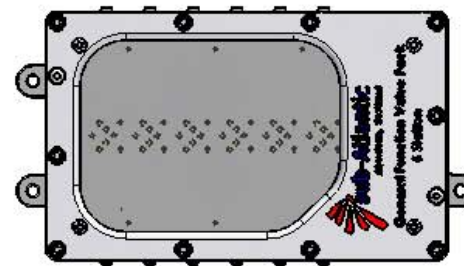
**12 STATION  
GENERAL FUNCTION  
VALVE PACK  
P/N 3287-MAS-12Z**

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Housing - 8 Station Intermediate Assembly	1233-IAS-8	
2	16	Flow-Check Housing Sub-Assembly	1234-MASZ	
3	8	9 mm Poppet	1199-DET	
4	8	O-RING 1.78 x 6.07 (BS-010)	SOR-178-0060-N70	Nitrile 70
5	16	Cross Relief Cartridge Sub-Assembly	1235-MASZ	
6	1	Plug 9~16 SAE Hex Head	HYD-0161	
7	1	GFVP Cover O-Ring - 8 Station (3.0 x 301)	SOR-300-3010-N70	Nitrile 70
8	1	O-RING 1.98 x 11.89(SAE 906)	SOR-198-0119-N70	Nitrile 70
9	1	Anode 25 x 6.3 x 18 lg	1763-DET	
10	1	Plain Washer M6	F-PW-M6-SS	Stainless Steel
11	1	Socket Head Cap Screw M6 x 30 long	F-SHCS-M6-30-A270	Stainless Gr A2-70
12	1	Spring Washer M6	F-SW-M6-SS	Stainless Steel
13	1	GFVP Lid Assembly 8 Station	3270-MAS-8	
14	6	M3 x 25 Spacer	F-HSS-M3-25-A270	Stainless Gr A2-70
15	6	M3 x 12 Spacer	F-HSS-M3-12-A270	Stainless Gr A2-70
16	2	Water Sensor	3286-DET	
17	7	Plain Washer M3	F-PW-M3-SS	Stainless Steel
18	8	Spring Washer M3	F-SW-M3-SS	Stainless Steel
19	8	Socket Head Cap Screw M3 x 8 long	F-SHCS-M3-8-A270	Stainless Gr A2-70



**8 STATION  
GENERAL FUNCTION  
VALVE PACK  
P/N 3287-MAS-08**

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Housing - 6 Station Intermediate Assembly	1233-IAS-6	
2	12	Flow-Check Housing Sub-Assembly	1234-MASZ	
3	6	9 mm Poppet	1199-DET	
4	6	O-RING 1.78 x 6.07 (BS-010)	SOR-178-0060-N70	Nitrile 70
5	12	Cross Relief Cartridge Sub-Assembly	1235-MASZ	
6	1	Plug 9~16 SAE Hex Head	HYD-0161	
7	1	GFVP Cover O-Ring - 6 Station (3.0 x 260)	SOR-300-2600-N70	Nitrile 70
8	1	O-RING 1.98 x 11.89(SAE 906)	SOR-198-0119-N70	Nitrile 70
9	1	Anode 25 x 6.3 x 18 lg	1763-DET	
10	1	Plain Washer M6	F-PW-M6-SS	Stainless Steel
11	1	Socket Head Cap Screw M6 x 30 long	F-SHCS-M6-30-A270	Stainless Gr A2-70
12	1	Spring Washer M6	F-SW-M6-SS	Stainless Steel
13	1	GFVP Lid Assembly 6 Station	3270-MAS-6	
14	6	M3 x 25 Spacer	F-HSS-M3-25-A270	Stainless Gr A2-70
15	6	M3 x 12 Spacer	F-HSS-M3-12-A270	Stainless Gr A2-70
16	2	Water Sensor	3286-DET	
17	8	Plain Washer M3	F-PW-M3-SS	Stainless Steel
18	8	Spring Washer M3	F-SW-M3-SS	Stainless Steel
19	8	Socket Head Cap Screw M3 x 8 long	F-SHCS-M3-8-A270	Stainless Gr A2-70



**6 STATION  
GENERAL FUNCTION  
VALVE PACK  
P/N 3287-MAS-06**

THIS DRAWING SHOWS BUILD DETAILS FOR 6, 8, 12 & 16 STATION GENERAL FUNCTION VALVE PACK BASE BUILDS. REFER TO SHEET 2 FOR PRODUCT EXPLOSION (12 STATION SHOWN, SIMILAR OTHER TYPES) REFER TO THE RELEVANT BILL OF MATERIALS

REV	BY	DATE	DESCRIPTION	APP
3C	DMA	17/06/2008	TYPING ERROR CORRECTED. PART REF ITEMS 2 & 5 UPDATED	
3B	DMA	03/06/2008	INACCURATE NOTE REMOVED	GDU
3A	LZA	04/01/2008	LID RETAINING SCREWS MADE VISIBLE	GDU
3	LZA	12/04/2007	REPLACED LID	
2	DAN	20/12/06	PRESSURE RELIEF VALVE REMOVED (NOW ON HIGHER ASSEMBLY)	
1	CMI	26/10/05	APPROVED FOR MANUFACTURE	CMI

RECORD OF REVISIONS

MATERIAL	WT AIR	WT WATER
-	- kg (E)	- kg (E)
FINISH	DRAWN	DATE
-	CMI	26/10/05
USO, TOLERANCES TO BE	CHECK	APPRV.
-	EBR	CMI
-	ENGR.	CMI

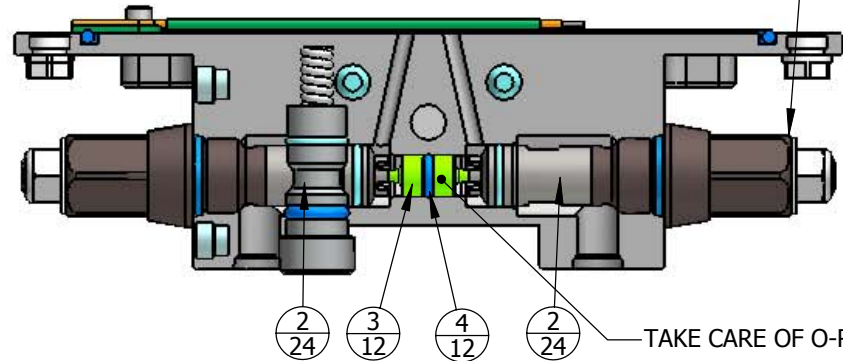
**sub-Atlantic**  
Woodburn Road,  
Blackburn Business Park, Blackburn,  
Aberdeen. U.K. AB21 0PS  
Tel: +44 (0) 1224 798660  
Fax: +44 (0) 1224 798661  
SCALE (USO) ORIG. SIZE  
A2

PROJECT	TITLE	DOC. No.	REV
VALVE PACKS	GFVP BASE BUILD - 6, 8, 12 & 16 STATION VERSIONS MAIN ASSEMBLY DRAWING Sheet 1 of 2	3287-MAS	3C

**IF IN DOUBT - ASK!**

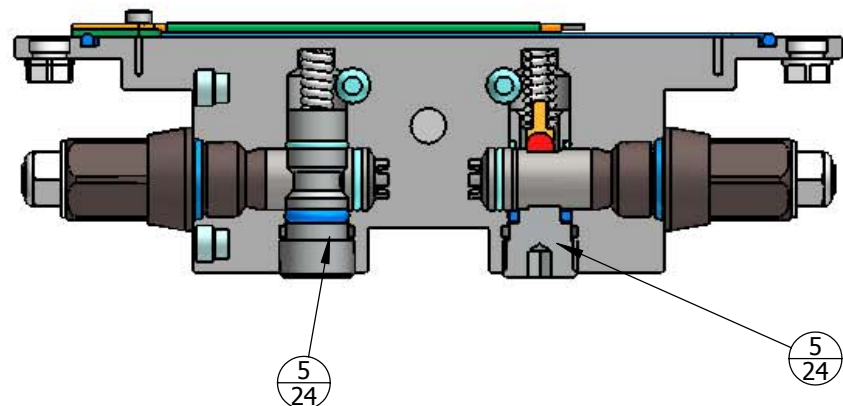
**NOTE:**  
1. THIS STRUCTURE RELATES TO A STANDARD STOCK BUILD WITH NO CUSTOMER OPTIONS FITTED.  
REFER TO HIGHER LEVEL ASSEMBLIES FOR CUSTOMER SPECIFIC BUILDS.

BEFORE INSTALLING, CHECK BOTH O-RINGS ARE PRESENT (SEE 1234-MAS FOR DETAILS)



TAKE CARE OF O-RING WHEN INSTALLING

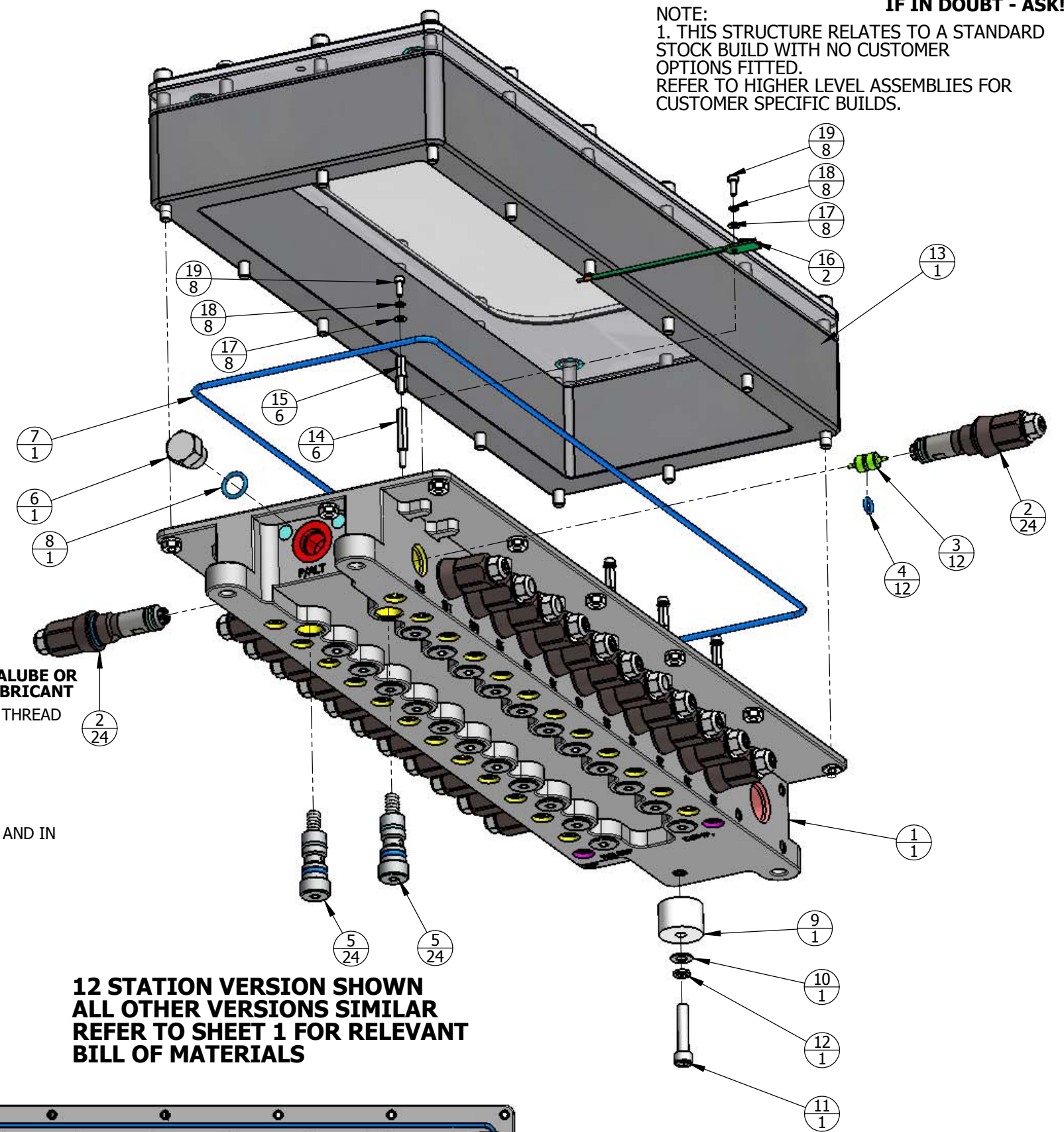
**SECTION THRO' FLOW CONTROL PORT**



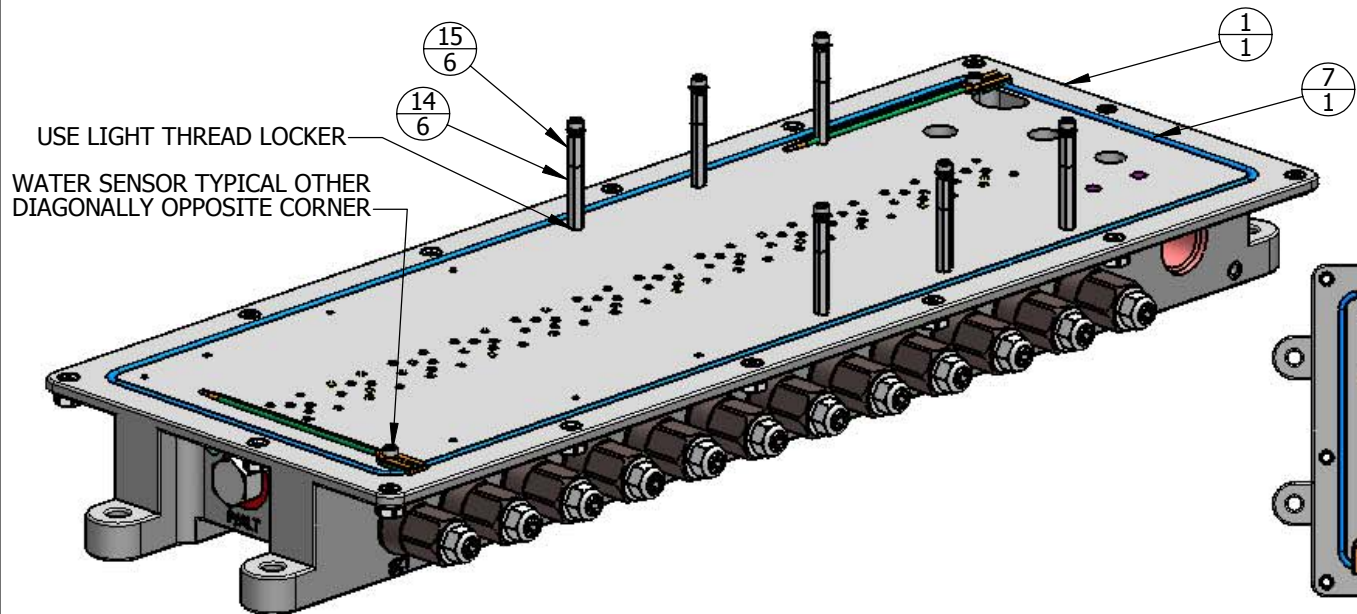
**SECTION THRO' CROSS LINE RELIEF PORT**

TAKE CARE ALL PARTS ARE PRESENT AND IN CORRECT ORDER WHEN INSTALLING (SEE 1235-MAS FOR DETAILS)

**DO NOT USE AQUALUBE OR SIMILAR TYPE LUBRICANT**  
USE LIGHT OIL ON THREAD FOR LUBRICATION



**12 STATION VERSION SHOWN**  
**ALL OTHER VERSIONS SIMILAR**  
**REFER TO SHEET 1 FOR RELEVANT BILL OF MATERIALS**



USE LIGHT THREAD LOCKER  
WATER SENSOR TYPICAL OTHER DIAGONALLY OPPOSITE CORNER

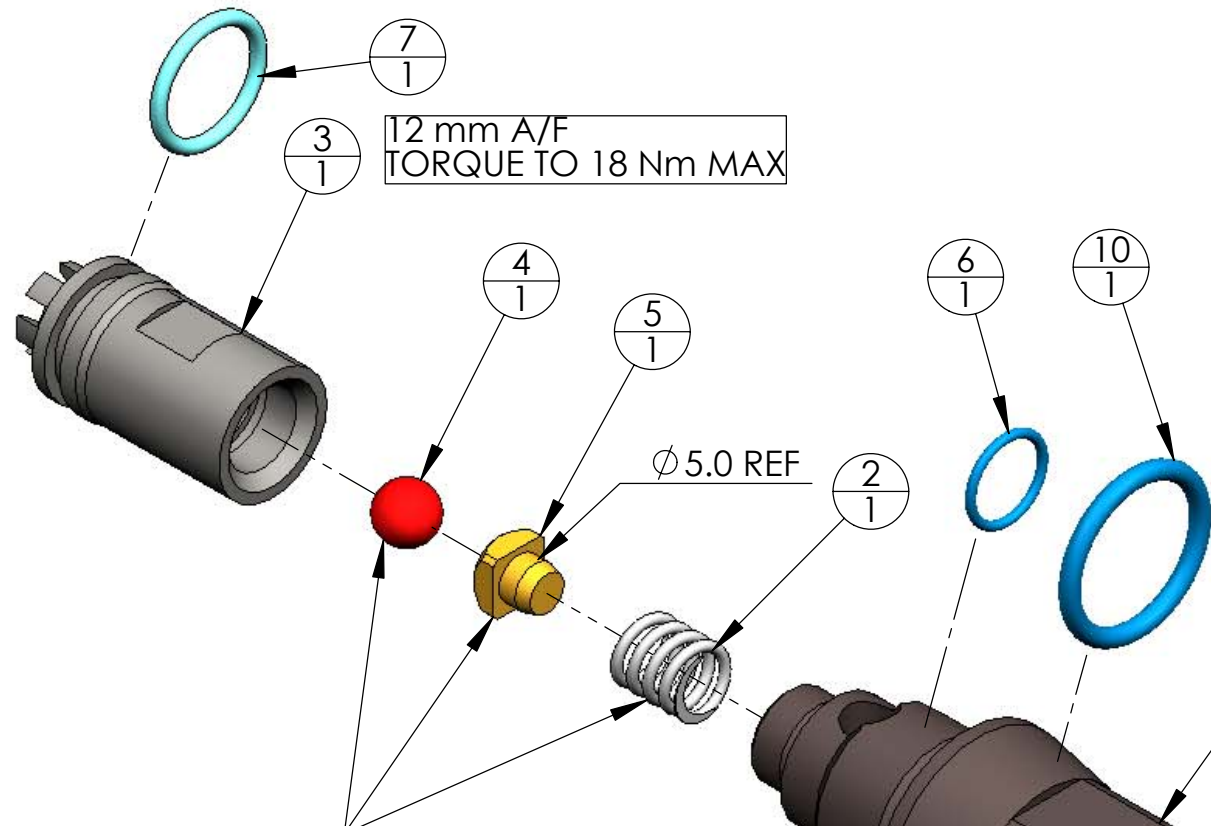
**sub-Atlantic**  
Woodburn Road,  
Blackburn Business Park, Blackburn,  
Aberdeen. U.K. AB21 0PS  
Tel: +44 (0) 1224 798660  
Fax: +44 (0) 1224 798661  
SCALE (USO) - ORIG. SIZE A2

PROJECT	VALVE PACKS	
TITLE	GFVP BASE BUILD - 6, 8, 12 & 16 STATION VERSIONS MAIN ASSEMBLY DRAWING Sheet 2 of 2	
DOC. No.	3287-MAS	REV 3C



**IF IN DOUBT - ASK!**

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Flow Housing	1193-DET	
2	1	Check Spring	MIS-0046	
3	1	Check Housing	1191-DET	
4	1	Ball - Chrome 1~4 in	MIS-0041	
5	1	P.O. Check Ball Carrier	1192-DET	
6	1	O-RING 1.00 x 8.00	SOR-100-0080-N70	Nitrile 70
7	1	O-RING 1.5 x 11.0	SOR-150-0110-N70	Nitrile 70
8	1	O-Ring 2.62 x 7.59 (BS-109)	SOR-262-0076-N90	Nitrile 90
9	1	Spiral Retaining Ring - Int Dia 13mm	F-SRR-INT-13-SS	Stainless Steel
10	1	O-RING 2.00 x 15.00	SOR-200-0150-N70	Nitrile 70
11	1	Housing Flow Check Int Assy	1282-IAS	
12	1	Nylok Hex Nut M8	F-NL-M8-A270	Stainless Gr A2-70
13	1	Plain Washer M8	F-PW-M8-SS	Stainless Steel



**NOTE TO END USER:**  
 THESE 3 ITEMS TO BE REMOVED IF THE PILOT OPERATED CHECK VALVE IS NOT REQUIRED ON A PARTICULAR FUNCTION. THE PARTS SHOULD BE STORED FOR FUTURE USE. ALSO NOTE THAT ITEM (5) IS SLIGHTLY DIFFERENT FROM ITEM (4) ON DRG. No. 1235-MAS AND ARE NOT INTERCHANGEABLE. NOTE DIAMETER.

**NOTE: IF REMOVED, ITEMS 3, 6 & 7 MUST BE REPLACED.**

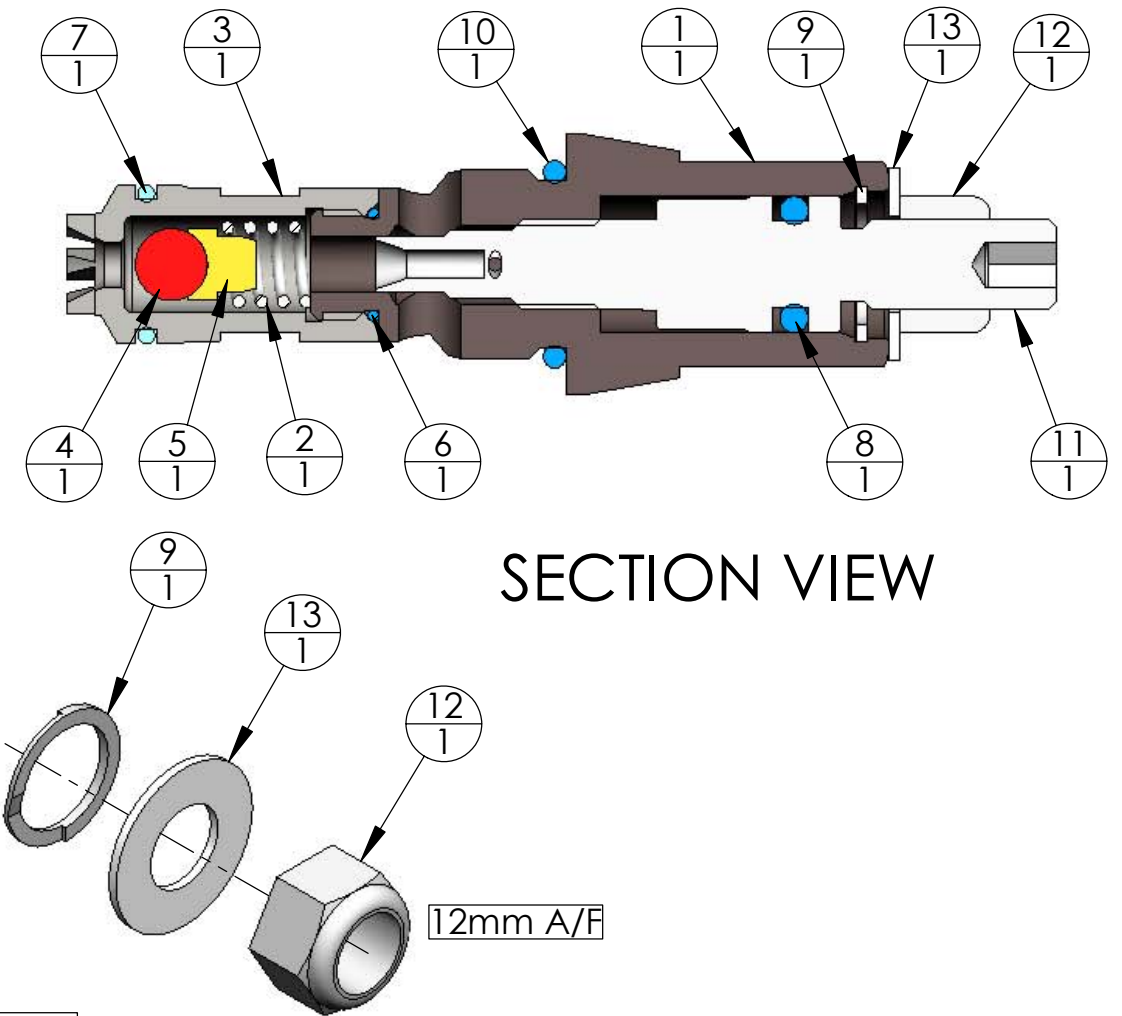
SCREW FLOW CONTROLLER FULLY IN TO SHUT FLOW AND FULLY OUT TO OPEN FLOW LOCK WITH NYLOC WHEN IN REQUIRED OPERATING POSITION

3  
3

18 mm A/F

4 mm INTERNAL A/F

SECTION VIEW



REV	BY	DATE	DESCRIPTION	APP
3	EBR	30/01/04	FLOW CONTROLLER RESIGNED FOR LOCKING. ECN-231-04	
2	CMI	20/11/02	O-RING, ITEM 8, NOW NITRILE 90	CMI
1	EBR	9/08/01	ISSUED FOR CONSTRUCTION	CMI

RECORD OF REVISIONS

MATERIAL	SEE BILL OF MATERIALS
FINISH	-
USO, TOLERANCES TO BE	-

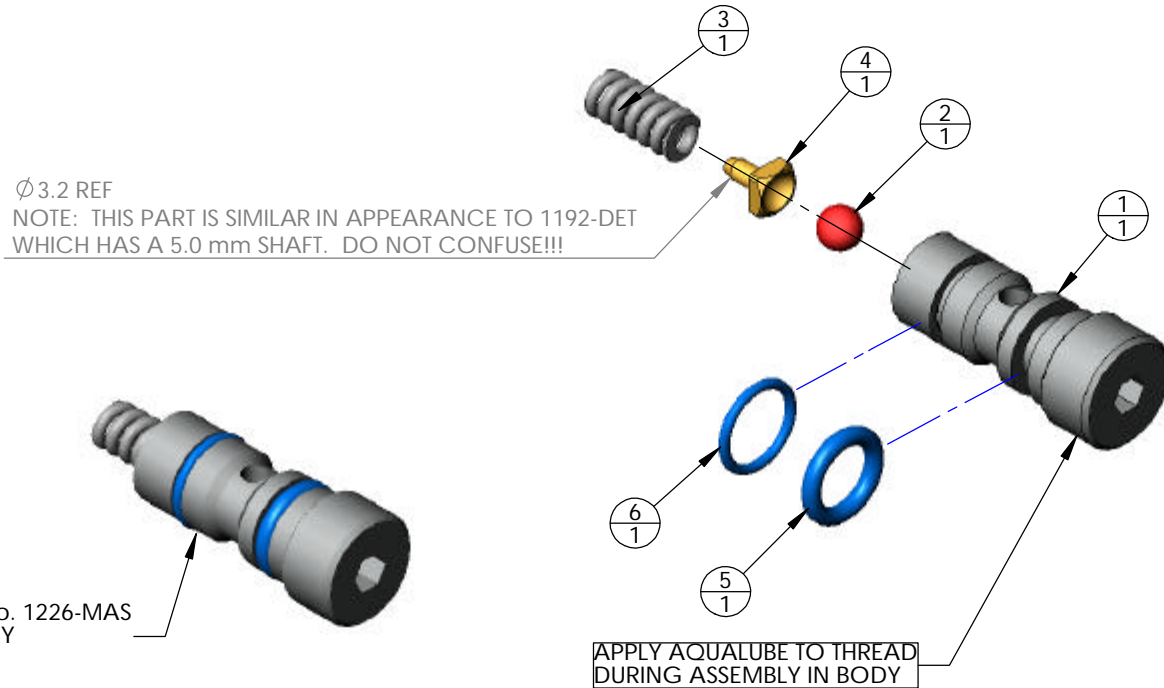
WT AIR	WT WATER
-	-
kg (E)	kg (E)
DRAWN	EBR
DATE	9/08/01
CHECK	CMI
APPRV.	CMI
ENGR.	CMI


**sub-Atlantic**  
 Unit 12, Airways Industrial Estate  
 Pitmedden Road, Dyce,  
 Aberdeen. U.K. AB21 0DT  
 Tel: ++44 (0) 1224 723623  
 Fax: ++44 (0) 1224 723822  
 SCALE (USO) 1.5 : 1  
 ORIG. SIZE A3

PROJECT	VALVE PACKS
TITLE	HOUSING - FLOW CHECK MAIN ASSEMBLY DRAWING Sheet 1 of 1
DOC. No.	1234-MAS
REV	3

**IF IN DOUBT - ASK!**

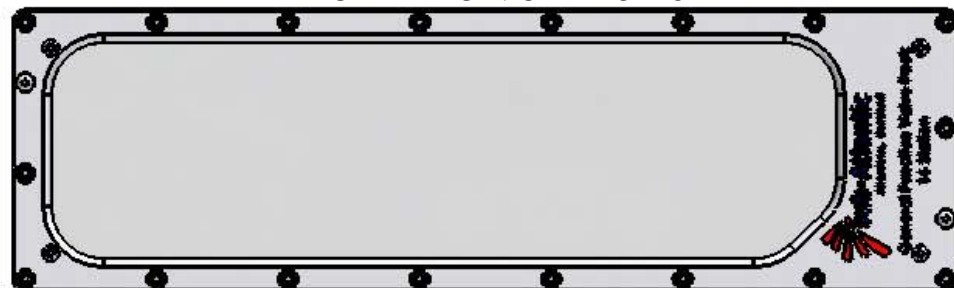
Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Cross Line Relief Check Housing	1197-DET	
2	1	0.25 inch Ball	MIS-0041	
3	1	Cross Relief Spring	MIS-0042	
4	1	Cross Relief Ball Carrier	1198-DET	
5	1	O-RING 2.62 x 9.19 (BS-110)	SOR-262-0092-N70	Nitrile 70
6	1	O-RING 1.5 x 11.0	SOR-150-0110-N70	Nitrile 70



				MATERIAL	WT AIR	WT WATER	 Unit 12, Airways Industrial Estate Pitmedden Road, Dyce, Aberdeen. U.K. AB21 0DT Tel: ++44 (0) 1224 723623 Fax: ++44 (0) 1224 723822 SCALE (USO) ORIG. SIZE	PROJECT	VALVE PACKS		
				SEE BILL OF MATERIALS	-	kg (E) -		kg (E)	TITLE	CROSS RELIEF CARTRIDGE MAIN ASSEMBLY DRAWING Sheet 1 of 1	
				FINISH	DRAWN	EBR		DATE	9/08/01		
				USO, TOLERANCES TO BE	CHECK	CMI		APPRV.	CMI		
1	EBR	10/08/01	ISSUED FOR CONSTRUCTION	CMI	ENGR.	CMI	RECORD OF REVISIONS	DOC. No.	1235-MAS	REV	1

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Spacer 16 Station	4030-DET	
2	1	GFVP Cover Frame 16 Station	4026-DET	
3	1	GFVP Transparent Cover 16 Station	4034-DET	
4	18	Captive Screw M6 x 85 long	4037-DET	
5	4	Bleed Screw 6MM	0267-DET	
6	20	Spring Washer M6	F-SW-M6-SS	Stainless Steel
7	20	Plain Washer M6	F-PW-M6-SS	Stainless Steel
8	4	O-RING 1.78 x 4.76 (BS 802)	SOR-178-0048-N70	
9	4	O-RING 2 x 12	SOR-200-0120-N70	Nitrile 70
10	1	GFVP Cover O-Ring - 16 Station (3.0 x 467)	SOR-300-4670-N70	Nitrile 70
11	2	Button Head Cap Screw M6 x 50 long	F-BHCS-M6-50-A270	Stainless Gr A2-70

**16 STATION GFVP LID ASSEMBLY  
PART NUMBER 3270-MAS-16**



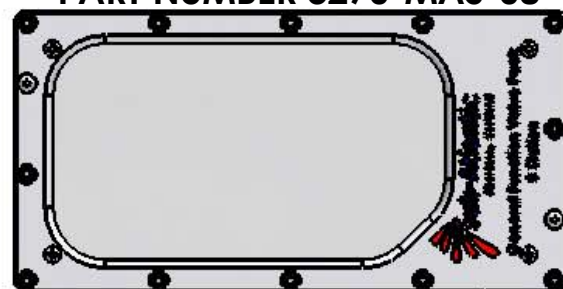
Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Spacer 12 Station	4029-DET	
2	1	GFVP Cover Frame 12 Station	4025-DET	
3	1	GFVP Transparent Cover 12 Station	4033-DET	
4	14	Captive Screw M6 x 85 long	4037-DET	
5	4	Bleed Screw 6MM	0267-DET	
6	16	Spring Washer M6	F-SW-M6-SS	Stainless Steel
7	16	Plain Washer M6	F-PW-M6-SS	Stainless Steel
8	4	O-RING 1.78 x 4.76 (BS 802)	SOR-178-0048-N70	
9	4	O-RING 2 x 12	SOR-200-0120-N70	Nitrile 70
10	1	GFVP Cover O-Ring - 12 Station (3.0 x 384)	SOR-300-3840-N70	Nitrile 70
11	2	Button Head Cap Screw M6 x 50 long	F-BHCS-M6-50-A270	Stainless Gr A2-70

**12 STATION GFVP LID ASSEMBLY  
PART NUMBER 3270-MAS-12**



Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Spacer 8 Station	4032-DET	
2	1	GFVP Cover Frame 8 Station	4027-DET	
3	1	GFVP Transparent cover 8 Station	4036-DET	
4	12	Captive Screw M6 x 85 long	4037-DET	
5	4	Bleed Screw 6MM	0267-DET	
6	14	Spring Washer M6	F-SW-M6-SS	Stainless Steel
7	14	Plain Washer M6	F-PW-M6-SS	Stainless Steel
8	4	O-RING 1.78 x 4.76 (BS 802)	SOR-178-0048-N70	
9	4	O-RING 2 x 12	SOR-200-0120-N70	Nitrile 70
10	1	GFVP Cover O-Ring - 8 Station (3.0 x 301)	SOR-300-3010-N70	Nitrile 70
11	2	Button Head Cap Screw M6 x 50 long	F-BHCS-M6-50-A270	Stainless Gr A2-70

**8 STATION GFVP LID ASSEMBLY  
PART NUMBER 3270-MAS-08**



Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Spacer 6 Station	4031-DET	
2	1	GFVP Cover Frame 6 Station	4028-DET	
3	1	GFVP Transparent Cover 6 Station	4035-DET	
4	10	Captive Screw M6 x 85 long	4037-DET	
5	4	Bleed Screw 6MM	0267-DET	
6	12	Spring Washer M6	F-SW-M6-SS	Stainless Steel
7	12	Plain Washer M6	F-PW-M6-SS	Stainless Steel
8	4	O-RING 1.78 x 4.76 (BS 802)	SOR-178-0048-N70	
9	4	O-RING 2 x 12	SOR-200-0120-N70	Nitrile 70
10	1	GFVP Cover O-Ring - 6 Station (3.0 x 260)	SOR-300-2600-N70	Nitrile 70
11	2	Button Head Cap Screw M6 x 50 long	F-BHCS-M6-50-A270	Stainless Gr A2-70

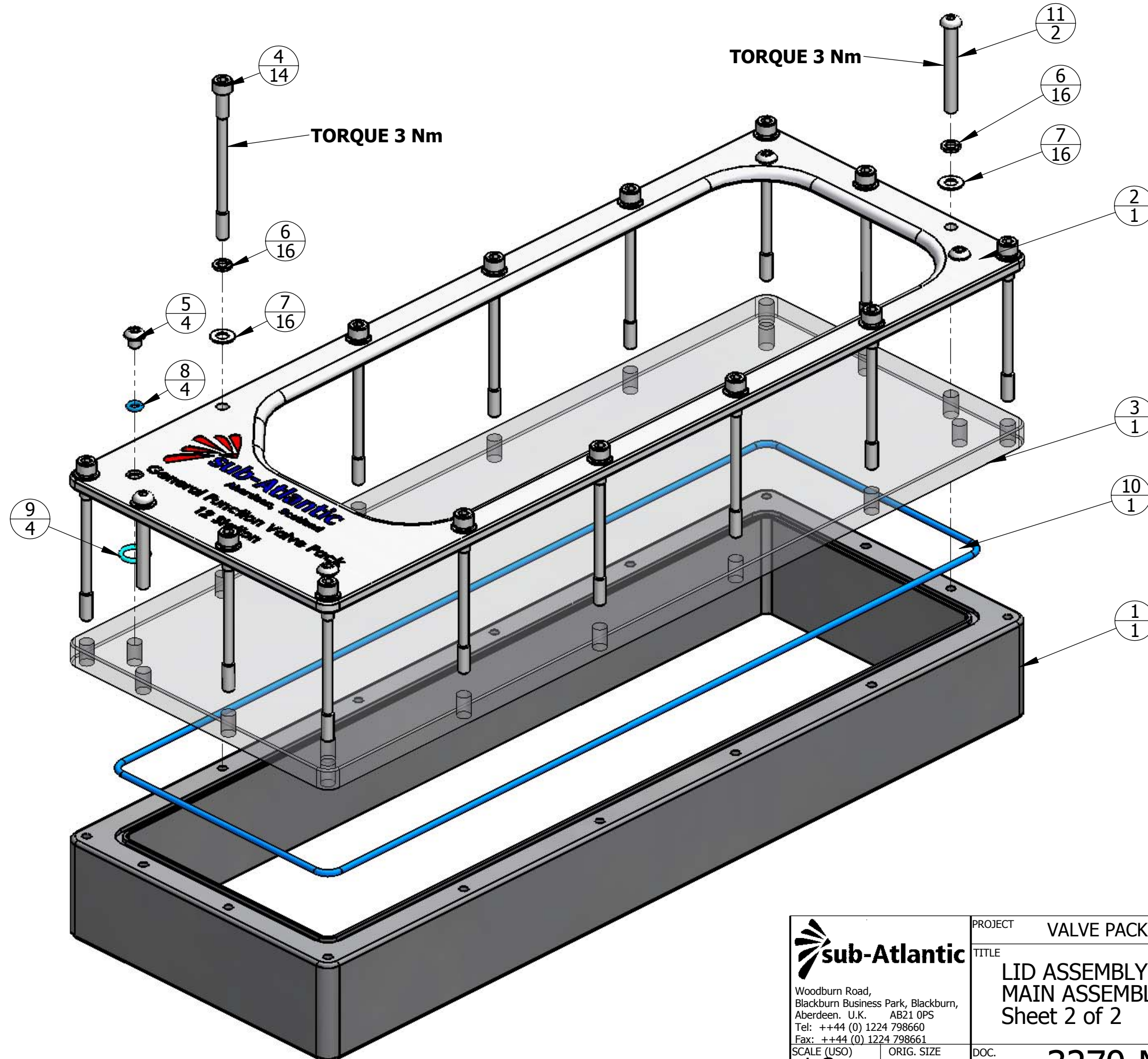
**6 STATION GFVP LID ASSEMBLY  
PART NUMBER 3270-MAS-06**



**THIS DRAWING SHOWS LID ASSEMBLY DETAILS FOR 6, 8, 12 & 16 STATION GENERAL FUNCTION VALVE PACKS  
REFER TO SHEET 2 FOR PRODUCT EXPLOSION (12 STATION SHOWN, SIMILAR OTHER TYPES)  
REFER TO RELEVANT BILL OF MATERIALS ABOVE**

RECORD OF REVISIONS				MATERIAL -	WT AIR	WT WATER	<p>Woodburn Road, Blackburn Business Park, Blackburn, Aberdeen. U.K. AB21 0PS Tel: ++44 (0) 1224 798660 Fax: ++44 (0) 1224 798661</p>	PROJECT	VALVE PACKS			
3	LZA	10/07/2007	ADDED TWO SCREWS TO KEEP THE LID PARTS TOGETHER AND TORQUE	FINISH	-	kg (E) -		kg (E)	TITLE	LID ASSEMBLY ALL VERSIONS MAIN ASSEMBLY DRAWING Sheet 1 of 2		
2	LZA	12/04/2007	MODIFIED LID	USO, TOLERANCES TO BE	DRAWN	CMI		DATE	19/10/05	SCALE (USO)	ORIG. SIZE	
1	CMI	19/10/05	APPROVED FOR MANUFACTURE	-	CHECK	EBR		APPRV.	CMI	-	A3	
REV	BY	DATE	DESCRIPTION	APP	ENGR.	CMI		-	-	DOC. No.	3270-MAS	REV

**IF IN DOUBT - ASK!**



**sub-Atlantic**  
 Woodburn Road,  
 Blackburn Business Park, Blackburn,  
 Aberdeen. U.K. AB21 0PS  
 Tel: ++44 (0) 1224 798660  
 Fax: ++44 (0) 1224 798661

PROJECT	VALVE PACKS		
TITLE	LID ASSEMBLY ALL VERSIONS MAIN ASSEMBLY DRAWING Sheet 2 of 2		
SCALE (USO)	ORIG. SIZE	DOC. No.	REV
1:2	A3	3270-MAS	3

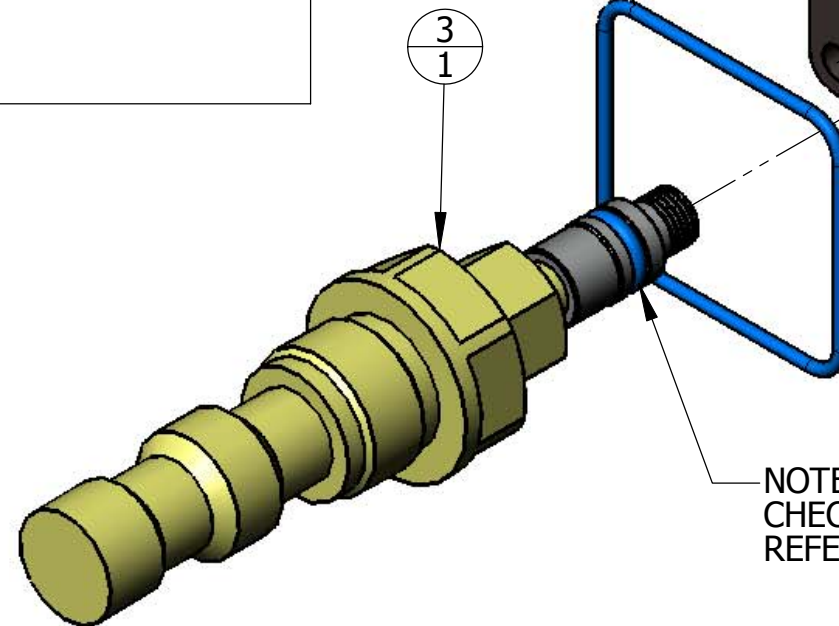
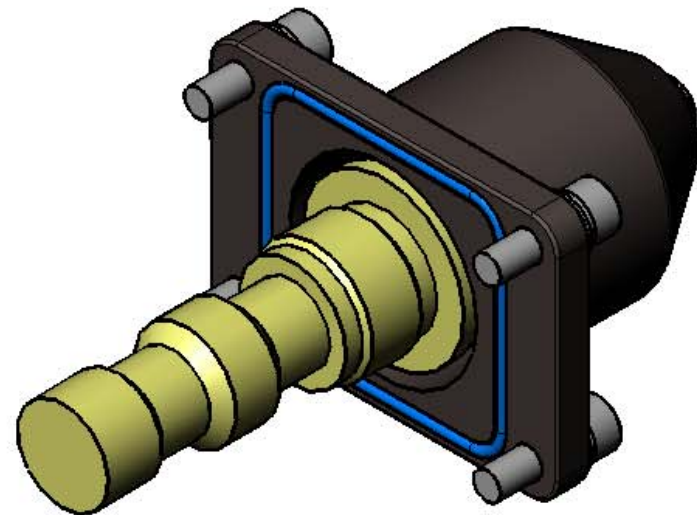
Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	PRV Cover	1204-DET	
2	1	Manual PRV O-ring (BS-033)	SOR-178-0505-N70	Nitrile 70
3	1	PRV Sub Assembly - 350 Bar Manual	1236-IAS-350	
4	4	Spring Washer M5	F-SW-M5-SS	Stainless Steel
5	4	Plain Washer M5	F-PW-M5-SS	Stainless Steel
6	4	Socket Head Cap Screw M5 x 16	F-SHCS-M5-16-A270	Stainless Gr A2-70

## PRV KIT - MANUAL OPERATION - 350 BAR SA PART NUMBER 3271-MAS-350

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	PRV Cover	1204-DET	
2	1	Manual PRV O-ring (BS-033)	SOR-178-0505-N70	Nitrile 70
3	1	PRV Sub Assembly - 200 Bar Manual	1236-IAS-200	
4	4	Spring Washer M5	F-SW-M5-SS	Stainless Steel
5	4	Plain Washer M5	F-PW-M5-SS	Stainless Steel
6	4	Socket Head Cap Screw M5 x 16	F-SHCS-M5-16-A270	Stainless Gr A2-70

## PRV KIT - MANUAL OPERATION - 200 BAR SA PART NUMBER 3271-MAS-200

**IF IN DOUBT - ASK!**



**NOTE!!!**  
CHECK O-RING IS FITTED TO PRV SUB-ASSEMBLY (ITEM 3)  
REFER TO 1236-IAS FOR DETAILS

REV	BY	DATE	DESCRIPTION	APP
1A	DMA	20/03/08	BUBBLE NUMBERS CORRECTED	
1	CMI	20/10/05	APPROVED FOR MANUFACTURE	

RECORD OF REVISIONS

MATERIAL	-
FINISH	-
USO, TOLERANCES TO BE	-

WT AIR	WT WATER
-	-
kg (E)	kg (E)
DRAWN	CMI
DATE	20/10/05
CHECK	EBR
APPRV.	CMI
ENGR.	CMI

Woodburn Road,  
Blackburn Business Park, Blackburn,  
Aberdeen. U.K. AB21 0PS  
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Fax: ++44 (0) 1224 798661

PROJECT	VALVE PACKS
TITLE	PRV KITS (MANUAL OPERATION) MAIN ASSEMBLY DRAWING Sheet 1 of 1
DOC. No.	3271-MAS
REV	1A

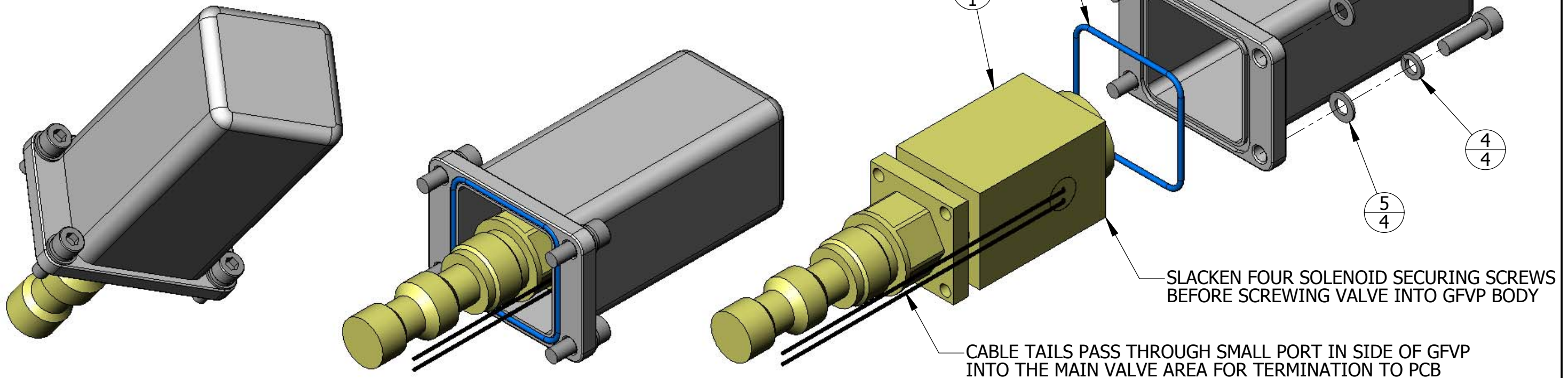
**IF IN DOUBT - ASK!**

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Proportional PRV Cover	3239-DET	
2	1	Manual PRV O-ring (BS-033)	SOR-178-0505-N70	Nitrile 70
3	1	Press Reducing Valve -350 bar (Proportional) MVPPM22-350-G24-M35-55	HYD-0165	
4	4	Spring Washer M5	F-SW-M5-SS	Stainless Steel
5	4	Plain Washer M5	F-PW-M5-SS	Stainless Steel
6	4	Socket Head Cap Screw M5 x 16	F-SHCS-M5-16-A270	Stainless Gr A2-70

## PRV KIT - PROPORTIONAL OPERATION - 350 BAR SA PART NUMBER 3272-MAS-350

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Proportional PRV Cover	3239-DET	
2	1	Manual PRV O-ring (BS-033)	SOR-178-0505-N70	Nitrile 70
3	1	Press Reducing Valve -200 bar (Proportional) MVPPM22-200-G24-M35-55	HYD-0167	
4	4	Spring Washer M5	F-SW-M5-SS	Stainless Steel
5	4	Plain Washer M5	F-PW-M5-SS	Stainless Steel
6	4	Socket Head Cap Screw M5 x 16	F-SHCS-M5-16-A270	Stainless Gr A2-70

## PRV KIT - PROPORTIONAL OPERATION - 200 BAR SA PART NUMBER 3272-MAS-200



REV	BY	DATE	DESCRIPTION	APP
1	CMI	20/10/05	APPROVED FOR MANUFACTURE	
RECORD OF REVISIONS				

MATERIAL	-
FINISH	-
USO, TOLERANCES TO BE	-

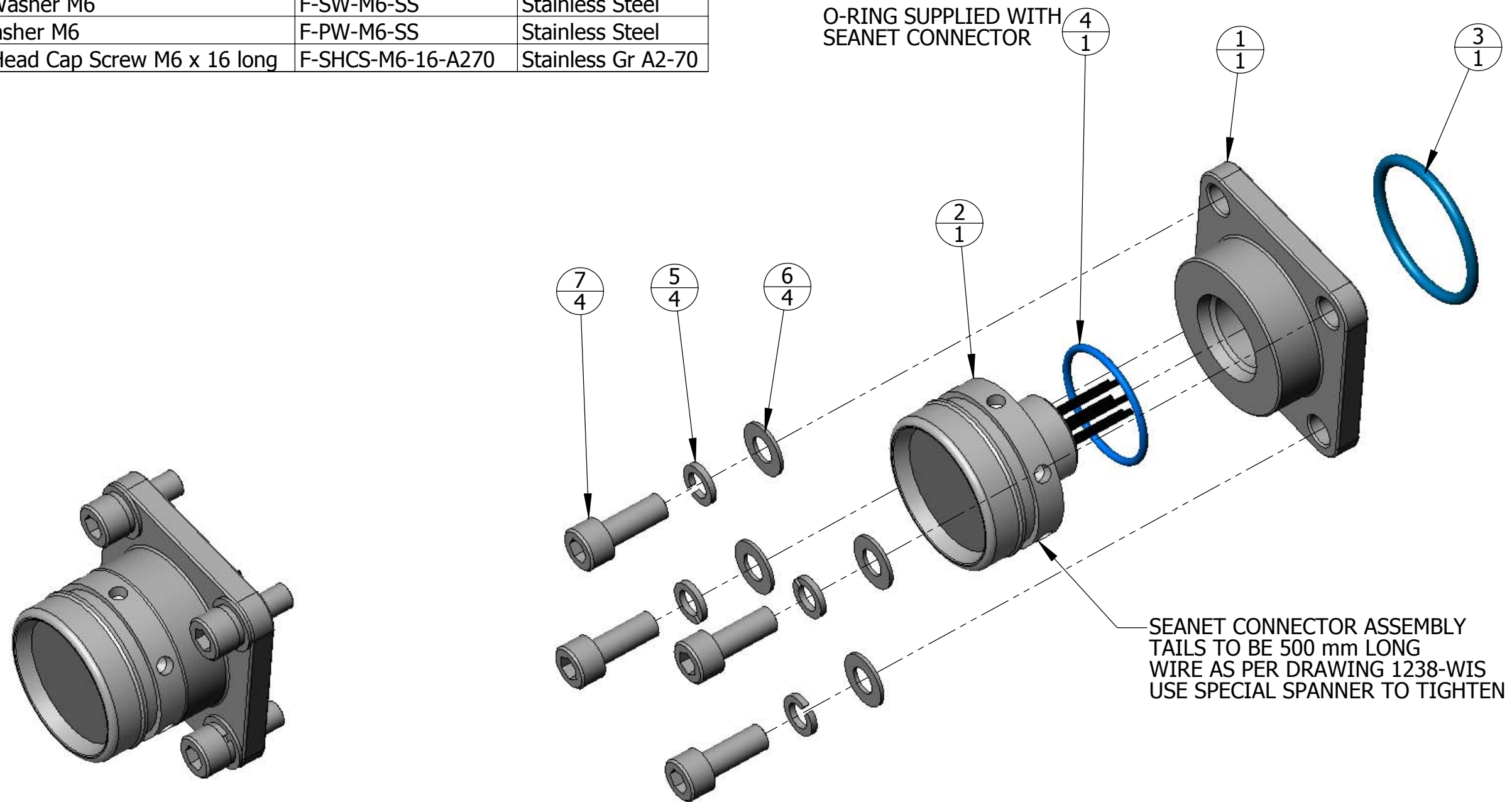
WT AIR	WT WATER
-	-
kg (E)	kg (E)
DRAWN	CMI
DATE	20/10/05
CHECK	EBR
APPRV.	CMI
ENGR.	CMI

**sub-Atlantic**  
 Woodburn Road,  
 Blackburn Business Park, Blackburn,  
 Aberdeen. U.K. AB21 0PS  
 Tel: ++44 (0) 1224 798660  
 Fax: ++44 (0) 1224 798661  
 SCALE (USO)      ORIG. SIZE  
 -                      A3

PROJECT	VALVE PACKS	
TITLE	PRV KITs (PROPORTIONAL OPERATION) MAIN ASSEMBLY DRAWING Sheet 1 of 1	
DOC. No.	3272-MAS	REV 1

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	GFVP Seanet Adaptor	3244-DET	
2	1	Seanet Connector	SR-101-5386	
3	1	O-RING 2.62 x 29.82 (BS-123)	SOR-262-0298-N70	Nitrile 70
4	1	O-Ring 1.78 x 25.12 (BS-022)	SOR-178-0251-N70	Nitrile 70
5	4	Spring Washer M6	F-SW-M6-SS	Stainless Steel
6	4	Plain Washer M6	F-PW-M6-SS	Stainless Steel
7	4	Socket Head Cap Screw M6 x 16 long	F-SHCS-M6-16-A270	Stainless Gr A2-70

**IF IN DOUBT - ASK!**



REV	BY	DATE	DESCRIPTION	APP
2	DAN	20/09/2006	ITEM 2 WAS SR-101-4172	
1	CMI	02/11/05	APPROVED FOR MANUFACTURE	
RECORD OF REVISIONS				

MATERIAL -	WT AIR	WT WATER
FINISH -	kg (E)	kg (E)
USO, TOLERANCES TO BE		

DRAWN	CMI
DATE	02/11/05
CHECK	EBR
APPRV.	CMI
ENGR.	CMI

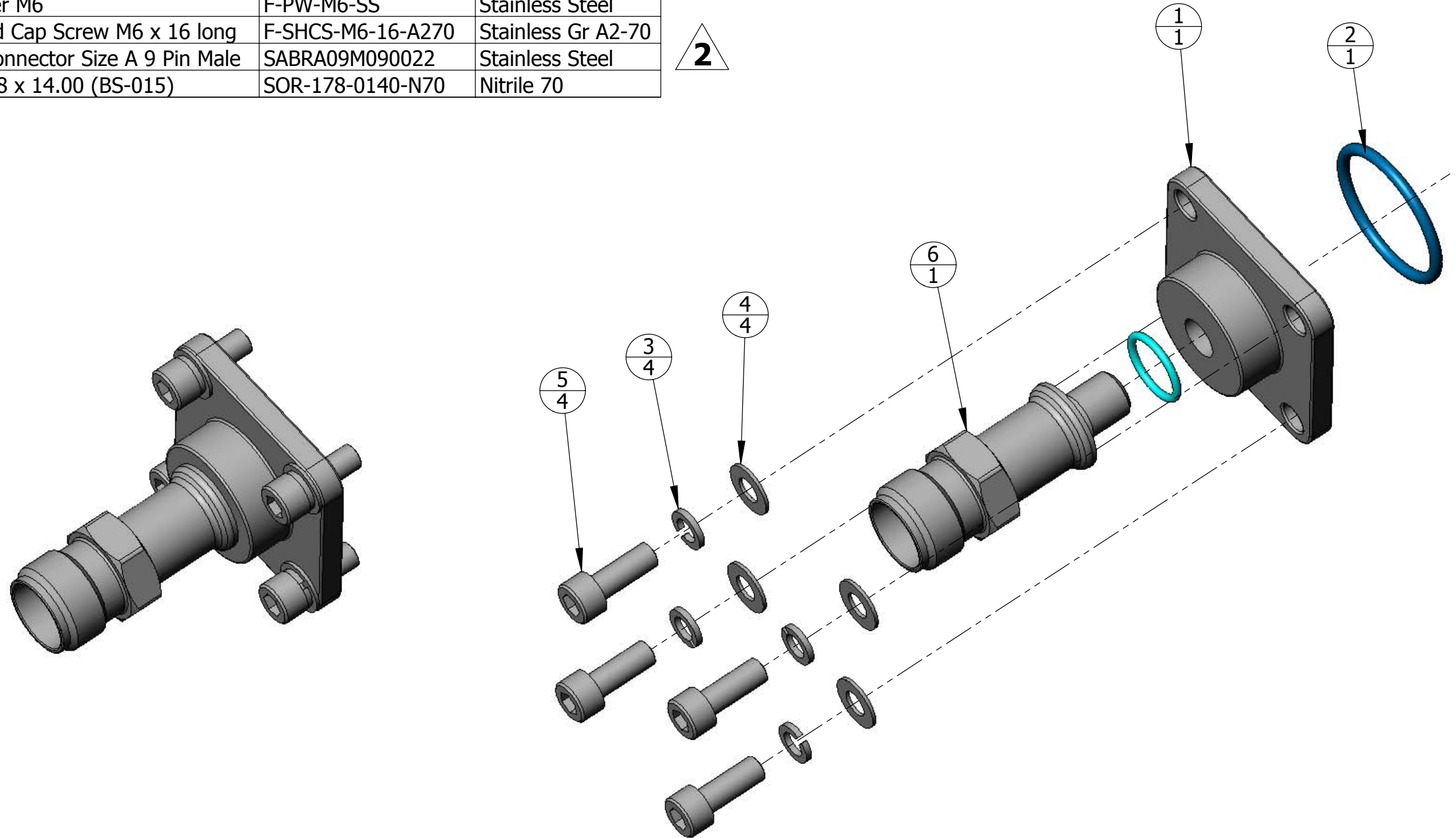
**sub-Atlantic**  
 Woodburn Road,  
 Blackburn Business Park, Blackburn,  
 Aberdeen. U.K. AB21 0PS  
 Tel: ++44 (0) 1224 798660  
 Fax: ++44 (0) 1224 798661  
 SCALE (USO) - ORIG. SIZE A3

PROJECT	VALVE PACKS	
TITLE	GFVP CONNECTOR KIT - SEANET MAIN ASSEMBLY DRAWING Sheet 1 of 1	
DOC. No.	3301-MAS	REV 2

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Adaptor - 20 Shell x 7-16 UNF	3293-DET	
2	1	O-RING 2.62 x 29.82 (BS-123)	SOR-262-0298-N70	Nitrile 70
3	4	Spring Washer m6	F-SW-M6-SS	Stainless Steel
4	4	Plain Washer M6	F-PW-M6-SS	Stainless Steel
5	4	Socket Head Cap Screw M6 x 16 long	F-SHCS-M6-16-A270	Stainless Gr A2-70
6	1	Bulkhead Connector Size A 9 Pin Male	SABRA09M090022	Stainless Steel
7	1	O-RING 1.78 x 14.00 (BS-015)	SOR-178-0140-N70	Nitrile 70



**IF IN DOUBT - ASK!**



REV	BY	DATE	DESCRIPTION	APP
2	EBR	15/03/06	PART REFERENCE CHANGED IN BOM	
1	CMI	02/11/05	APPROVED FOR MANUFACTURE	
RECORD OF REVISIONS				

MATERIAL	SEE BILL OF MATERIALS
FINISH	-
USO, TOLERANCES TO BE	-

WT AIR	WT WATER
-	-
kg (E) - kg (E)	
DRAWN	CMI
DATE	02/11/05
CHECK	EBR
APPRV.	CMI
ENGR.	CMI

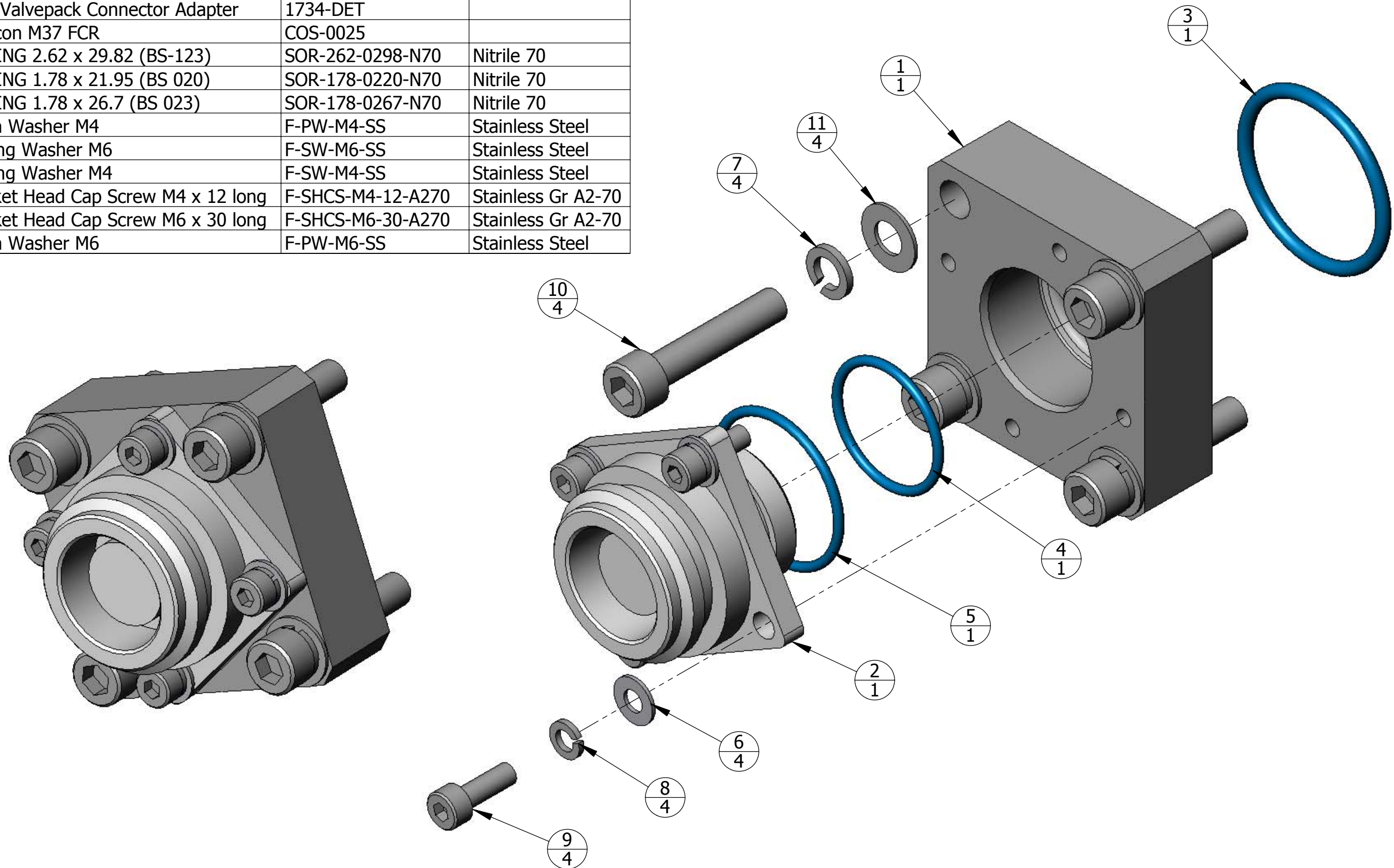
**sub-Atlantic**  
 Woodburn Road,  
 Blackburn Business Park, Blackburn,  
 Aberdeen. U.K. AB21 0PS  
 Tel: ++44 (0) 1224 798660  
 Fax: ++44 (0) 1224 798661

PROJECT	VALVE PACKS
TITLE	GFVP CONNECTOR KIT - SA SHELL A VARIOUS OPTIONS MAIN ASSEMBLY DRAWING Sheet 1 of 1
DOC. No.	3303-MAS
REV	2



Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Aux Valvepack Connector Adapter	1734-DET	
2	1	Seacon M37 FCR	COS-0025	
3	1	O-RING 2.62 x 29.82 (BS-123)	SOR-262-0298-N70	Nitrile 70
4	1	O-RING 1.78 x 21.95 (BS 020)	SOR-178-0220-N70	Nitrile 70
5	1	O-RING 1.78 x 26.7 (BS 023)	SOR-178-0267-N70	Nitrile 70
6	4	Plain Washer M4	F-PW-M4-SS	Stainless Steel
7	4	Spring Washer M6	F-SW-M6-SS	Stainless Steel
8	4	Spring Washer M4	F-SW-M4-SS	Stainless Steel
9	4	Socket Head Cap Screw M4 x 12 long	F-SHCS-M4-12-A270	Stainless Gr A2-70
10	4	Socket Head Cap Screw M6 x 30 long	F-SHCS-M6-30-A270	Stainless Gr A2-70
11	4	Plain Washer M6	F-PW-M6-SS	Stainless Steel

**IF IN DOUBT - ASK!**



REV	BY	DATE	DESCRIPTION	APP
1	EBR	9/11/04	APPROVED FOR CONSTRUCTION	
RECORD OF REVISIONS				

MATERIAL	SEE BILL OF MATERIALS
FINISH	-
USO, TOLERANCES TO BE	-

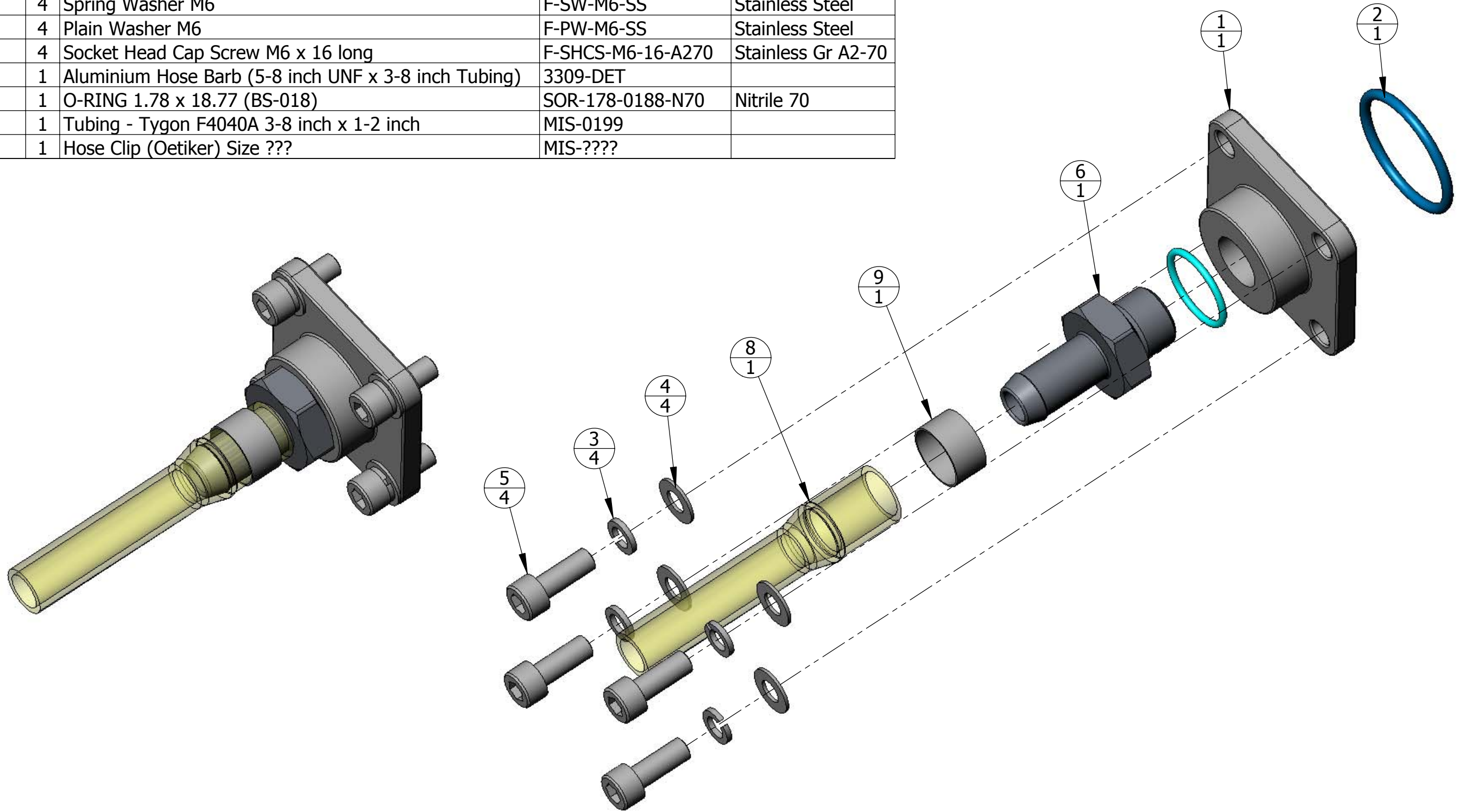
WT AIR	WT WATER
-	-
kg (E)	kg (E)
DRAWN	EBR
DATE	9/11/04
CHECK	-
APPRV.	-
ENGR.	CMI

**sub-Atlantic**  
 Woodburn Road,  
 Blackburn Business Park, Blackburn,  
 Aberdeen. U.K. AB21 0PS  
 Tel: ++44 (0) 1224 798660  
 Fax: ++44 (0) 1224 798661  
 SCALE (USO) 1.5 : 1    ORIG. SIZE A3

PROJECT	VALVE PACKS
TITLE	SEACON MINM37FCR ADAPTOR ASSY MAIN ASSEMBLY DRAWING Sheet 1 of 1
DOC. No.	2648-MAS
REV	1

Item No.	Qty	Description	Sub-Atlantic Part Ref.	Material
1	1	Adaptor - 20 Shell x 5-8 UNF	3386-DET	
2	1	O-RING 2.62 x 29.82 (BS-123)	SOR-262-0298-N70	Nitrile 70
3	4	Spring Washer M6	F-SW-M6-SS	Stainless Steel
4	4	Plain Washer M6	F-PW-M6-SS	Stainless Steel
5	4	Socket Head Cap Screw M6 x 16 long	F-SHCS-M6-16-A270	Stainless Gr A2-70
6	1	Aluminium Hose Barb (5-8 inch UNF x 3-8 inch Tubing)	3309-DET	
7	1	O-RING 1.78 x 18.77 (BS-018)	SOR-178-0188-N70	Nitrile 70
8	1	Tubing - Tygon F4040A 3-8 inch x 1-2 inch	MIS-0199	
9	1	Hose Clip (Oetiker) Size ???	MIS-????	

**IF IN DOUBT - ASK!**

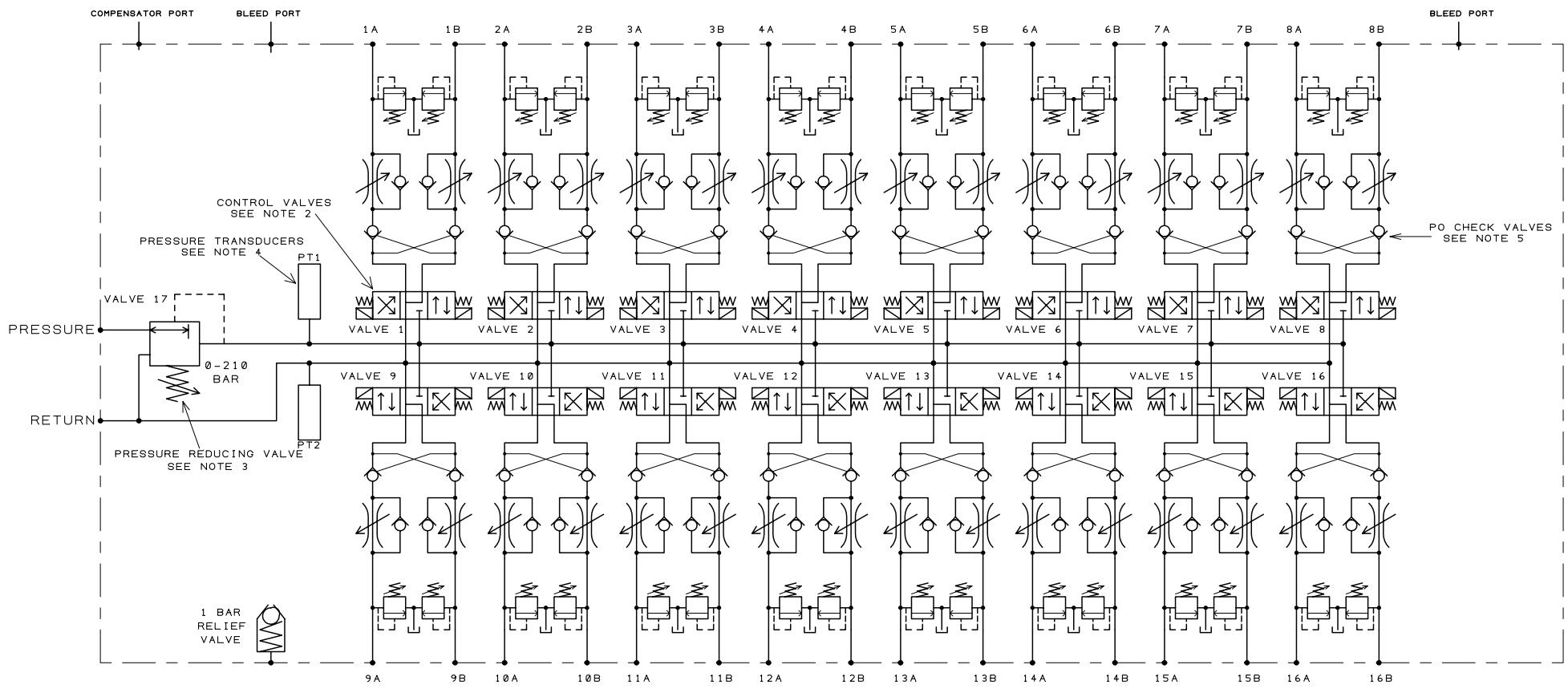


REV	BY	DATE	DESCRIPTION	APP
1	EBR	21/12/05	APPROVED FOR MANUFACTURE	
RECORD OF REVISIONS				

MATERIAL	-	WT AIR	WT WATER
FINISH	-	-	-
USO, TOLERANCES TO BE	-	kg (E)	kg (E)

**sub-Atlantic**  
 Woodburn Road,  
 Blackburn Business Park, Blackburn,  
 Aberdeen. U.K. AB21 0PS  
 Tel: ++44 (0) 1224 798660  
 Fax: ++44 (0) 1224 798661

PROJECT	VALVE PACKS
TITLE	GFVP CONNECTOR KIT - 3/8 HOSE BARB VARIOUS OPTIONS MAIN ASSEMBLY DRAWING Sheet 1 of 1
DOC. No.	3387-MAS
REV	1



- NOTES:**
- 1) THIS DRAWING RELATES TO THE 16 STATION GENERAL FUNCTION VALVE PACKS, BUT IS TYPICAL FOR 6.8 AND 12 STATION VERSIONS (VALVE QUANTITIES CHANGE).
  - 2) VALVE PACKS CAN BE POPULATED WITH BOTH SOLENIOD (BANG/BANG) OR PROPORTIONAL 'WANDFLUH' NG3 MINI VALVES DEPENDING ON CUSTOMER SPECIFICATION.
  - 3) THE PRESSURE REDUCING VALVE CAN BE MANUAL OR PROPORTIONAL OPERATION.
  - 4) SUPPLY AND RETURN LINE PRESSURE SENSORS CAN BE SUPPLIED DEPENDING ON SPECIFICATION.
  - 5) PO CHECK VALVES CAN EASILY BE REMOVED BY USER IF REQUIRED.
  - 6) VARIOUS CONTROL SYSTEM OPTIONS ARE AVAILABLE DEPENDING ON CUSTOMER SPECIFICATION.

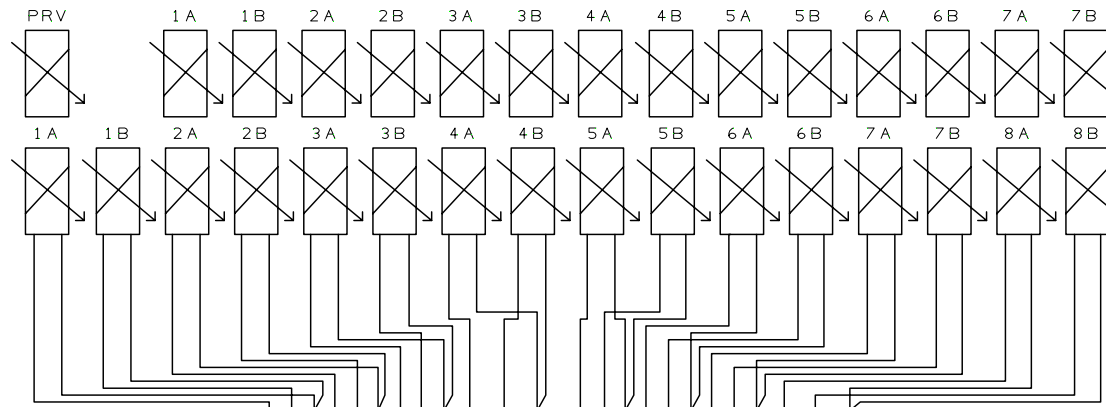
					Date 08/12/05	Drawn RCW	Check	Rev 1 Date 08/12/05	Sheet 1 of 1	<p>Unit 12, Airways Industrial Est. Pitmedden Road, Dyce, Aberdeen, U.K. AB21 0DT Tel: +44(0) 1224 723623 Fax: +44(0) 1224 723822</p>
					Project 6.8.12.16 STATION GENERAL FUNCTION VALVE PACKS		Drawing No. 1239-HYS			
					Title HYDRAULIC SCHEMATIC		Filename 1239.SCH			
REV	BY	DATE	DESCRIPTION	APP						

\* See Note #1

\* See Note #1

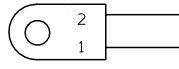
16 FUNCTION VALVE PACK SHOWN  
SCHEMATIC IS TYPICAL FOR 6, 8 & 12

( ANY PROPORTIONAL VALVE MAY  
BE REPLACED WITH AN ON / OFF  
TYPE VALVE )

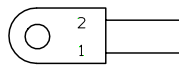


\* See Note #2

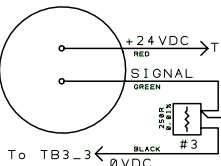
Water Sensor 1



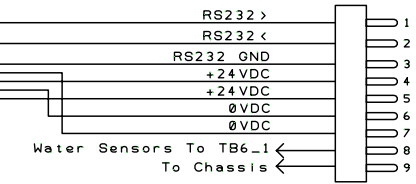
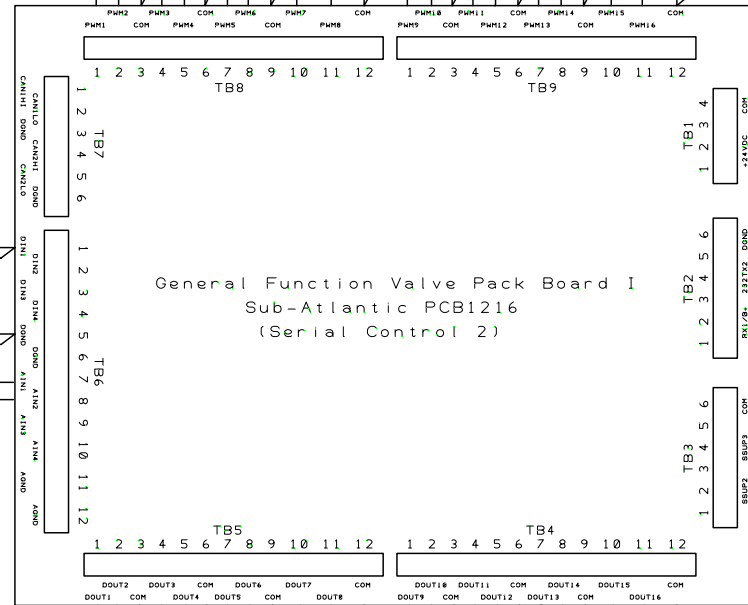
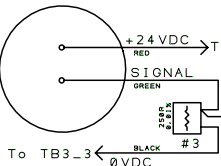
Water Sensor 2



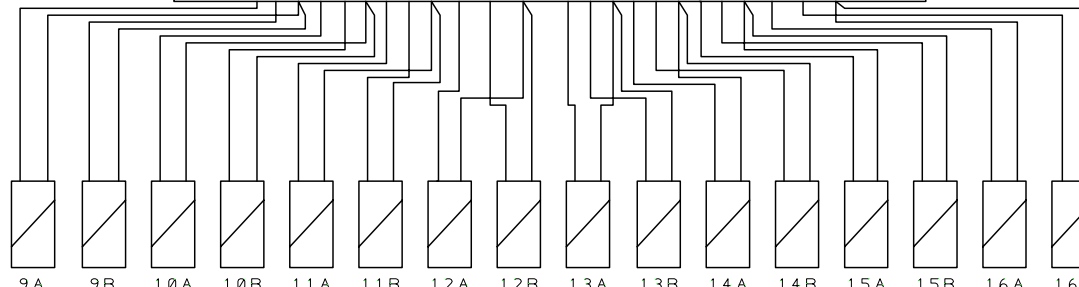
Pressure Transducer 1  
SEN-0036



Pressure Transducer 2  
SEN-0036



\* See Note #1



Notes

- #1  
If an electrically controlled Pressure Reducing Valve is required then the rest of the proportional valves are shifted along. This means that valve coils 8A and 8B are then controlled by the on / off supplies SSUP3 and SSUP4.
- #2  
The connector shown is a Sub-Atlantic connector. For other client specific connector pinouts see Sheet 2 of this drawing.
- #3  
Resistor part numbers are ELA-0164

5	MWA	29/10/08	ECN-0756	CRE	Date	21/12/05	Drawn	MWA	Check	Rev 5	Sheet
4	MWA	21/07/08	ECN-0062	CRE						Date 21/07/08	1 of 2
3	DOW	18/01/08	ECN-461-08	MWA	Project	GENERAL FUNCTION VALVE PACK (SERIAL CONTROL 2)		Drawing No.	1238-WIS		
2	MWA	23/04/07						Filename	1238.SCH		
1	MWA	21/12/05			Title	ELECTRICAL SCHEMATIC					
REV	BY	DATE	DESCRIPTION	APP							

Woodburn Road  
Blackburn Business Park  
Blackburn, Aberdeen, U.K. AB21 0PS  
Tel: +44 (0) 1224 798660  
Fax: +44 (0) 1224 798661



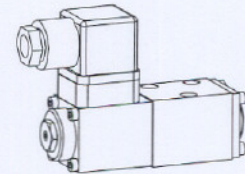
## **APPENDIX 1 – VALVE DATA SHEETS**

Data sheets for the valve options are available for reference only. Latest versions of data sheets can be obtained from the Wandfluh website:

[www.wandfluh.com](http://www.wandfluh.com)

**Solenoid operated spool valve**

- 4/2-way impulse valve
- 4/3-way with spring centred mid position
- 4/2-way with spring reset
- $Q_{max} = 15 \text{ l/min}$ ,  $p_{max} = 315 \text{ bar}$

**NG3-Mini<sup>®</sup>**

**DESCRIPTION**

Spool valve in flange design NG3-Mini. Interface to Wandfluh standard with 4 ports. Solenoid to standard VDE 0580. Direct operated solenoid valve in 5 chamber design. Spool detented or with spring reset. Wet pin type solenoid. Precise spool fit, low leakage, long life time. Threaded ports through additional base plate. Spool made from hardened steel, body from high quality cast steel. Wide range of standard and special voltages. The body made of high grade hydraulic casting for long service life is painted. The cover is phosphated and the solenoid is zinc coated.

**FUNCTION**

The solenoid shifts the spool into the corresponding position.

- 4/2-way detented spool valve:  
2 solenoids and 2 detented positions. With the solenoids deenergised the spool remains in the last switched position.
- 4/2-way spool valve:  
1 solenoid and 2 spool positions, spring offset. With the solenoid deenergised the spool returns to the offset position.
- 4/3-way spool valve:  
2 solenoids and 3 spool positions, spring centered. With the solenoids deenergised the spool returns to the center position.

**APPLICATION**

Solenoid operated spool valves are mainly used for controlling direction of movement and stopping of hydraulic cylinders and motors. Direction of movement depends on the position of spool and its flow symbol. Please pay attention to the performance limits and leakage of the valves. Solenoid operated spool valves are suitable for machine tools and handling systems. Mini-3 valves are used where both, reduced dimensions and weight are important.

**CONTENT**

GENERAL SPECIFICATIONS .....	1
HYDRAULIC SPECIFICATIONS .....	1
ELECTRICAL CONTROL .....	2
TYPE LIST/ DESIGNATION OF SYMBOLS .....	2
CHARACTERISTICS .....	2/3
DIMENSIONS .....	3
PARTS LIST .....	3
ACCESSORIES .....	3

**TYPE CODE**

	B	M	4		-		#	
Interface								
Medium-solenoid								
Number of control ports								
Description of symbols acc. to table 1.2-26/2								
Standard- nominal voltage $U_N$ :	12 VDC	G12						
	24 VDC	G24						
	110 VAC	R110						
	115 VAC	R115						
	230 VAC	R230						
Design-Index (Subject to change)								

**GENERAL SPECIFICATIONS**

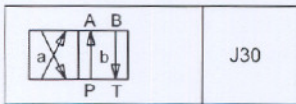
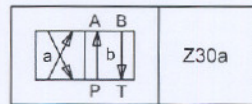
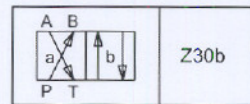
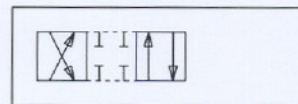
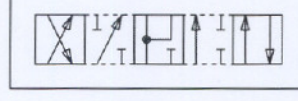
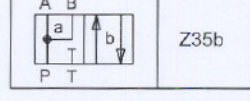
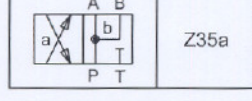
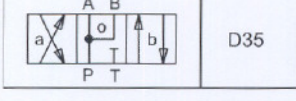
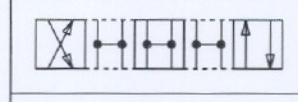
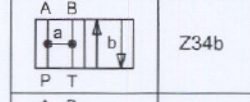
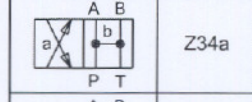
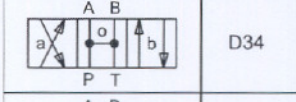
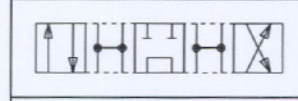
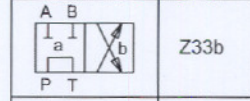
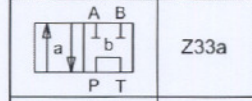
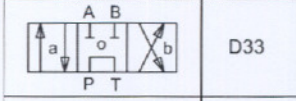
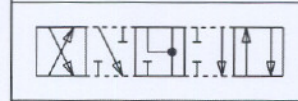
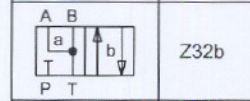
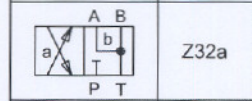
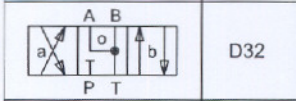
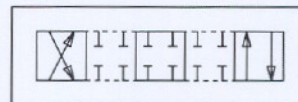
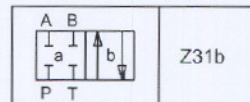
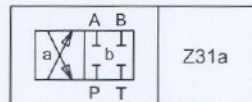
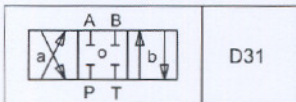
Description	4/2-, 4/3-spool valve
Nominal size	NG3-Mini to Wandfluh standard
Construction	Direct operated spool valve
Operation	Solenoid
Mounting	Flange
	3 fixing holes for socket head cap screws M4x30
Connections	Threaded connection plates
	Multi-flange subplates
	Longitudinal stacking system
Ambient temperature	-20...+50°C
Mounting position	any, preferably horizontal
Fastening torque	$M_D = 2,8 \text{ Nm}$ (screw quality 8.8)
Weight: 4/2-way impulse	$m = 0,65 \text{ kg}$
4/3-way	$m = 0,65 \text{ kg}$
4/2-way (1 solenoid)	$m = 0,50 \text{ kg}$

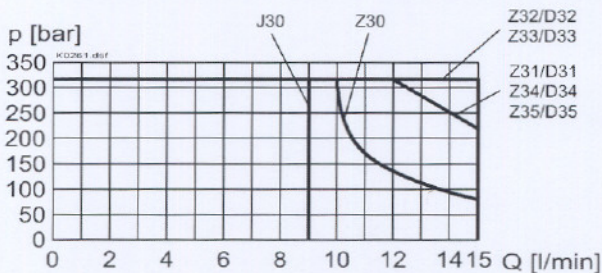
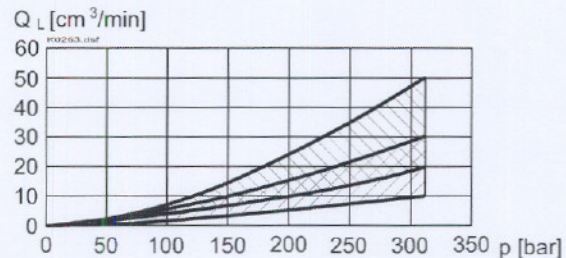

**HYDRAULIC SPECIFICATIONS**


Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, classe 20/18/14 (Required filtration grade $\beta_{10...16} \geq 75$ ) refer to data sheet 1.0-50/2
Viscosity range	12 mm <sup>2</sup> /s...320 mm <sup>2</sup> /s
Fluid temperature	-20...+70°C
Working pressure in port P, A, B	$p_{max} = 315 \text{ bar}$
Tank pressure in port T	$p_{max} = 100 \text{ bar}$
Max. volume flow	$Q_{max} = 15 \text{ l/min}$ , see characteristics
Leakage volume flow	see characteristics

**ELECTRICAL CONTROL**

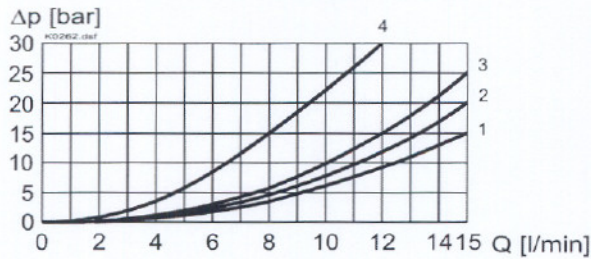
Construction	Solenoid, wet pin push type, pressure tight	Voltage tolerance	±10% of nominal voltage
Standard-nominal voltage	$U_N = 12$ VDC $U_N = 24$ VDC $U_N = 110$ VAC* $U_N = 115$ VAC* $U_N = 230$ VAC* AC = 50 bis 60 Hz * Rectifier integrated in the plug, other nominal voltages and nominal performances on request	Protection class	IP 65 to EN 60529
		Relative duty factor	100% DF (see data sheet 1.1-430)
		Switching cycles	15'000/h
		Operating life	$10^7$ (number of switching cycles, theoretically)
		Connection/Power supply	Over device plug connection to ISO 4400/DIN 43650, (2P+E), other connections on request.
		Solenoid connection:	SIN29V (data sheet 1.1-80)

**TYPE LIST / DESIGNATION OF SYMBOLS**
**4/2-way valve impulse**

**4/2-way valve with spring reset operation A-side**

**operation B-side**

**Transitional functions**

**4/3-way valve spring centered**

**CHARACTERISTICS** Oilviscosity  $\nu = 30$  mm<sup>2</sup>/s

 $p = f(Q)$  Performance limits with standard voltage -10%

 $Q_L = f(p)$  Leakage volume flow characteristics per control edge

 Leakage envelope J30/Z30/D31/D32/D34/D35

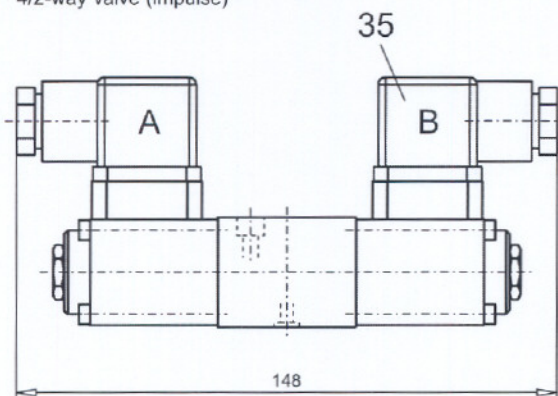
 Leakage envelope D33



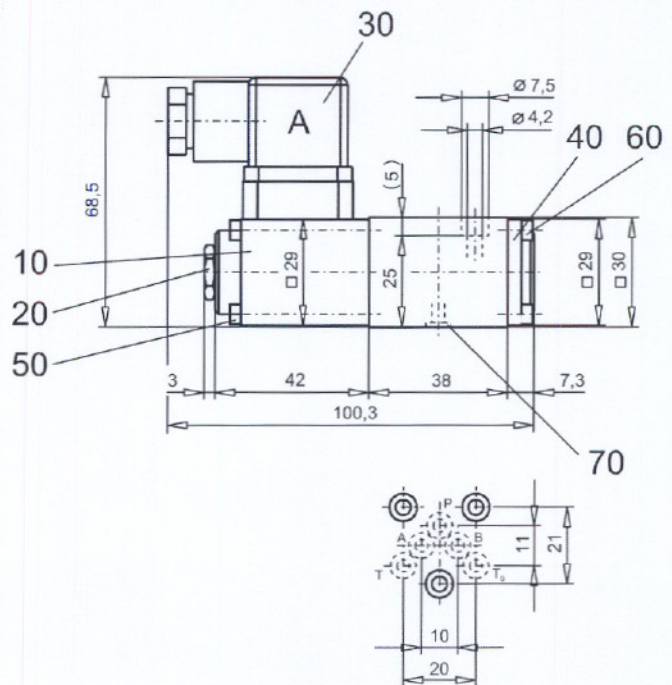
$\Delta p = f(Q)$  Pressure drop volume flow characteristics


Symbol	Pressure drop Curve no.	Volume flow direction				
		P - A	P - B	P - T	A - T	B - T
Z30/J30	3	3	3	-	2	2
D31/Z31	3	3	3	-	2	2
D32/Z32	3	3	3	-	1	1
D33/Z33	4	4	4	3	4	4
D34/Z34	4	4	4	3	1	1
D35/Z35	2	2	2	-	2	2

**DIMENSIONS**

 4/3-way valve (spring centred)  
 4/2-way valve (impulse)


4/2-way valve (spring reset)


**PARTS LIST**

Position	Article	Description
10	260.2 ...	Solenoid SIN29V
20	253.8000	Plug with integr. manual override HB4,5
30	219.2001	Electric plug A (grey)
35	219.2002	Electric plug B (black)
40	56.4200	Cover
50	246.0141	Socket head cap screw M3x40 DIN 912
60	246.0108	Socket head cap screw M3x8 DIN 912
70	160.2045	O-ring ID 4,50x1,50

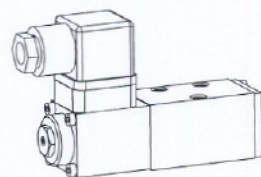
**ACCESSORIES**

 Threaded connecting plates, Multi-flange subplates and  
 Longitudinal stacking system see Reg. 2.9

Technical explanation see data sheet 1.0-100E

**Proportional directional valve**

- not pressure compensated
- $Q_{max} = 8 \text{ l/min}$
- $p_{max} = 315 \text{ bar}$

**NG3-Mini<sup>®</sup>**

**DESCRIPTION**

Direct operated proportional spool valve in flange design NG3-Mini according to Wandfluh standard with 4 ports. The spool valve is designed to the 5 chamber principle. The volume flow is adjusted by a Wandfluh proportional solenoid (VDE standard 0580). Low pressure drop due to the body design and spool profiling. The spool is made of hardened steel. The body made of high grade hydraulic casting for long service life is painted. The cover is phosphated and the solenoid is zinc coated.

**FUNCTION**

Proportionally to the solenoid current spool stroke, spool opening and valve volume flow will increase. Proportional directional valves NG3-Mini are not load-compensated. The optimum spool shape and progressive characteristics curve allow fine motion control. To control the valve Wandfluh proportional amplifiers are available (see register 1.13).

**APPLICATION**

Proportional directional spool valves are well suited for demanding applications where high resolution, high volume flow and low hysteresis are requested. They are implemented in industrial hydraulics as well as in mobile hydraulics for the smooth control of hydraulic actuators. Mini-3 valves are used where both, reduced dimensions and weight are important. Application examples: pitch control of wind generators, forest and earth moving machines, machine tools and paper production machines with simple position controls, robotics and fan control.

**CONTENT**

GENERAL SPECIFICATIONS .....	1
HYDRAULIC SPECIFICATIONS .....	1
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CHARACTERISTICS .....	2
DIMENSIONS .....	2
PARTS LIST .....	2
ACCESSORIES .....	2

**TYPE CODE**

	WDP	F	A03	-	<input type="checkbox"/>	-	<input type="checkbox"/>	-	5	-	<input type="checkbox"/>	#	<input type="checkbox"/>
Proportional directional valve													
Flange construction													
Interface nominal size 3-Mini													
Description of symbols acc. to table 1.10-65/2													
Nominal flow at 10 bar pressure drop over 2 metering edges = 5 l/min													
Standard nominal voltage $U_N$ :	12 VDC	<input type="checkbox"/>		G12									
	24 VDC	<input type="checkbox"/>		G24									
Design-Index (Subject to change)													

**GENERAL SPECIFICATIONS**

Nominal size	NG3-Mini acc. to Wandfluh standard
Designation	4/2-, 4/3-way prop. directional valve
Construction	Direct operated spool valve
Mounting	Flange, 3 fastening holes for socket head cap screws M4x30
Fastening torque	2,8 Nm (qual. 8.8)
Pipe connection	Connection plates Multi-station flange subplate Longitudinal stacking system
Mounting position	any, preferably horizontal
Ambient temperature	-20...+50°C
Weight: 1 solenoid-version	m = 0,5 kg
2 solenoid-version	m = 0,6 kg

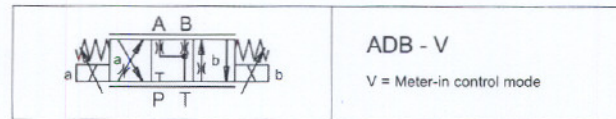
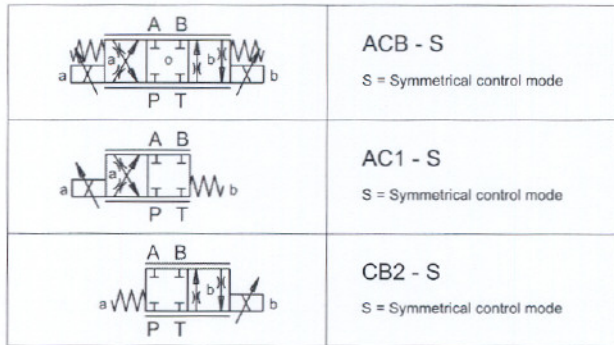
**HYDRAULIC SPECIFICATIONS**

Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 18/16/13 (Required filtration grade $\beta_{6...10} \geq 75$ ) refer to data sheet 1.0-50/2
Viscosity range	12 mm <sup>2</sup> /s...320 mm <sup>2</sup> /s
Fluid temperature	-20...+70°C
Working pressure	$p_{max} = 315 \text{ bar}$ (connection P, A, B)
Tank pressure	$p_{max} = 160 \text{ bar}$ (connection T)
Nominal volume flow	$Q_N = 5 \text{ l/min}$ at 10 bar pressure drop over 2 metering edges
Max. volume flow	$Q_{max} = 8 \text{ l/min}$
Leakage volume flow	see characteristic
Hysteresis	$\leq 5\%$ * * by optimal dithersignal

**ELECTRICAL SPECIFICATIONS**

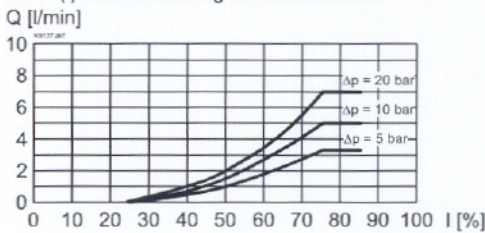
Construction	Proportional solenoid, wet pin push type, pressure tight	
Standard-Nominal voltage	U = 12 VDC	U = 24 VDC
Limiting current	$I_G = 1080 \text{ mA}$	$I_G = 540 \text{ mA}$
Relative duty factor	100% DF (see data sheet 1.1-430)	
Protection class	IP 65 acc. to EN 60 529	
Connection/Power supply	Over device plug connection acc. to ISO 4400/DIN 43650 (2P+E)	
Other electrical specifications	see data sheet 1.1-90 (PI29V)	

TYPE CHARTS / DESIGNATIONS OF SYMBOLS

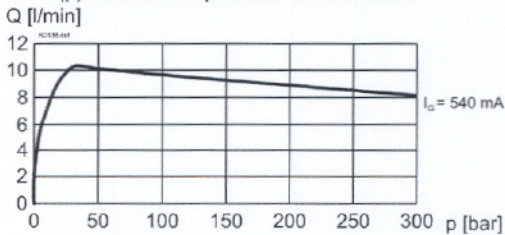


**CHARACTERISTICS** oil viscosity  $\nu = 30 \text{ mm}^2/\text{s}$

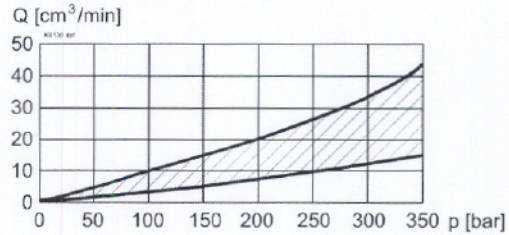
$Q = f(I)$  Volume flow-signal-characteristics



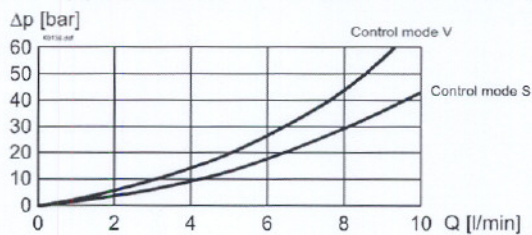
$Q = f(p)$  Volume flow-pressure-characteristics



$Q_L = f(p)$  Leakage-characteristics



$\Delta p = f(Q)$  Pressure loss/flow-characteristics over 2 metering edges



**PARTS LIST**

Position	Article	Description
10	256.2452	Proportional solenoid PI29V-G24
	256.2416	Proportional solenoid PI29V-G12
20	253.8000	Plug with integrated manual override HB4,5
30	219.2001	Plug A (grey)
35	219.2002	Plug B (black)
40	056.4100	Cover
50	246.0141	Socket head cap screw M3x40 DIN 912
60	246.0108	Socket head cap screw M3x8 DIN 912
70	160.2045	O-ring ID 4,50x1,5

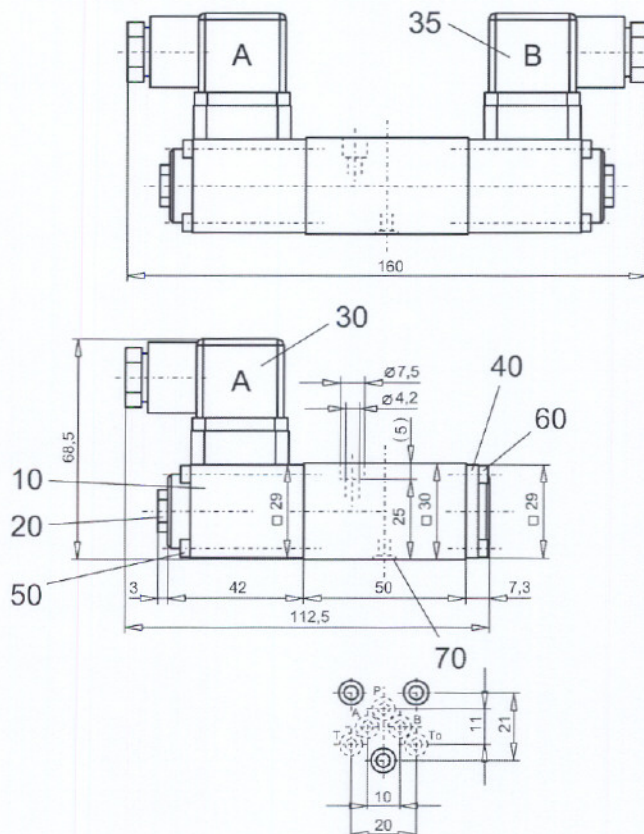
**ACCESSORIES**

Sub-plates  
Proportional-amplifier

Register 1.9  
Register 1.13

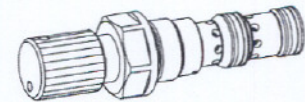
Technical explanation see data sheet 1.0-100E

**DIMENSIONS**



**Pressure reducing valve**
**Screw-in cartridge**

- Pilot operated
- $Q_{max} = 80 \text{ l/min}$
- $p_{max} = 400 \text{ bar}$
- $p_{N \text{ red max}} = 350 \text{ bar}$

**M22x1,5**  
 ISO 7789

**DESCRIPTION**

Pilot operated 3-way pressure reducing valve of the screw-in cartridge type with thread M22x1,5 for cavity in according to ISO 7789. This valve reduces the inlet pressure to an adjustable outlet pressure. The integrated pressure relief function prevents the reduced pressure from being exceeded as a result of external forces. The valve is available with 3 types adjustments: 2 interlockable, the other lockable. A cover is also available for key adjustment, see data sheet 2.0-50. There are 3 pressure stages to choose from. The steel cartridge body and adjustment spindle are galvanised and the aluminium knob has a natural anodised finish. The quality of this product is reflected in the good performance data and design.

**FUNCTION**

The spool, located in the pilot operated main section of the valve, is held in the reset position by a spring. The connection to the consumer is fully open. With the pilot stage which is designed as relief valve, reduced pressure is adjustable. It opens when the set value is reached. As a result, a pilot volume flows through the nozzle in the spool. The resultant pressure difference displaces the spool towards the spring. The volume flow is throttled in the valve inlet and the reduced pressure is controlled. If forces acting on the actuator allow the reduced pressure to exceed the set value, the spool is displaced until the valve inlet closes and the reduced pressure port is being connected to tank. The pressure increase is then limited.

**APPLICATION**

Pressure reducing valves are used to keep the pressure constant in the consumer, irrespective of pressure fluctuations on the supply side. If there are several consumers, the pressure of the individual consumers can be set individually using the pressure reducing valve. The integrated pressure relief facility means that no additional pressure relief valve is needed in the actuator line. Installation of the screw-in cartridge in control blocks as well as in the Wandfluh sandwich plates (vertical stacked systems) and flange valves of the NG4-Mini, NG6 and NG10 types. (Please note the separate data sheets in register 2.2). Cavity tools are available for machining the cavities in steel and aluminium (hire or purchase). Please refer to the data sheets in register 2.13.

**CONTENT**

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MECHANICAL ACTUATION .....	1
CHARACTERISTICS .....	2
DIMENSIONS/ SECTIONAL DRAWINGS .....	2
PARTS LIST .....	2
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**TYPE CODE**

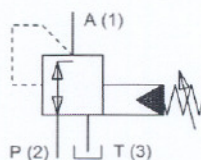
	M	V	<input type="checkbox"/>	PM22 -	<input type="text"/>	#	<input type="text"/>
Pressure reducing valve							
Pilot operated							
Types of adjustment:	Key	<input type="checkbox"/>	S				
	Control knob	<input type="checkbox"/>	D				
	Lock	<input type="checkbox"/>	K				
	Cover	<input type="checkbox"/>	A	(see data sheet 2.0-50)			
Screw-in cartridge M22x1,5							
Standard nominal pressure range:	$p_{N \text{ red}} = 63 \text{ bar}$	<input type="checkbox"/>	63				
	$p_{N \text{ red}} = 160 \text{ bar}$	<input type="checkbox"/>	160				
	$p_{N \text{ red}} = 350 \text{ bar}$	<input type="checkbox"/>	350				
Design-Index (Subject to change)							

**GENERAL SPECIFICATIONS**

Description	Pilot operated pressure reducing valve
Construction	Screw-in cartridge for cavity according to ISO 7789
Mounting	Screw-in thread M22x1,5
Ambient temperature	-20...+50°C
Mounting position	any
Fastening torque	$M_D = 50 \text{ Nm}$
Weight:	$m = 0,17 \text{ kg}$ (Key) $m = 0,18 \text{ kg}$ (Control knob) $m = 0,28 \text{ kg}$ (Lock)

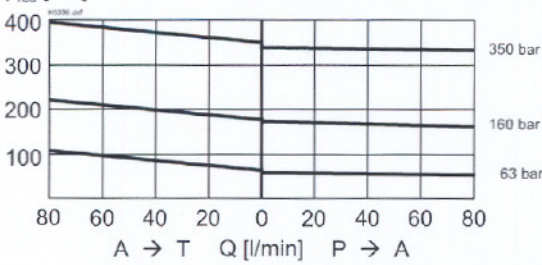
**HYDRAULIC SPECIFICATIONS**

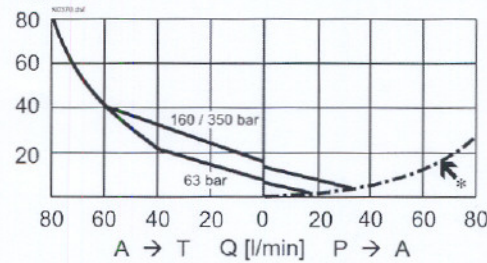
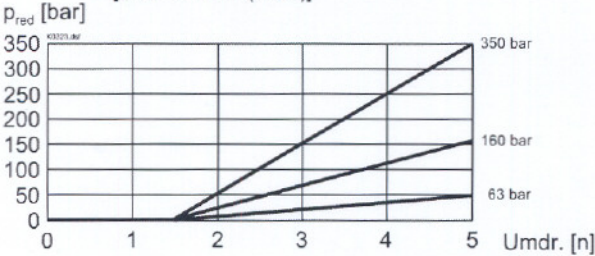
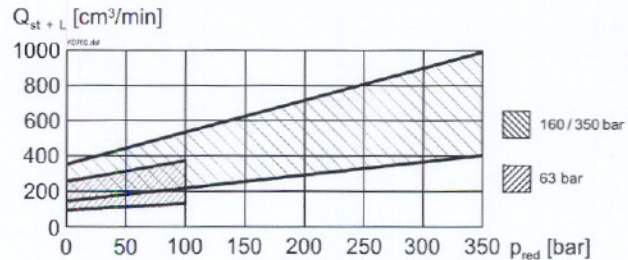
Fluid	Mineral oil, other fluid on request
Contamination efficiency	ISO 4406:1999, class 18/16/13 (Required filtration grade $\beta_{6...10} \geq 75$ ) refer to data sheet 1.0-50/2
Viscosity range	12 mm <sup>2</sup> /s...320 mm <sup>2</sup> /s
Fluid temperature	-20...+70 °C
Peak pressure	$p_{max} = 400 \text{ bar}$
Nominal pressure ranges	$p_{N \text{ red}} = 63 \text{ bar}, 160 \text{ bar}$ and 350 bar
Volume flow	$Q = 0...80 \text{ l/min}$
Pilot- and leakage volume flow	see characteristics

**SYMBOL**

**MECHANICAL ACTUATION**

3 types of adjustments:  
 S = Key adjustment by means of key and screw driver  
 D = control knob adjustment, fixed  
 K = Lock adjustment  
 Control stroke  $S_b = 5 \text{ mm}$   
 Control angle  $\alpha_b = 1800^\circ$  (5 revolutions)

**CHARACTERISTICS** oil viscosity  $\nu = 30 \text{ mm}^2/\text{s}$ 
 $p_{\text{red}} = f(Q)$  Pressure volume flow characteristics

 $p_{\text{red}}$  [bar] (Maximal adjustable pressure)

 $p_{\text{red}} = f(Q)$  Pressure volume flow characteristics (Minimal adjustable pressure)

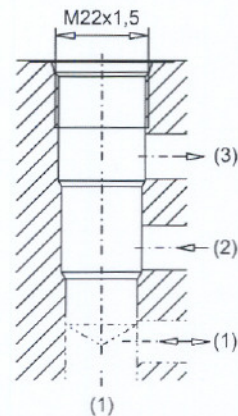
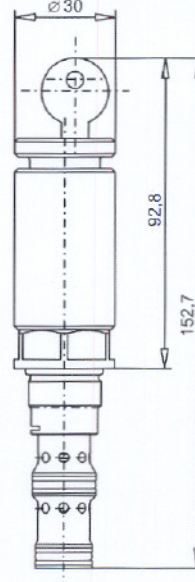
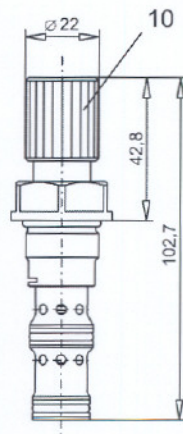
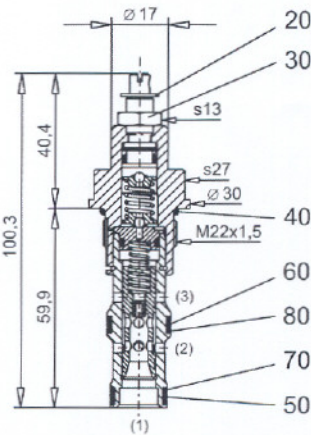
 $p_{\text{red}}$  [bar] \* Consumption resistance dependent on system

 $p_{\text{red}} = f(l)$  Pressure adjustment characteristics [at  $Q = 0 \text{ l/min}$  (static)]

 $Q_{\text{st}+L} = f(p)$  Pilot- and leakage volume flow characteristic [A (1) → T (3)] (Pressure in P (2) = 350 bar)

**DIMENSIONS/SECTIONAL DRAWINGS**

Screw adjustment „S“

Knob adjustment „D“

Lock adjustment „K“

Cavity drawing acc. to ISO 7789-22-04-0-98



For detailed cavity drawing and cavity tools see data sheet 2.13-1004

**PARTS LIST**

Position	Article	Description
10	114.2217	Knob
20	193.1050	Safety plate RD5 DIN 6799
30	153.1402	Hexagonal nut 0,5D M8x1
40	160.2188	O-ring ID 18,77x1,78
50	160.2140	O-ring ID 14,00x1,78
60	160.2156	O-ring ID 15,60x1,78
70	049.3176	Back-up ring RD 14,1x17x1,4
80	049.3196	Back-up ring RD 16,1x19x1,4

**ACCESSORIES**

 Cartridge built into flange or sandwich body  
 Flange body / sandwichplate

register 2.2

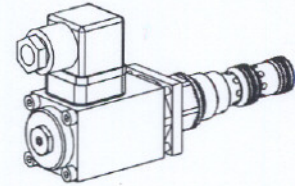
Technical explanation see data sheet 1.0-100E

**Proportional pressure reducing valve**
**Screw-in cartridge**

- Pilot operated
- $Q_{max} = 60 \text{ l/min}$
- $p_{max} = 400 \text{ bar}$
- $p_{N \text{ red max}} = 350 \text{ bar}$

**M22x1,5**

ISO 7789


**DESCRIPTION**

Pilot operated proportional pressure reducing valve as a screw-in cartridge with a thread M22x1,5 for cavity according to ISO 7789. 4 standard pressure levels are available: 20, 100, 200 and 350 bar. Adjustment by a Wandfluh proportional solenoid (VDE standard 0580). The cartridge and the solenoid made of steel are zinc coated and therefore rust-protected.

**FUNCTION**

The proportional pressure regulating valve controls the pressure in port A (1). Proportionally to the solenoid current solenoid force and pressure in port A (1) rise. The valve functions practically independently of pressure in port P (2). A pressure rise in Port A (1) above the set pressure e.g. due to an active oil consumer, will be prevented by relieving excess volume flow to tank via port T (3). With deenergised solenoid the volume flow passes freely from port P to the consumer port A. Design specific a minimum adjustable pressure according characteristic curve cannot be underpassed. To control the valve proportional amplifiers are available from Wandfluh (see register 1.13).

**APPLICATION**

The valve has its application in hydraulic systems, in which the pressure frequently has to be changed. The facility for remote control and signal processing from process control systems enable elegant, comfortable solutions to problems. Installation of the screw-in cartridge in control blocks as well as in the Wandfluh sandwich plates (vertical stacked systems) and flange valves of the NG4-Mini, NG6 and NG10 types. (Please note the separate data sheets in register 2.3). Cavity tools are available for machining the cavities in steel and aluminium (hire or purchase). Please refer to the data sheets in register 2.13.

**CONTENT**

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PARTS LIST .....	2
ACCESSORIES .....	2

**TYPE CODE**

Pressure reducing valve	M	V	P	PM22	-		-		#	
Pilot operated										
Proportional										
Screw-in thread M22x1,5										
Standard nominal pressure range:	$p_{N \text{ red}} = 20 \text{ bar}$					20				
	$p_{N \text{ red}} = 100 \text{ bar}$					100				
	$p_{N \text{ red}} = 200 \text{ bar}$					200				
	$p_{N \text{ red}} = 350 \text{ bar}$					350				
Standard nominal voltage:	$U_N = 12 \text{ VDC}$					G12				
	$U_N = 24 \text{ VDC}$					G24				
Design-Index (Subject to change)										

• Data sheet is valid from design-index # 2 on

**GENERAL SPECIFICATIONS**

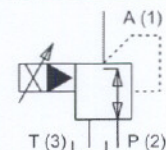
Denomination	Pilot operated proportional pressure reducing valve
Construction	Screw-in cartridge for cavity acc. to ISO 7789
Operation	Proportional solenoid
Mounting	Screw in thread M22x1,5
Ambient temperature	-20...+50° C
Mounting position	any
Fastening torque	$M_D = 50 \text{ Nm}$ for screw-in cartridge $M_D = 2,6 \text{ Nm}$ (qual. 8.8) for solenoid screws
Weight	$m = 0,6 \text{ kg}$

**HYDRAULIC SPECIFICATIONS**

Fluid	Mineral oil, other fluid on request
Contamination efficiency schmutzungsgrad	ISO 4406:1999, class 18/16/13 (Required filtration grade $\beta_{6...10} \geq 75$ ) refer to data sheet 1.0-50/2
Viscosity range	12 mm <sup>2</sup> /s...320 mm <sup>2</sup> /s
Fluid temperature	-20...+70° C
Peak pressure	$p_{max} = 400 \text{ bar}$
Nominal pressure range	$p_{N \text{ red}} = 20 \text{ bar}$ , $p_{N \text{ red}} = 100 \text{ bar}$ $p_{N \text{ red}} = 200 \text{ bar}$ , $p_{N \text{ red}} = 350 \text{ bar}$
Volume flow range	$Q = 0...60 \text{ l/min}$
Pilot- and leakage volume flow	see characteristics
Repeatability	≤ 1 % *
Hysteresis	≤ 4 % *
	* at optimal dither signal

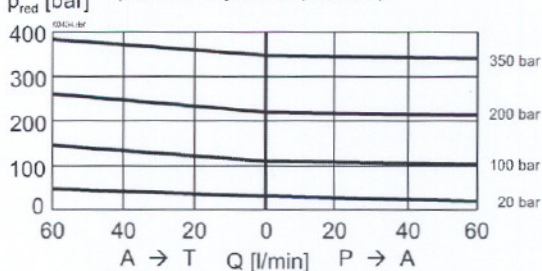
**ELECTRICAL SPECIFICATIONS**

Construction	Proportional solenoid, wet pin push type, pressure tight.	
Standard nominal voltage	$U_N = 12 \text{ VDC}$	$U_N = 24 \text{ VDC}$
Limiting current	$I_G = 1250 \text{ mA}$	$I_G = 680 \text{ mA}$
Relative duty factor	100% DF (see date sheet 1.1-430)	
Protection class	IP 65 acc. to EN 60 529	
Connection/Power supply	Over device plug connection acc. to ISO 4400 / DIN 43 650 (2P+E)	
Other electrical specifications	see data sheet 1.1-115 (PI35V)	

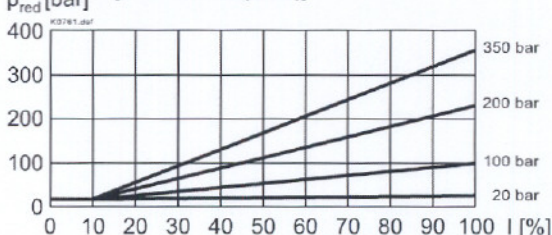
**SYMBOL**


**CHARACTERISTICS** oil viscosity  $\nu = 30 \text{ mm}^2/\text{s}$

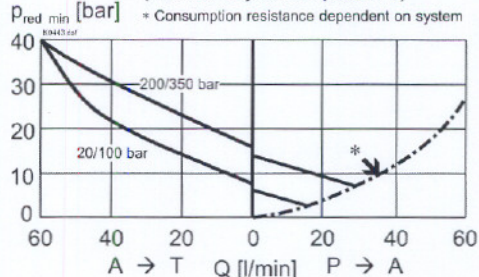
$p_{\text{red}} = f(Q)$  Pressure volume flow characteristics  
(Maximal adjustable pressure)



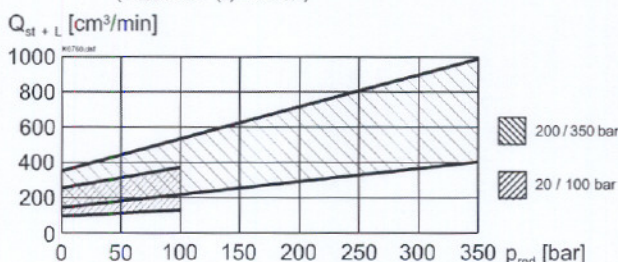
$p_{\text{red}} = f(I)$  Pressure adjustment characteristics  
[at  $Q = 0 \text{ l/min}$  (static)]



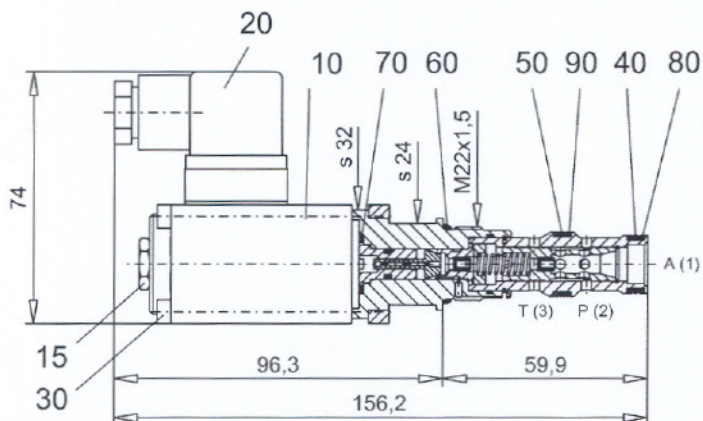
$p_{\text{red}} = f(Q)$  Pressure volume flow characteristics  
(Minimal adjustable pressure)



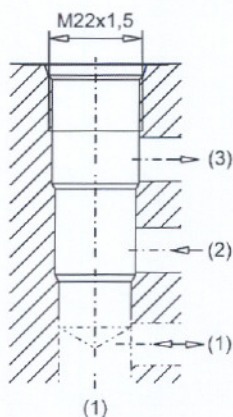
$Q_{\text{st+L}} = f(p)$  Pilot- and leakage volume flow characteristic [A(1) → T(3)]  
(Pressure in P(2) = 350 bar)



**DIMENSIONS / SECTIONAL DRAWINGS**



Cavity drawing acc. to  
ISO 7789-22-04-0-98



For detailed cavity drawing  
and cavity tools see data  
sheet 2.13-1004

**PARTS LIST**

Position	Article	Description
10	256.3505 256.3443	Proportional solenoid PI35MV-G24 Proportional solenoid PI35MV-G12
15	253.8000	Mounted screw with integrated manual override HB4,5
20	219.2002	Plug (black)
30	249.1007	Socket head cap screw M4x63
40	160.2140	O-ring ID 14,00x1,78
50	160.2156	O-ring ID 15,60x1,78
60	160.2188	O-ring ID 18,77x1,78
70	160.2140	O-ring ID 14,00x1,78
80	049.3176	Back-up ring RD 14,1x17x1,4
90	049.3196	Back-up ring RD 16,1x19x1,4

**ACCESSORIES**

Cartridge built-in flange- or sandwich body  
Flange body / sandwich plate register 2.3  
Proportional amplifier register 1.13

Technical explanation see data sheet 1.0-100E

## **APPENDIX 2 – TOP LEVEL ASSEMBLY DRAWING - PART NUMBER SPECIFIC CONFIGURATION**

The drawing attached represents the actual version of the GFVP supplied configured as per the order requirements. The part numbering matrix is also shown for reference.



**Part Numbering System for GFVPs**  
**20 Characters maximum**

**Rev 3**

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

**S A - H V 1 2 G 0 8 0 8 A 0 0 A 1 X X**

