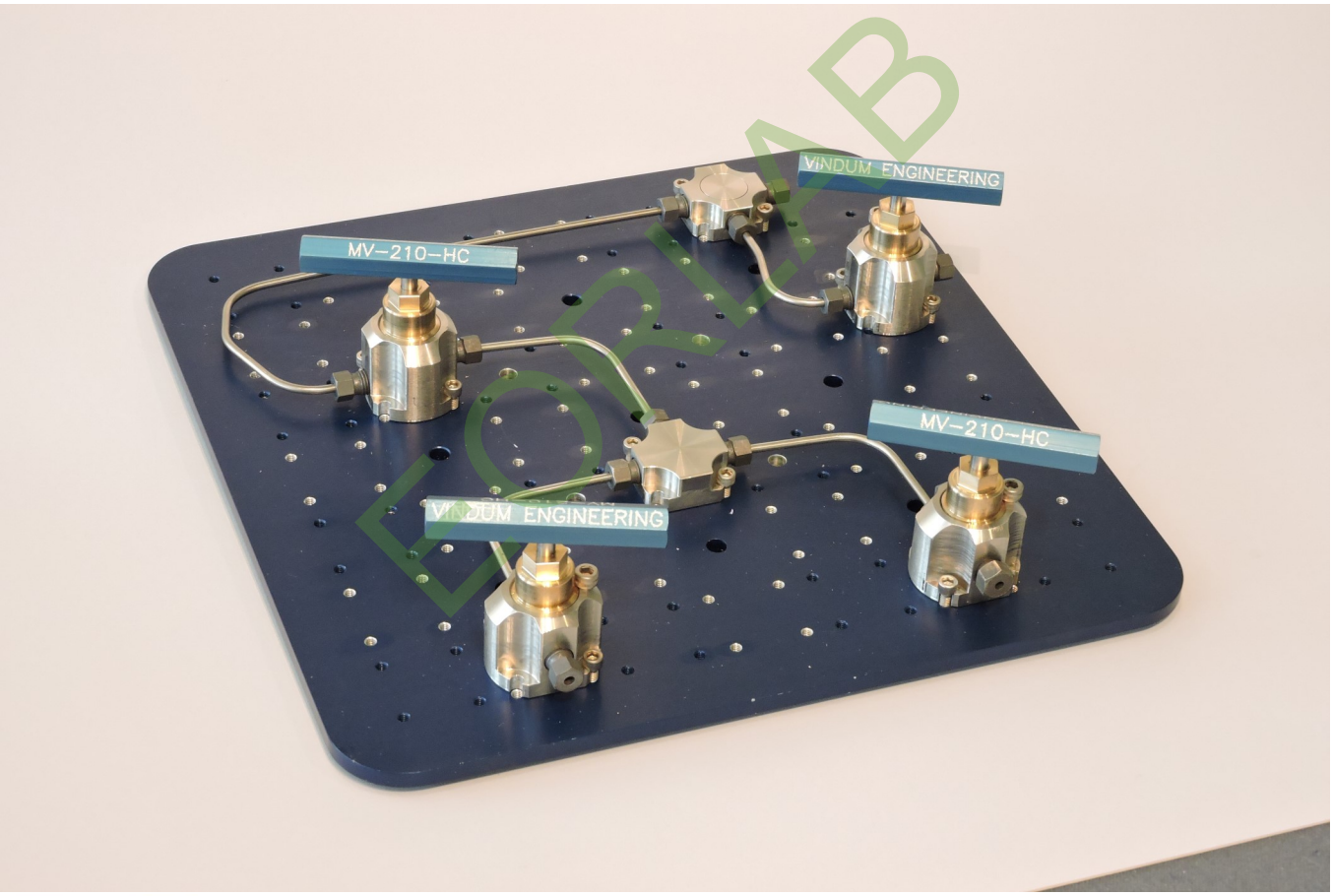
MV-Series

High-Pressure Valves

USER GUIDE



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V:1.0 (6-27-17)

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Chapter 1

1. General Overview

The Vindum Modular Valve System (MVS) is designed to allow fast, easy construction of high pressure fluid flow systems. The MV system is available in a wide variety of configurations for valves, manifolds, and "breadboard style" mounting grids. Our manual valves are needle-style valves, and can withstand pressures up to 12,000 psi, and temperatures of up to 350^{o} (higher temperatures options available), with proper O-ring selection.

1.1 Configurations

Each MV can be manufactured with both Autoclave Speedbite ports, or High-Pressure (HiP) AF2 ports. Valves can be manufactured in 2 and 3 way configurations. The manifolds can be manufactured in 2, 3, 4, 5, and 9 way configurations. Both valves and manifolds are available in full stainless steel and Hastelloy core configurations. Hastelloy core parts are resistant to corrosion from many fluids, such as brines.

1.2 Main O-Ring Seal Material

The following materials are available for the wetted O-ring. The wetted O-ring material needs to agree with the fluid used.

- Viton (Standard unless specified)
- Aflas
- Buna
- Teflon
- UHMW

1.3 Pressure Rating

The MV system is rated for pressures up to 12,000 psi.

1.4 Temperature Rating

The MV system can withstand temperatures up to 350^{o} F with proper O-ring selection. Higher temperature options are available on request.

1.5 Wetted Parts

There are two options of materials for the valves wetted parts, or the parts of the valve that will come in contact with the fluid:

- 316 Stainless Steel for inert materials, or
- Hastelloy C-276 for corrosive materials or brine

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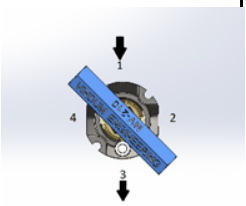
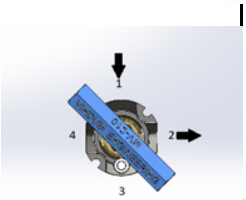
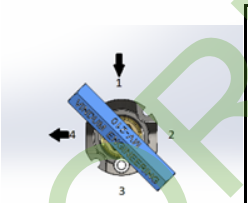
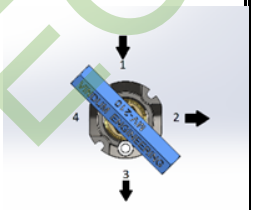
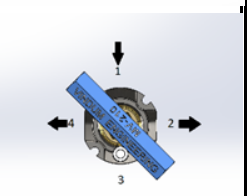
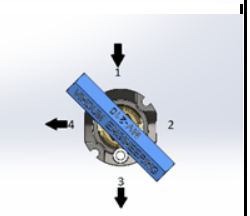
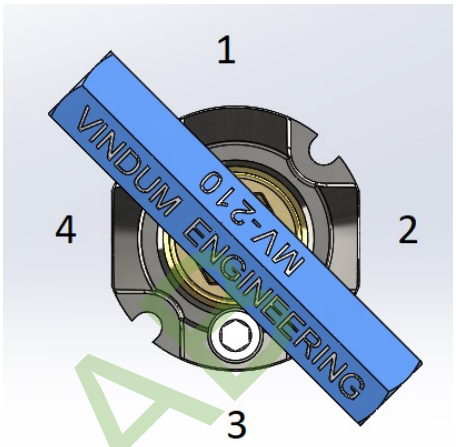
Chapter 2

2. Valve Configurations

2.1 Single Handled Valves

Valves are available with one inlet and one outlet, two inlets and one outlet, and with one inlet and two outlets. The lower ports should be used for inputs, as using the upper ports for inputs places constant pressure on the O-rings, and will reduce O-ring life. The following table details the various configurations allowed.

Inlets	Outlets	Flow direction
1	2	
1	3	
1	4	
1	2,3	
1	2,4	
1	3,4	



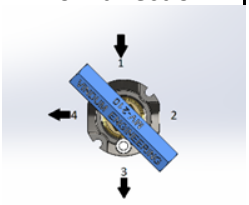
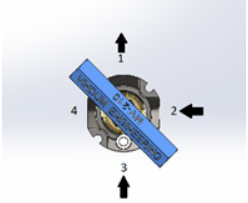
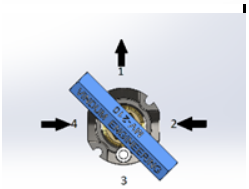
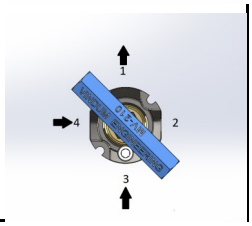
Inlets	Outlets	Flow direction
1	3,4	
2,3	1	
2,4	1	
3,4	1	

Figure 2.1: Valve options and flow directions

Chapter 3

3. Manifold Options

The following table shows the available configurations of our manifolds. Manifolds are available with both Autoclave Speedbite ports (standard) and HiP AF2 ports (specify).

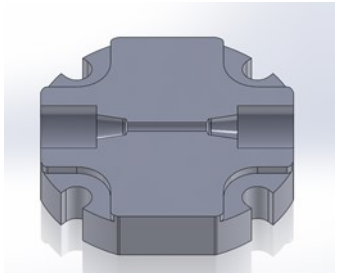
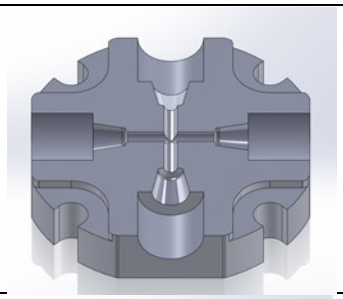
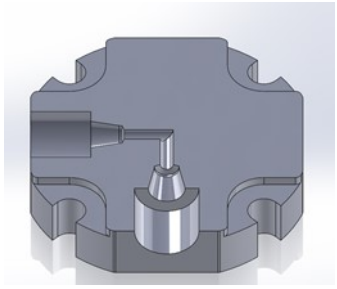
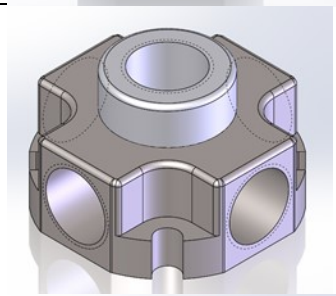
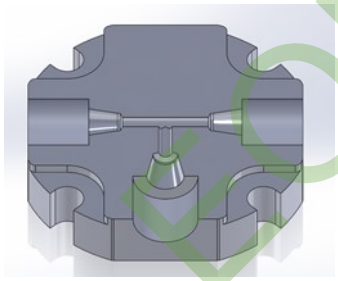
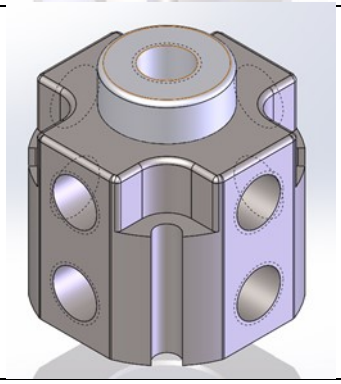
Number of Ports		Number of Ports	
2, Union		4, Cross	
2, Elbow		5	
3, Tee		9	
• SS stands for full stainless steel construction. HC stands for stainless steel body with a Hastelloy Core.			

Figure 3.1: Manifold options

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Chapter 4

4. Modular Breadboard Plate

4.1 Plate Sizing

Breadboard plates are available at almost any size, by request. 1” or 25mm hole spacing patterns are available. 1” spaced boards require 8-32 screws.

4.2 Tube Sizing

If you are using Autoclave Speedbite ports (standard) with Vindum Manual Valves, you have the option of using 1/8” or 1/16” tubing. HiP AF2 ports require 1/8” diameter tubing.

In order to properly size tubing on Vindum breadboards, we use 90° angles when creating bends in the tubing. This allows the tubing length to be calculated with a simple equation.

L=X+Y*(n+0.5)

Variable	Variable name
L	Length of tubing in one direction
X	Depth of fitting
n	Number of spaces
Y	Spacing size (either 1” or 25 mm.

X values

HiP AF2	Speedbite
.3” (7.62 mm)	.28” (6.35 mm)

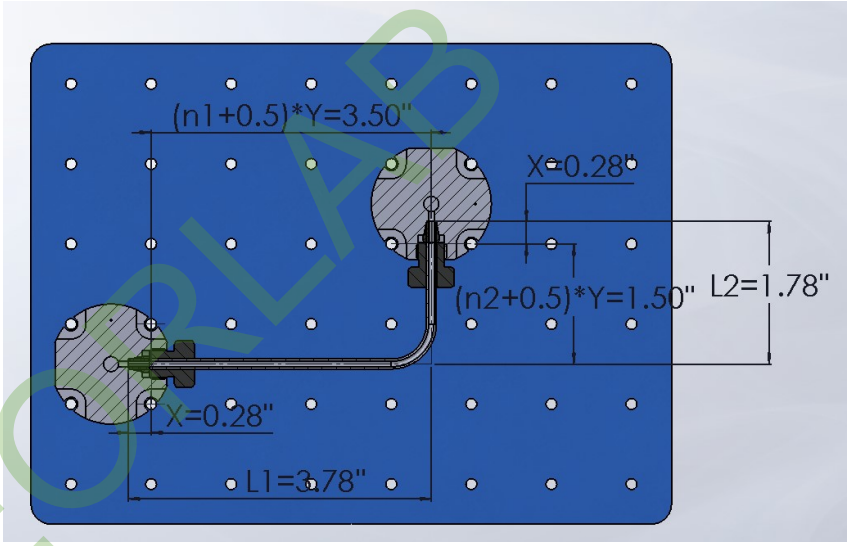

Figure 4.1: Tubing Length Chart

The length of one direction of the tube is measured from the end of the tube to the center of the perpendicular portion along the direction of the tube. While it is possible to calculate the exact length of the tube required by using the formula in the table, and adding length for the radius of the turn, it is often easier to bend the tube into the appropriate shape with excess tubing, then cut the tubing to length. If you use this approach, make sure you account for the radius of the tubing, as failure to do so will result in tubing that is the incorrect length. Slight bends might be required to adapt to the difference in heights between outputs and inputs.

4.2.1 Tube Routing for 5-way and 9-way Manifolds

When using a 5-way or 9-way manifold, it is necessary to route tubing to the top port of the manifold. The easiest way to do this is create three 90° bends in the tubing. Care should be taken when planning the tube routing to ensure that there is no interference with the other tubes coming from the manifold. See figures 4.2 and 4.3 for details on how high the tube routing needs to be. When creating customized bend lengths, it is recommended that you leave at least 5/8” (16mm) before the bend for Autoclave fittings and 7/ 8” (23mm)

for HiP fittings. To fit the tube properly, the tube should enter into the surface of the manifold by X+.2” (5.08 mm). For values of X, see Figure 4.1. It is also necessary to have special routing for the top row of the 9 way manifold fittings. See figure 4.2 for information on 9-way manifold dimensions.

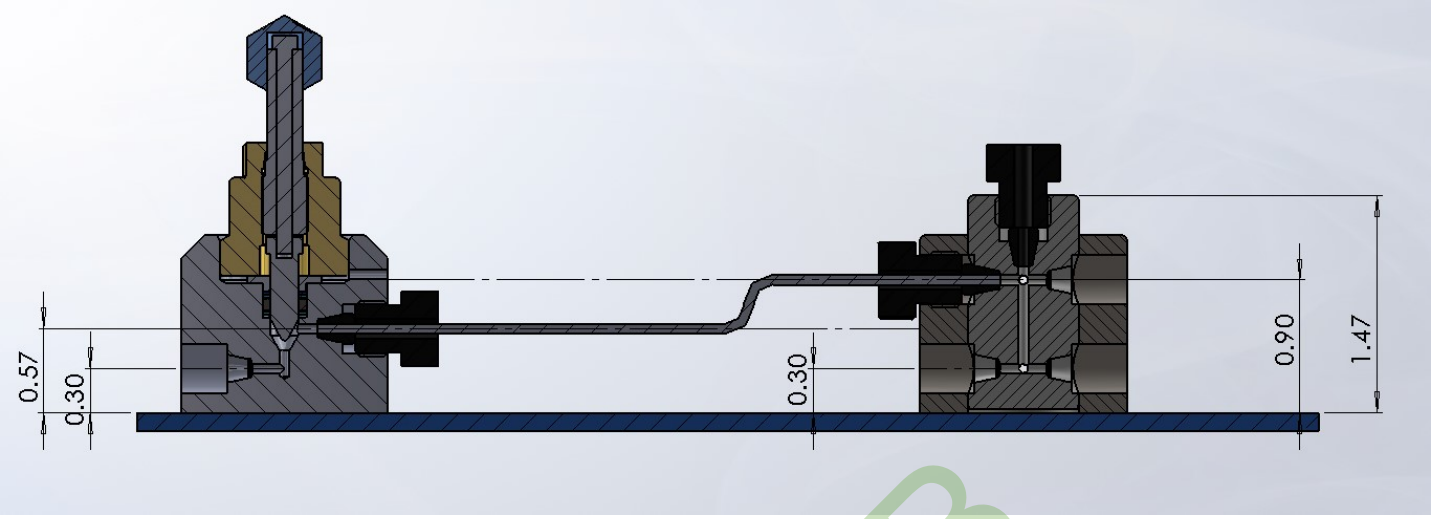

Figure 4.2: 9-way manifold dimensions.

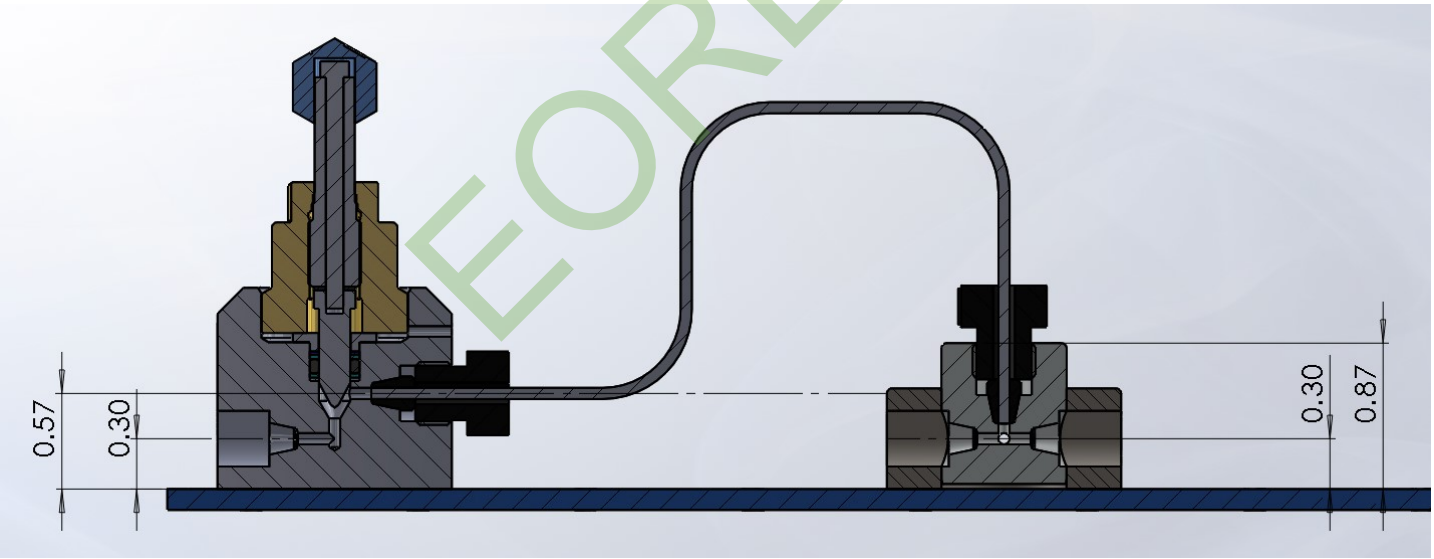

Figure 4.3: 5-way manifold dimensions

Chapter 5

5. Manual Valve Maintenance

5.1 Manual Valve Parts

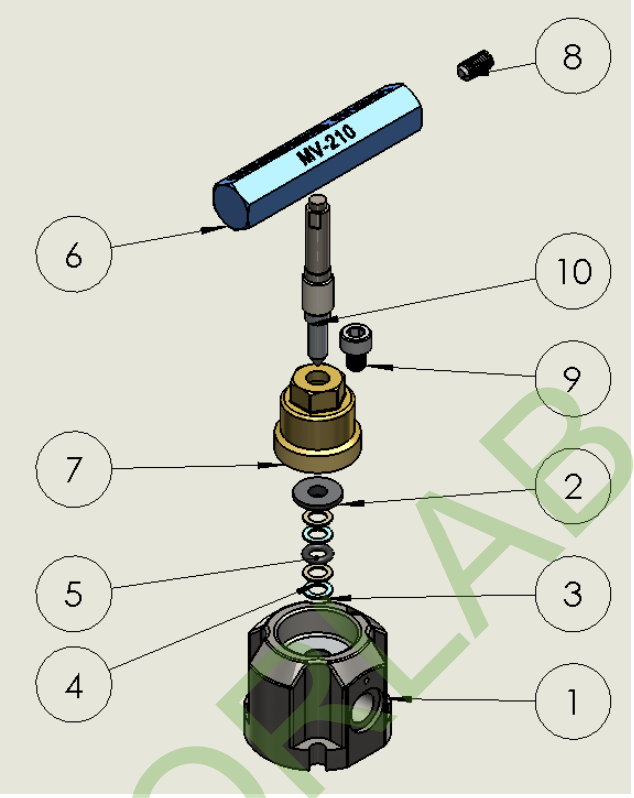

Figure 5.1: Manual Valve Exploded view

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	21100	VALVE BODY, SS & HC	1
2	21070	NUT, PACKING	1
3	410302	Teflon Backup Ring	2
4	410301	PEEK Backup Ring	2
5	ASA568A-119	O-RING, 1.130 O.D. X .924 I.D. X .103 W, Viton® Fluoroelastomer*	1
6	21060	HANDLE	1
7	21050	KEEPER, SEAL PACK	1
8	94105A826	10-32 Set Screw, 3/8" long	1
9	92196A265	18-8 Screw	1
10	21120	Valve Stem Assembly	1

*Other materials available on request.

Figure 5.2: Manual Valve Parts list

5.2 Necessary Tools

- 9/64 Allen wrench
- 5/32 Allen wrench
- 1/8 in Allen wrench
- 1/2 in wrench
- Non metal tapered rod, such as a small wooden skewer, plastic dental pick or nylon rod approximately 1/8" in diameter. (No Metal)

5.3 Disassembly

1. Close the valve all the way.
2. Shut off pressure to fluid and disconnect valve from plumbing.
3. Use 5/32 Allen wrench to remove the screw on top of the valve.
4. Use the 1/2 in wrench to unscrew the brass keeper.
5. Open the valve all the way. This will remove the stem gently without damaging any of the components.
6. Use 1/8 Allen wrench to loosen the set screw in the handle. Remove the handle.
7. Remove the packing nut.
8. Unscrew the stem assembly from the bottom side of the brass keeper.
9. Using the non-metal tapered rod, remove the backup rings in the valve body. The backup rings are removed in the following order: Teflon, PEEK, O-ring, PEEK, Teflon.

5.4 Inspect the part for damages

Wipe the part clean with a paper towel or a clean cloth. Look at the valve stem for scratches or divots. If there are scratches or divots on the valve stem, you may need to polish the stem or purchase a new one.

Inspect the inside of the base for buildup or damage. If there is build-up, remove it with solvent and a rag, but do not use anything that might scratch the seat where the stem contacts the valve body, or near the O-rings. At high pressures, even small scratches can cause leaks.

5.5 Reassembly

1. Replace the backup rings and the O-ring. The order to replace them in is Teflon (tan), PEEK (white), O-Ring, PEEK, Teflon.
2. Place the packing nut in the base with the smaller section toward the backup rings.
3. Screw the stem assembly into the brass keeper all the way. This ensures you do not damage the stem in the next step.
4. Screw the brass keeper into the base. Snug it, but do not overtighten, with a wrench.
5. Replace the 18-8 Screw in the top of the base.
6. Replace the handle and tighten the set screw.

Chapter 6

6. Troubleshooting

6.1 Fluid Supply Problems

If the valve leaks, any one of the following can occur:

- It can leak to the outside, in which case the fluid will come out the bleed port located above one of the high pressure fittings.
- The needle will let fluid pass by it.
- Fluid can leak from one of the high-pressure fittings.

6.1.1 Fluid Leaks from the Valve Bleed Port

If fluid is leaking from the bleed port, fluid is bypassing the O-ring seal. To solve this problem, follow the following steps.

1. Inspect the O-Ring. Make sure it is free from damage and wear. Inspect the O-Ring for contaminants. If there is damage, wear, or contaminates, replace the O-ring. Inspect the back-up rings for damage or contaminants. If the back-up rings are damaged or contaminated, they may be damaging the O-ring. If the backup rings are damaged, replace them. If they are contaminated, you can attempt to remove the contaminate with a cloth and solvent, but if this is unsuccessful, you will have to replace the back-up rings. If the O-ring is damaged, check which direction the pressure is coming from. We recommend using the lower valve port(s) for the high pressure inlet . Using the upper ports will put constant pressure on the O-ring and reduce O-ring life.
2. Inspect the surface of the needle where it contacts the O-ring and back-up rings for scratches. If a scratch is present, fluid will leak through that scratch. The needle will need to be polished with 2000 grit polishing paper, or the stem assembly will need to be replaced.
3. Inspect the valve base where the O-ring and backup rings contact the base for scratches. If the valve base is scratched, the valve base will need to be replaced. You can attempt to polish it with 2000 grit polishing paper, but due to the tight geometry of the valve base, you will most likely be unsuccessful.

6.1.2 Fluid Leaks across a closed valve

If fluid is flowing through the valve when it should be closed, it indicates the fluid is bypassing the valve needle.

- Check the valve stem, needle, and base for contaminates that may be jamming the valve open. If contaminates are present, remove them with solvent, rags, or soft, non-metal tools to avoid scratching any of the valve surfaces.
- Remove the stem assembly and check the valve needle for scratches or indentations. If the needle is scratched or indented, you will need to polish the surface of the valve needle with 2000 grit polishing paper. This is easiest if done on a lathe. If the scratches or indentations cannot be removed, you will need

to replace the valve stem.

- Check the sloped portion of the valve base below the valve stem. If the surface is scratched or indented, you will need to replace the valve base. You can attempt to polish the scratches out with 200 grit polishing paper, but you are unlikely to succeed due to the tight geometries of the valve base.

6.1.3 Fluid leaks from the high pressure fittings

If fluid is leaking from one of the high pressure fittings, it indicates the fitting might not be installed correctly.

- Ensure the fitting is tightened onto the valve properly. For liquids, finger-tight is tight enough. For gasses, tighten about 3/8 of a turn with a wrench.
- If a sufficiently tight fitting is still leaking, the fitting may be damaged. Inspect the fitting sleeve for damage or contamination. Clean any contamination and check for leaks. If the sleeve is damaged, you will have to replace it. This requires replacing the tube as well. However, you should be able to salvage the fitting glands.
- Check the fitting gland for damage. If the threads are not gripping properly, you will have to replace the gland. Replacing the gland requires you to replace both the sleeve and the tube as well, because in most cases you can't remove the gland without destroying the tube the sleeve is on.
- Check the port for damage or contamination. Clean any contamination with a soft cloth, solvent, and soft, non-metal tools. If the port is damaged, you will have to replace the valve body or manifold.

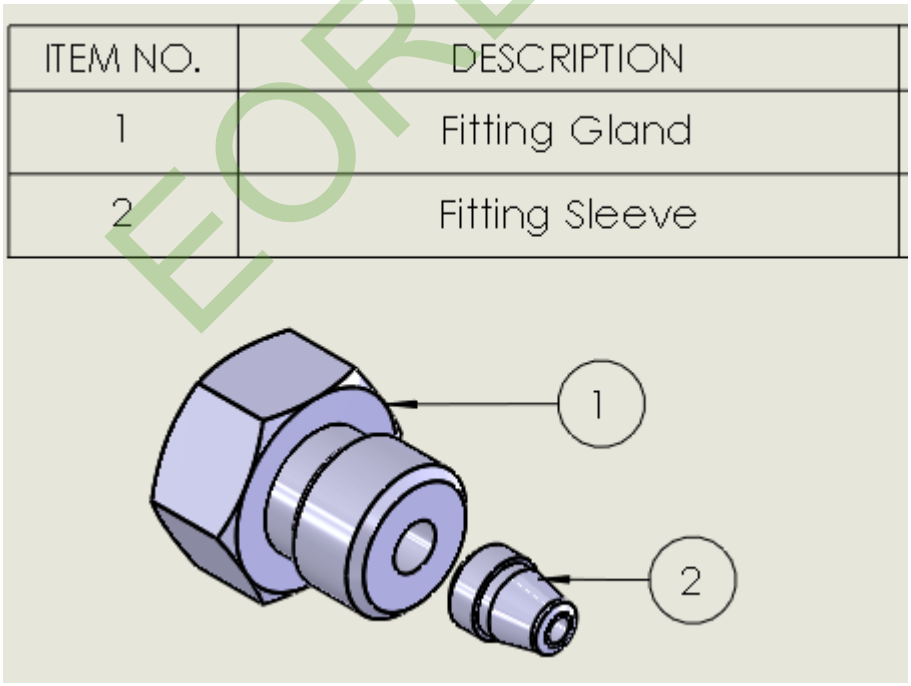

Figure 6.1: Autoclave Speedbite pressure fitting

APPENDIX 1

MV valve parts

Description	BOM Number*	**Quantity**	**Part Number**	**Notes**
Valve Body*	1	1	21100	Available in Stainless Steel or Hatelloy Core
Packing Nut	2	1	21070	
Teflon Backup Ring	3	2	410302	
PEEK Backup Ring	4	2	410301	
O-Ring	5	1	2-008	Wetted O-ring, available in several materials
Handle	6	1	21060	
Seal Pack Keeper	7	1	21050	
10-32 X 3/8” Set Screw	8	1	94105A826	
18-8 X 1/4” Socket Head Cap Screw	9	1	92196A265	
Valve Stem Assembly	10	1	21120	

* BOM number refers to the labels on Figure 4: manual valve parts, page 8

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APPENDIX 2

Commercially Available Parts

FLUID FITTINGS

Description	Manufacturer	Part Number	Notes
Fitting Sleeve* 1/16 in tubing	Autoclave	SSL10 XX	XX is material type: SS for Stainless 316 HC for Hastelloy C-276
Fitting Sleeve* 1/8 in tubing	Autoclave	SSL20 XX	XX is material type: SS for Stainless 316 HC for Hastelloy C-276
Fitting Nut 1/16 in tubing gland	Autoclave	SMN10	Only available in SS, as it is not a wetted part
Fitting Nut 1/8 in tubing gland	Autoclave	SMN20	Only available in SS, as it is not a wetted part
Fitting Nut 1/8 in tubing gland	HiP	15-2AM2	Only available in SS, as it is not a wetted part
Fitting Sleeve* 1/8 in tubing	HiP	15-2A2 XX	XX is material type: SS for Stainless 316
1/16 inch Tubing	Vindum or Any Supplier	.062” OD x .010” wall	SS-316 Hastelloy C-276
1/8 inch Tubing	Vindum or Any Supplier	.125” OD x .035” wall	SS-316 Hastelloy C-276

- The wetted material for the valves is listed on the warranty card.

Description	Manufacturer	Part Number	Notes
10-32 X 3/8” Set Screw	Mcmaster Carr Any Supplier	94105A826	
18-8 X 1/4” Socket Head Cap Screw	Mcmaster Carr Any Supplier	92196A265	
8-32 X 3/8” Socket Head Cap Screw	Mcmaster Carr Any Supplier	91251A192	For use with modular breadboard

Fasteners

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APPENDIX 3

O-ring Compatibility Chart

(taken from "Parker O-Ring® Handbook")

P = Poor F = Fair G = Good E = Excellent	Abrasion Resistance	Acid Resistance	Chemical Resistance	Cold Resistance	Dynamic Properties	Electrical Properties	Flame Resistance	Heat Resistance	Impermeability	Oil Resistance	Ozone Resistance	Set Resistance	Tear Resistance	Tensile Strength	Water / Steam Resist	Weather Resistance
Butyl (-75 - 250F)	FG	G	E	G	F	G	P	G	E	P	GE	FG	G	G	G	GE
Chlorinated Poly-ethylene	G	F	FG	FP	G	G	GE	G		FG	E	F	FG	G	F	E
Chloro-sulfonated Polyethylene	G	G	E	FG	F	F	G	G	G	F	E	F	G	F	F	E
Ethylene Propylene	GE	G	E	GE	GE	G	P	E	G	P	E	GE	GE	GE	E	E
Flourocarbon (Viton) (-515 - 400F)	G	E	E	FP	GE	F	E	E	G	E	E	GE	F	GE	FG	E
Flourosilicone (-100 – 350F)	P	FG	E	GE	P	E	G	E	P	G	E	GE	P	F	F	E
Neoprene (-45 – 250F)	G	FG	FG	FG	F	F	G	G	G	FG	GE	F	FG	G	F	E
Nitrile or Buna N (-30 – 250F)	G	F	FG	G	GE	F	P	G	G	E	P	GE	FG	GE	FG	F
Polyacrylate (-5 to 350F)	G	P	P	P	F	F	P	E	E	E	E	F	FG	F	P	E
Polyurethane (-40 – 180F)	E	P	F	G	E	FG	P	F	G	G	E	F	GE	E	P	E
SBR or Buna S (-70 – 400F)	G	F	FG	G	G	G	P	FG	F	P	P	G	FG	GE	FG	F
Silicone (-70 – 400F)	P	FG	GE	E	P	E	F	E	P	PG	E	GE	P	P	F	E
Teflon Encapsulated (-70 – 400F)	G	E	E	G	G			G		G					G	

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APPENDIX 4
Quote Request/Order Form
For MV Series High Pressure Valves

Required Valve Type and Configuration Information.

	MV Valve	MV Manifold
Select Wetted Material		
316 Stainless Steel	_____	_____
Hastelloy C-276	_____	_____
Port configuration		
Autoclave Speedbite	_____	_____
HiP AF2	_____	_____
Inputs (NA for manifolds)	_____	_____
Outputs (NA for manifolds)	_____	_____
Shape (Tee, union, elbow, or cross)	_____	_____
Expected Fluid Types		
Water, brine, oil, solvents, etc.	_____	_____
Expected Operating Temperature		
Less than 32ºF (0ºC)	_____	_____
If less than 32ºF, how low? _____	_____	_____
Between 60ºF and 320ºF (16º to 160º C)?	_____	_____
Greater than 320ºF (160ºC)	_____	_____
If greater than 320ºF, how high? _____	_____	_____

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