



MDVG-10
with VCR 1/8" fitting



ELDV2-6



MDVG-6



MDVG HT



HIGH PERFORMANCE GC DIAPHRAGM VALVE *

THE ONLY ONE WITH AN EMBEDDED PATENTED PURGE SYSTEM

Diaphragm based chromatographic valves have been around for more than a half-century. Originally, they were in use in BTU analyzers and hydrocarbon measurement GC. With time, their size and built-in actuator feature made them attractive for other applications. Unfortunately, their sealing performance and problems associated with atmospheric diffusion through diaphragm have limited their usage. Users had no choice but to stick to conical rotary valve.

Now, this situation is behind us, thanks to all the innovative concepts we introduced in GC diaphragm valve technology. Indeed, we are providing an entirely new set of performance parameters, which is many times greater than those found in today's market, with a sizable reduction in cost.

Indeed, the valves shown in the following section overcome all the problems of previous diaphragm valve designs. They perform better and longer than GC rotary valves. In fact, the new valves can be used instead of GC rotary valves for most applications, with the exception of a few specific cases.

The unique purging feature, actuator design and assembly procedures result in an outstanding level of performance. Choice of performance grade, multiple ports fitting configuration, choice of actuation, NeSSI™ platform (a world premier for GC valves) and the possibility of custom designs allow maximum flexibility to instrument manufacturers and integrators.

Finally, GC valves that allow your highly sensitive detectors to unleash their full potential.

FIVE SERIES: ELDV1 / ELDV2 / MDVG / DADV / CADV

ELDV1: Standard level of performance, optimized for cost sensitive applications.

ELDV2: High performance level, better leak performance and lifetime, at medium cost.

MDVG: Premium performance grade, low, medium and high temperature grade.

DADV : Double actuation diaphragm valve. This gives independant control of the N.C. and N.O. plungers.

CADV : Cam actuated diaphragm valve, allows upgrade of system based on rotary valve without changing existing actuators and related hardware. First Electrical Driven GC Diaphragm Valve.

*Covered by Pat# 7,931,043 - 8,104,506 - EP2331858 and (5) patents pending.

FEATURES AND BENEFITS

PURGE FEATURES AND BENEFITS

- Add some intelligence to your system with real time valve smart diagnostic capability

- 1) Eliminates permeation and diffusion for low level trace measurement.
- 2) Eliminates inboard/outboard contamination. There are no fugitive emission.
- 3) Creates an inert atmosphere underneath the diaphragm for hazardous application.
- 4) Allows vacuum operation by balancing pressure over and under the diaphragm.
- 5) Allows real time monitoring of valve condition by verifying the purge outlet quality.

This unique purging feature makes GC instrument much more reliable.

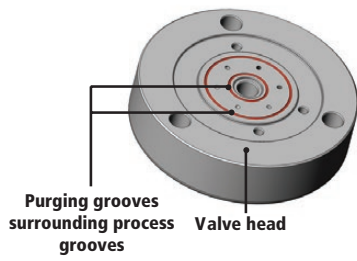


FIGURE A

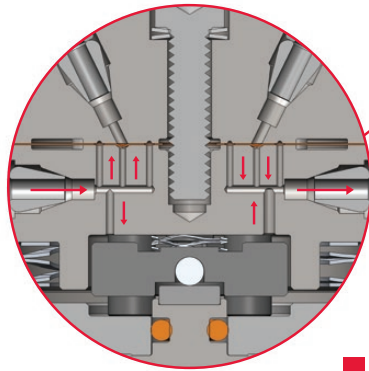


FIGURE B

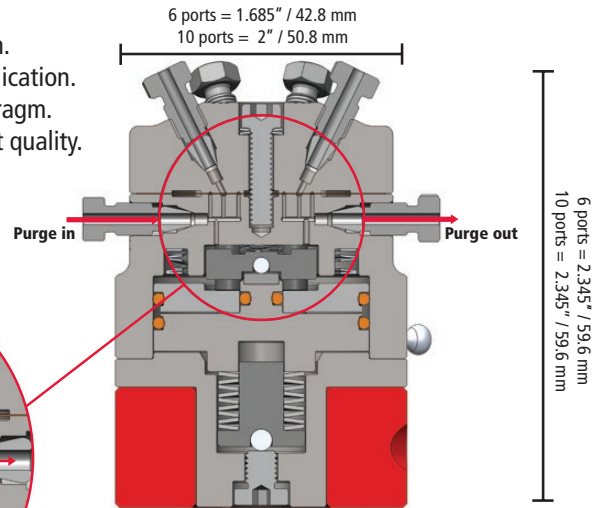


FIGURE C

SEE AN-04 FOR HOW TO GET MAXIMUM BENEFITS FROM THE PURGE FEATURE.

RELIEF PINS :

- 1) Eases the process of diaphragm replacement in the field by pulling down all plungers
- 2) Relief pins remove stress on diaphragm for long term storage.

DIAPHRAGM DESIGN :

- 1) Multi-layer diaphragm.
- 2) Optional coating / metallization.
- 3) Choice of material.

PLUNGER DESIGN

- 1) Precisely machined in metal.
- 2) Tight length tolerance.
- 3) Self aligned compressible (spring return), two-part-plungers (Patent Pending Design).
- 4) Tied base plunger design.
- 5) Valve can be operated in any position. Plungers will not stick, and there is no friction. Low and equal pressure drop on all ports.
- 6) Force is applied to the total plunger surface area.
- 7) Uniforms sealing force on the diaphragm.

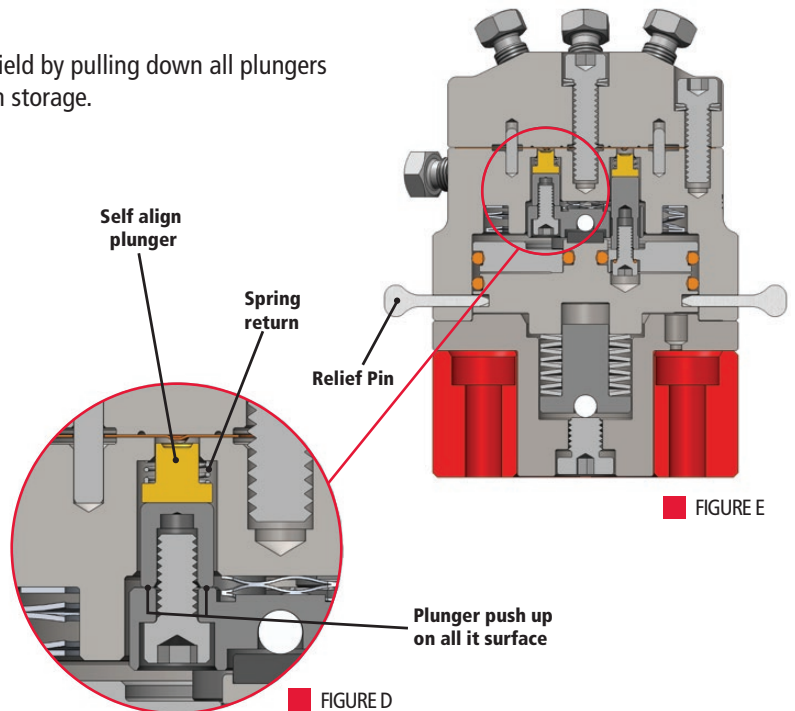


FIGURE D

FIGURE E

3 CHOICES OF PERFORMANCE MODE

ELD V 1 STANDARD AND ELD V 2 HIGH-PERFORMANCE GRADE GC DIAPHRAGM VALVE

Mission critical applications demand the best available product, but not every system requires the Premium Grade MDVG series. This family of chromatographic diaphragm valves have been designed to fill the need for standard and high performance specifications are required.

The ELDV series will fill the need of most bench top laboratory GC while providing a high level of sealing performance and lifetime, better than the standard GC rotary valve generally available on the market and this at a lower cost and better offering value.

Description:

The user may choose only the configuration option he needs, contributing to a further cost reduction. The valve is available in two (2) configurations, ELDV 1 and ELDV 2. Add to this the XL option, i.e. extended life (1.5 million cycles), is available.

ELD V Series Configuration:

- Aluminum actuator body, SS-316L valve head
- Both configurations are purge, as per premium grade MDVG series. See purging description section to understand the purge concept and its benefits.

Selection guideline:

- ELDV1 (standard grade): Optimize for cost sensitive application.
- ELDV2 (high performance grade): Better leak performance and lifetime at medium cost.
- XL (extended life) option available for the LT grade.



Note: If your application requires fast temperature cycling, please see the MDVG series.

MDVG - PREMIUM GRADE, GC DIAPHRAGM VALVE

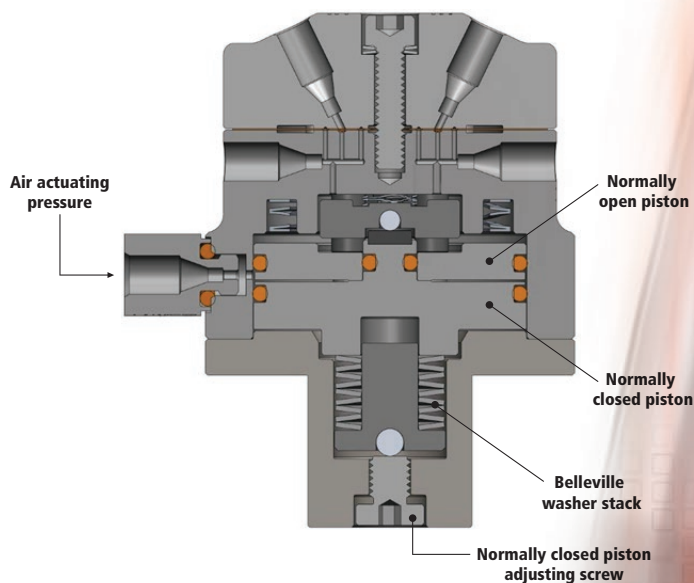
This series is the premium grade, all stainless steel purge valve. It allows higher pressure and temperature operation. It is also available with VCR 1/8" fittings. This is the choice for mission critical applications, process GC, fast temperature cycling and where a special coating is required. XL option, i.e. extended life (1.5 million cycles) available for the LT grade. Ideal for sensitive GC/MS vacuum application.

ACTUATOR TYPE

ELD V / MDVG - STANDARD ACTUATOR TYPE I.E. PNEUMATIC, SINGLE ACTING

This standard version is in use in most of the ELDV / MDVG-series valves. It's based on a single acting pneumatic actuator, supplied by an only inlet actuation port. When pressure (60-65psig) is applied, the normally open piston and plungers will move up closing connections between ports, while the normally closed piston and plungers will go down opening new connections. The non-mixing time is determined by adjusting the compression of the Belleville washer stack. The non-mixing time is defined as the time that all plungers are up during the actuation process. This make sure that there is no cross-port flow contamination during actuation. Indeed all ports are isolate before to move to next position. This is true when actuating and de-actuating the valve.

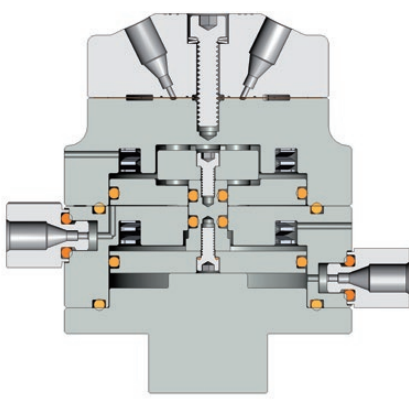
Note: The valve could also be tune to allow very little mixing upon actuation. This could be a benefit for specific application like when the sample loop is very small and the sample is gas. This eliminates redundant peaks up in valve de-actuation.



DADV - DOUBLE ACTUATION DIAPHRAGM VALVE ACTUATOR

This actuator allow independent control of the normally opened (N.O.) and normally closed (N.C.) plungers. Different actuating pressure could be used, control of the non-mixing time, control of the actuation speed, etc... Belleville spring may be also added to allow a fail safe position or to pre-define plunger position i.e. N.C. or N.O.. Ideal for method and specific system development.

SEE APPLICATION NOTE AB-04 FOR APPLICATION IDEAS AND ACTUATOR MECHANISM VARIATION.



DADV6-16TP

CADV - CAM ACTUATED DIAPHRAGM VALVE THE FIRST ELECTRICAL DRIVEN GC DIAPHRAGM VALVE

This is a cam actuated version of our ELDV or MDVG series diaphragm valves. This valve can be actuated manually with the help of a handle. The CADV allows a direct upgrade of the existing GC equipped with rotary valves and their related pneumatic actuators. The CADV could be installed on existing pneumatic actuators, allowing the system to benefit from the GC diaphragm valve features.

However the most important benefit of the Cam base actuator is the possibility to use an electrical actuator. This is the first time that a GC diaphragm valve is made available with such actuator. This eliminates the need of actuating gas, a real benefit for portable instrument like explosive and hazardous detection system for homeland security. Sequential sample injection could be easily done, resulting in the elimination of baseline upset upon injection. See AN01, app#8 for more detail about this specific application.



CADV installed on a electrical rotary actuator.



CADV with base mounted handle actuation handmade.



CADV installed on a VICI[®] pneumatic rotary actuator, for older system upgrade.

NeSSI™ : THE NeSSI™ MODULAR MOUNTING PLATFORM (ANSI/ISA 76.00.02 COMPATIBLE)

During the last decade, the NeSSI™ platform has become more and more popular. However no chromatographic valve was available for this standard. Here the first GC diaphragm valve for the NeSSI™ platform. Internal sampling loop, six and ten ports are available. These valve series is the same as our MDVG, except for valve's head connection.

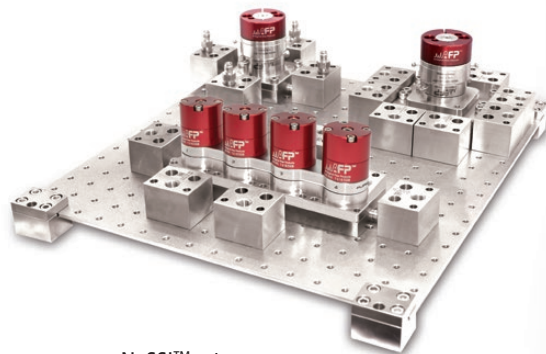
When use with the DVS, sample stream selection valve, (see DVS product literature) a complete analytical grade sampling system could be done with a level of performance not attainable with existing system on the market. This platform enable plug and play installation, easy maintenance, sample integrity, standard design and smart system i.e. self diagnostic by monitoring the purge gas and absolutely NO sample contamination.



MDVG-6-NT-P
Six ports sample injection valve



DVS-4-NT-RM-31
Inlets sample stream selection valve



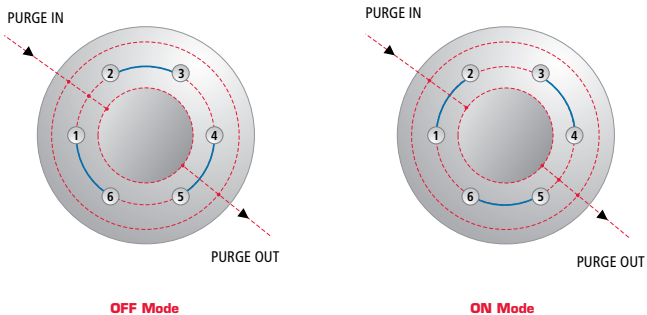
NeSSI™ valves
mounted on the platform.

FLOW PATHS

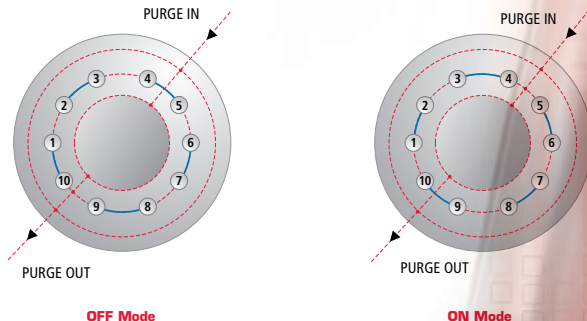
CONVENTIONAL FLOW PATH

The conventional flow path is the most common one used in gas chromatography. The main benefit of this configuration is to never interrupt the fluid, upon normal operation. So, fluid is continuously flowing in all ports, whether the valve is actuated or not. This particularity comes from the fact that actuation plungers are stopping the flow between the ports, instead of acting directly on the port.

MDVG-6



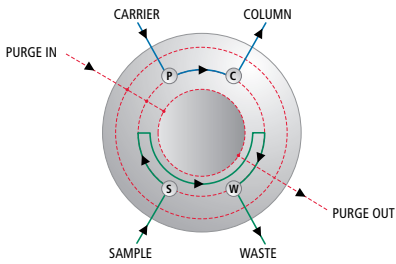
MDVG-10



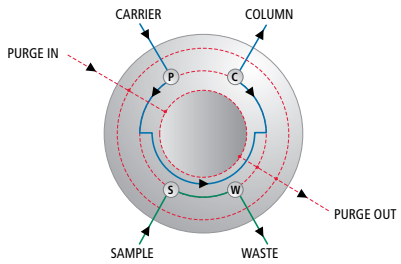
ISL - INTERNAL SAMPLING LOOP

The internal sampling loop is available in a variety of model i.e. ELDV / MDVG / CADV / DADV / NeSSI™ and the size of the sampling loop is available in 0.5µl, 1.0µl, 1.5µl, 2.0µl, 3.0µl, 5.0µl. There is also the double internal sampling loop diaphragm valve. It can be configured in two different modes i.e. alternate or simultaneous. The ADSL version (Alternate Double Sampling Loop) will inject the two samples on an alternate base. On the other end we also have the SDSL version (Simultaneous Double Sampling Loop) that will inject both samples simultaneously. We offer the possibility to have different size of sampling loop in the same valve in a range of 1.0µl to 5.0µl. It is also possible to have one internal sampling loop and one external on the same valve head. Useful when the instrument measuring range must be change in real time.

MDVG-4-ISL-SERIES (INTERNAL SAMPLING LOOP)



OFF Mode
The sample is injected into the sampling loop

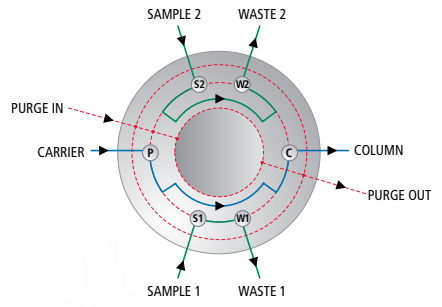


ON Mode
The sample is injected into the column

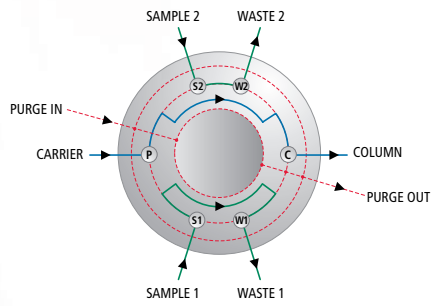


MDVG-4-16TP-ISL

MDVG-10-ADSL-SERIES (ALTERNATE DOUBLE SAMPLING LOOP)

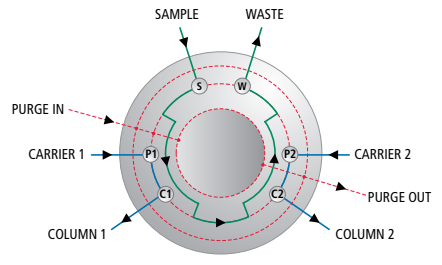


OFF Mode
Sample #1 is injected into the column • Sample #2 is loaded into the sampling loop

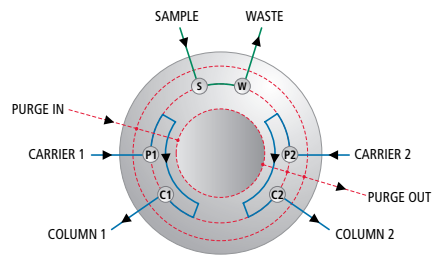


ON Mode
Sample #1 is loaded into the sampling loop
Sample #2 is injected into the column

MDVG-10-SDSL-SERIES (SIMULTANEOUS DOUBLE SAMPLING LOOP)






OFF Mode
Sample is loaded into the double sampling loop



ON Mode
Sample is injected into the column #1 and column #2

- Longer lifetime, and better performance than rotary valves.
- Eliminates/reduces detector upset and valve artifacts.
- Allows new GC methods, not possible with commercial GC diaphragm valves.
- Includes all fittings, adaptors and mounting clamps.
- Parts traceability.
- 100% Helium mass spectrometer leak tested.

		ELDVSERIES		MDVGSERIES	
		Standard grade, low temperature		Premium grade valves high pressure / high temperature	
		ELDVSERIES	ELDVSERIES	MDVGSERIES	
					
		(Aluminium Body & SS-316L valve valve head)	(Aluminium Body & SS-316L valve valve head)	(ALL SS-316L Body & valve head)	
FEATURES					
STANDARD MAXIMUM WORKING PRESSURE (PSI / kPa) ①		300 / 2068	300 / 2068	500 / 3450	
MAXIMUM WORKING TEMPERATURE (°C / °F)	LT	100 / 212	100 / 212	100 / 212	
	MT	N/A	180 / 356	180 / 356	
	HT	N/A	N/A	250 / 482	
DIAPHRAGM TYPE (LT / MT / HT) ②		AFPD-1	AFPD-1 / AFPD-2	AFPD-1 / AFPD-2 / AFPD-3	
LEAK RATE ③	Cross ports (max pressure)	9.0x10 ⁻⁹ Atm-cc/sec He	4.7x10 ⁻¹¹ Atm-cc/sec He	3.0x10 ⁻¹² Atm-cc/sec He	
	Cross ports (100 PSI)	5.0x10 ⁻¹⁰ Atm-cc/sec He	9.4x10 ⁻¹² Atm-cc/sec He	6.0x10 ⁻¹³ Atm-cc/sec He	
	In / Outboard	1.0x10 ⁻¹⁰ Atm-cc/sec He	4.7x10 ⁻¹² Atm-cc/sec He	3.0x10 ⁻¹³ Atm-cc/sec He	
ESTIMATED WORKING LIFETIME (YEAR) ④		2	3	5	
Valve Cap	VALVE CAP MATERIAL ⑤	SS-316L	SS-316L	SS-316L	
	NUMBER OF PORTS (6/10)	6 / 10	6 / 10	6 / 10	
	PORT CONNECTION (") ⑥	1 / 16	1 / 16	1 / 16	
	PORT SIZE (") ⑦	.030	.030	.030	
	INTERNAL DEAD VOLUME (6/10) ⑮	0.14 µl / 0.12 µl	0.14 µl / 0.12 µl	0.14 µl / 0.12 µl	
Actuator	ACTUATOR TYPE ⑧	Pneumatic single actuation (spring return) with relief pin			
	ACTUATING PRESSURE (PSI / kPa) ⑨	65 / 450	65 / 450	65 / 450	
	GAS CONSUMPTION PER ACTUATION (6/10)	in ³	.05 / .07	.05 / .07	.05 / .07
		cc	.75 / 1.00	.75 / 1.00	.75 / 1.00
	CYLINDER BODY MATERIAL ⑩	Special aluminium grade treated as per AFPM-3 method	Special aluminium grade treated as per AFPM-3 method	SS-316L	
SURFACE TREATMENT PROCEDURE ⑩	AFPM-2	AFPM-2	AFPM-2		
SURFACE CLEANING PROCEDURE ⑩	AFPC-2	AFPC-2	AFPC-2		
TYPICAL APPLICATIONS	GC / Standard performance / Low temperature	GC / High performance / Low and Medium temperature	GC / LC, Low / Medium / High performance		
WEIGHT (6/10)	GR	285 / 365	285 / 365	440 / 565	
	OZ	10 / 12.9	10 / 12.9	15.5 / 19.9	
Pricing	OPTIONS (\$US)				
	Valve head coating ⑪	Call	Call	Call	
	Pre-conditioning ⑫	+ \$125	+ \$125	+ \$125	
	Vacuum ⑬	+ \$95	+ \$95	+ \$95	
	XL (Extended life) ⑭	+ \$185	+ \$185	+ \$185	

NOTES

- ① Working pressure of the internal sampling loop configuration is available up to 700PSI. Please see ISL section.
- ② AFPD-1, AFPD-2 and AFPD-3 refer to the diaphragm type being use in the valve. AFP diaphragm could be multi-layer (metal coated). Special surface treatment is also involved. Be sure to always use your valve with the specified diaphragm type.
- ③ Leak rates are verified at maximum operation conditions. Please see engineering note EN-01 for more information. This note is available on our website. Leak rates are verified on a VARIAN™ helium leak mass spectrometer detector and on AFP® proprietary online leak detection system.
- ④ LT i.e. 100°C, 1.0 million actuations
 MT i.e. 180°C, 700, 000 actuations
 HT i.e. 250°C, 500,000 actuations
 Based on a cycle time of 5 minutes, 24 hours, 365 days / year. (see note ⑭ for extended life version)
- ⑤ Standard material is SS 316L, Hastelloy, Monel, Zirconium, Titanium, Peek, Teflon and ceramic material are available. Other polymers material are available on request. High temperature grade, HT, have the valve head with special coating.
- ⑥ Standard port fitting are 1/32", 1/16", 1/8" VCR, welded tube are available. Any mix of the above is also available on the same valve heads.
- ⑦ Other port size are available like .010", .015" or .040".
- ⑧ Standard actuation is the pneumatic single acting (spring return) type, with a single actuation inlet port. Another actuator type is available i.e. double actuation and cam base. All actuator versions allow actuation with no flow mixing upon actuation. The cam base actuator allow the sequential injection mode.
- ⑨ See specific valve configuration (i.e. LT, MT, HT or vacuum) for proper actuation pressure.
- ⑩ AFPM-2, AFPM-3 are proprietary surface treatment procedures. AFPC-2 are AFP cleaning procedures , O2 compatible.
- ⑪ Valve head coating : (for example SilcoNert 2000™) : the ultimate passivation of treated surfaces. There is a required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds & mercury. Greatly reduce moisture contamination, improve system performance and eliminates surface adsorption of active compounds on steel.
 Note : Others coating are available on request.
- ⑫ Pre-conditioning : This option allows the elimination of atmospheric contaminants from the wetted internal surface. It speeds up the system's start up. The valve is then ship with all it's port plugged. It is very useful when working with helium carrier gas and ionisation base detector.
- ⑬ The vacuum configuration has a special spring, and require different tuning during the assembly. Actuation pressure is also slightly higher. Please see specification sheet include with your valve.
- ⑭ The XL option, i.e. extended life, is available for all LT grade temperature with a rated actuation at 1.5 millions.
 *The XL option not available yet at the time of the printing of this brochure for the MT and HT temperature grade.
- ⑮ Internal dead volume is measured between a plunger in closed position and one of the adjacent port.

ELDV/MDVG/DADV/CADV SERIES CONFIGURATION

Models	# of port	Fitting	Temperature	Sampling	S.L. size	Option
ELDV1 ELDV2 MDVG DADV CADV	4 6 10	16= fitting 1/16" LS16= Lip Seal 1/16"* V8= VCR 1/8"	LT= 100°C MT= 180°C HT= 250°C	0= N/A ISL ADSL SDSL	0 = N/A 05= 0.5 µl 10= 1.0 µl 15= 1.5 µl 20= 2.0 µl 30= 3.0 µl 50= 5.0 µl XX= Custom size	P - Backside of the diaphragm purged XL - Extended life S - SilcoNert2000™ D - Dursan™ C - Pre-conditioning V - Vacuum HC - Hastelloy® MO - Monel® TI - Titanium P10 - .010" Ports Size P15 - .015" Ports Size P40 - .040" Ports Size XX - Custom request

Ex: MDVG-6-16MT-0-0
Mini Diaphragm Valve Grooved,
with purge, 6 ports of .030", Fitting 1/16",
180°C, 500 psi, diaphragm AFPD-2, All SS-316L valve.

***Lip Seal:** Lip Seal fitting is our new patent pending AFP fitting detail. This reduces the dead volume, eliminates the rotation of the ferrule and improves the sealing resulting in an improved connection for valve and fitting. This is very beneficial for any analytical high sensitivity instrumentation. Sealing integrity of a VCR fitting with the flexibility of a compression fitting. Please refer to Design Report 3 (DR-3) in the Analytical Flow Product Cookbook.

*Patent Pending

SPARE PARTS :

VALVE HEAD

# of port	Fitting	Temperature	Sampling	S.L. size	Option
4 6 10	16= fitting 1/16" LS16= Lip Seal 1/16"* V8= VCR 1/8"	LT= 100°C MT= 180°C HT= 250°C	0= N/A ISL ADSL SDSL	0 = N/A 05= 0.5 µl 10= 1.0 µl 15= 1.5 µl 20= 2.0 µl 30= 3.0 µl 50= 5.0 µl XX= Custom size	S - SilcoNert2000™ D - Dursan™ HC - Hastelloy® MO - Monel® TI - Titanium P10 - .010" Ports Size P15 - .015" Ports Size P40 - .040" Ports Size XX - Custom request

***Lip Seal:** Lip Seal fitting is our new patent pending AFP fitting detail. This reduces the dead volume, eliminates the rotation of the ferrule and improves the sealing resulting in an improved connection for valve and fitting. This is very beneficial for any analytical high sensitivity instrumentation. Sealing integrity of a VCR fitting with the flexibility of a compression fitting. Please refer to Design Report 3 (DR-3) in the Analytical Flow Product Cookbook.

*Patent Pending

REPLACEMENT DIAPHRAGM

# of port	Temperature	Sampling	S.L. size
4 6 10	LT= 100°C MT= 180°C HT= 250°C	0= N/A ISL ADSL SDSL	0 = N/A 05= 0.5 µl 10= 1.0 µl 15= 1.5 µl 20= 2.0 µl 30= 3.0 µl 50= 5.0 µl

VALVE ACTUATOR REPLACEMENT KIT

VARK - [] - [] - [] - [] - []

Valve type	# of port	Temperature	Sampling	Option
E1= ELDV-1 E2= ELDV-2 MG= MDVG CA= CADV DA= DADV	4 6 10	LT= 100°C MT= 180°C HT= 250°C	0= N/A ISL ADSL SDSL	V - Vacuum XX - Custom request

HARDWARE SPARE PARTS

(Screws & Belleville Washers)

BWVC - [] - []

# of port	Temperature
6 10	LT= 100°C MT= 180°C HT= 250°C

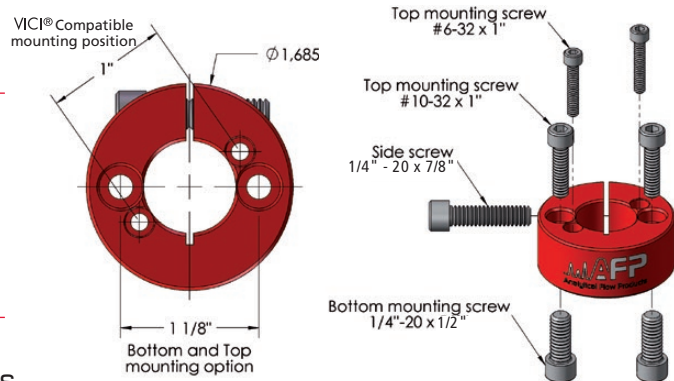
CLAMP RING

Part number: CR-MDV

TOOL KIT

(This include all the tools and spare relief pins to do the maintenance i.e. replacing a valve head, diaphragm, actuator)

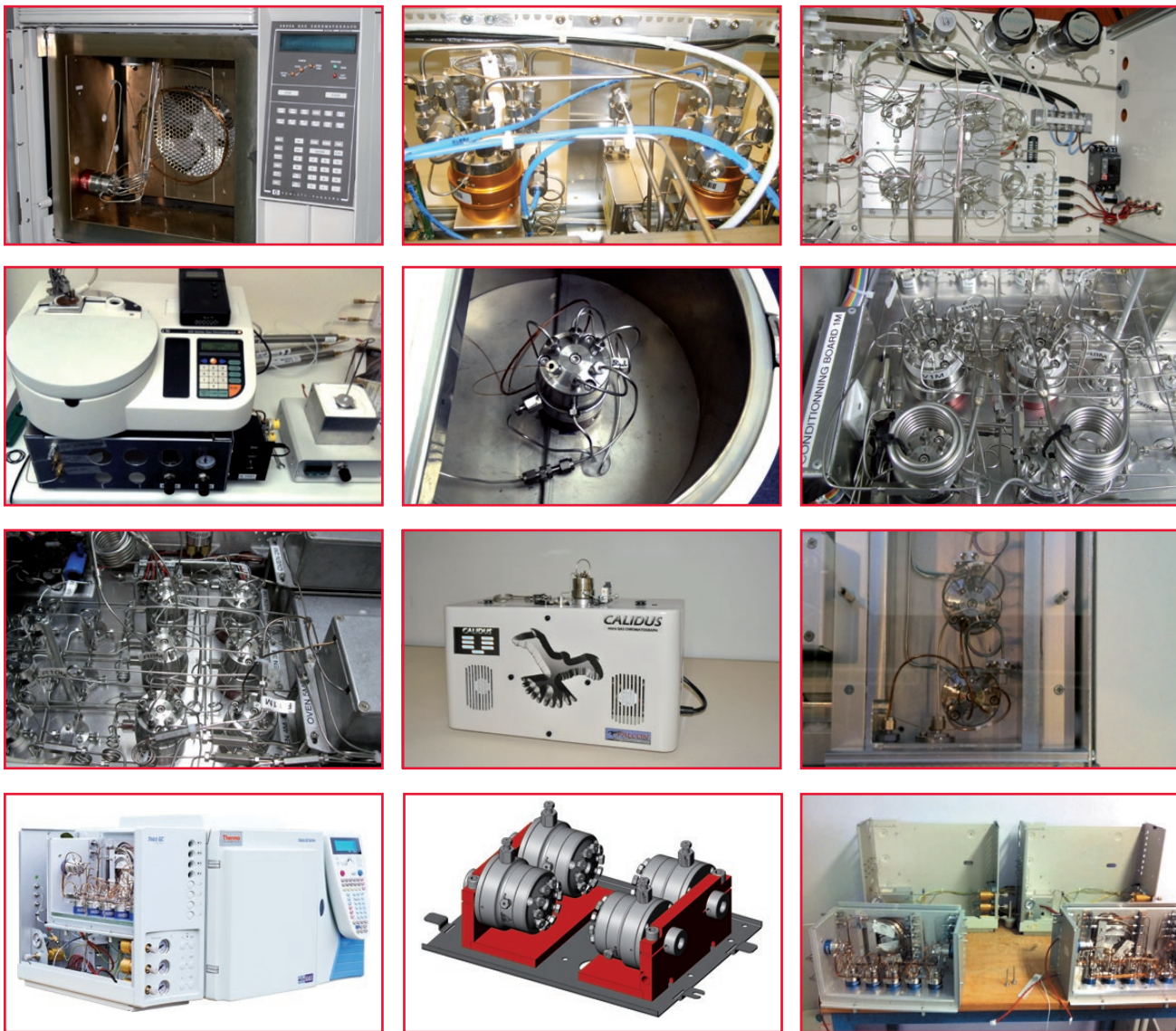
Part number: TK-01



Option

- | | |
|--|--|
| P = Purge option (included in MDVG series). | V = Vacuum operation configuration. |
| XL = Extended life (for LT temperature grade only). | HC = Valve head made of Hastelloy®. |
| S = SilcoNert 2000™ The ultimate passivation of treated surfaces. A required treatment for metal components when analyzing for parts-per-billion levels of organo-sulfur compounds & mercury. Greatly reduce moisture contamination, improve system performance and eliminates surface adsorption of active compounds on steel. | MO = Valve head made of Monel®. |
| D = Dursan™ is a coating designed to improve the inertness, hardness, and corrosion resistance of stainless steel. Ideal for sulfur, H ₂ S, mercaptan, ammonia and mercury sampling. | TI = Valve head made of Titanium. |
| C = Pre-conditioning; this allows the elimination of atmospheric contaminants from the wetted internal surface. | P10 = Valve head with .010" Ports Size. |
| | P15 = Valve head with .015" Ports Size. |
| | P40 = Valve head with .040" Ports Size. |
| | XX = Custom request. |

PICTURE GALLERY



Specially designed heated valve box

Note : Reference literature; ELDV/MDVG-User instructions, AN-04

SEE AN-02 IN THE TECHNICAL SECTION FOR APPLICATION IDEAS FOR THE ELDV, MDVG AND CADV SERIES

Base on a specific valve configuration and working condition, warranty period and valve maintenance procedure, (i.e.) parts replacement are different. Please refer to Analytical Flow Products™ specific valve documentation for more information.

Is still the responsibility of the user to make sure that for the selected valve configuration is safe and reliable for his application.

Analytical Flow Products engineering team will do their best to help customers for any application that may require custom modification. Analytical flow products will be please to supply demonstration parts to qualified O.E.M.

*SEE WEBSITE FOR WARRANTY AND DISCLAIMER NOTICE. PRODUCT SPECIFICATION MAY CHANGE WITHOUT NOTICE, ASK FOR UPTODATE NOTIFICATION.



OFFERING COMPARISON OF GC DIAPHRAGM VALVES

FEATURES AND BENEFITS	AFP®	COMPETITORS
3 Choices of Performance level No Leaks from 300 to 750 psig Valve can be used from -20°C to 250°C Internal Sample Valve can be used from -20°C to 250°C	3 • • •	N/A N/A N/A N/A
Standard Purge Design Concept Valve can be used under vacuum for GC/MS application Allows safe operation with hazardous gases Allows real time monitoring the valve's health Eliminates fugitive emission and inboard/outboard contamination Eliminates permeation/diffusion through the diaphragm	• • • • • •	N/A N/A N/A N/A N/A N/A
Valve Head Configuration 1/32", 1/16" ports AFP Lip Seal fitting 1/16" 1/8" VCR or welded tube NeSSI™ as per ANSI/ASI-76.00.02-2002 (surface mounted) Polymer or Ceramic Dual internal sampling loop Choice of coating: Sulfinert, Gold, Tantalum	A A A A A A A	• N/A N/A N/A N/A N/A N/A
Actuation Mechanism Relief pins design Tied plungers design No flow mixing upon actuation (Mixing is tunable) Single acting / Single inlet port Double actuation mechanism Cam or Electric actuator	• • • • A A	N/A N/A N/A • N/A N/A
Choices of Diaphragm to match Application Can be coated with Teflon®, Gold, Nickel, Custom Keyed to fit only one way	3 A •	2 N/A N/A
Manufacturing / Quality Assurance Internal parts traceability 100% helium leak test Valve Pre-conditioning	• • A	N/A EXTRA COST (175\$) N/A
Hardware Nuts and ferrules Pneumatic adaptor Clamp ring	• • •	• EXTRA COST EXTRA COST

• : Standard A : Available N/A : Not Available

FEATURES OF AFP® DIAPHRAGM VALVES

1- Selected from 3 models to match your requirements.

- Working lifetime ranges from 2 to 5 years.
- Pressure ranges from 300 to 700psig.
- Temperature ranges from -20°C to 250°C.
- Specs guaranteed for 500,000 to 1,000,000 cycles (depends on model).
- Gas or Liquid.

2- Unique Purging Design Concept: Unsurpassed Value added benefit for system designers and users.

- Eliminates fugitive emission and inboard / outboard leaks.
- Eliminates permeation / diffusion through the diaphragm.
 - No more negative peaks.
 - Ideal for low level impurities measurement.
- Allows vacuum application for GC / MS systems and sub atmospheric sampling
- Eliminates a bulky purge enclosure.
- Allow safe operation with hazardous gases.
- Built in purge flow restrictor option.
 - Eliminates the need to set up an external flow restrictor to fix the purge flow.
- Allows real time monitoring the valve's health.
 - Prevents unwanted and costly system shutdown.

3- Valve's Head Configuration: Users flexibility, tailor to fit application !

- Six or ten ports.
- Single internal sampling loop: 0.5µl to 5.0µl.
- Dual sampling loop:
 - Alternate or simultaneous injection.
 - Loop could be of different size on the same valve's head.
 - One internal / one external, configuration available.
- Material:
 - choice of polymers / SS-316L (Standard) / Hastelloy / Monel / Titanium / Others and custom...
- Choice of coating:
 - Sulfinert / Gold / Tantalum / Others...
- 1/32", 1/16", 1/8" VCR or welded tube or a combination of, on the same valve head.
- Unique to AFP® NeSSI® version as per ANSI / ISA-76.00.02-2002
 - Ideal for surface mounted petrochemical/chemical plant applications.

4- Choice of actuation mechanism for maximum user's flexibility.

General Characteristic :

- Absolutely no port flow mixing upon actuation (carrier mixing with the sample).
 - Eliminate unwanted artifacts upon actuation.
- Unique relief pins design concept. (Patent Pending)
 - Allows simple and quick diaphragm replacement.
 - Allows long term storage with no diaphragm distortion.

- Tied plungers design. Allow valve operation in any position under heavy vibration environment for extended period. Ideal for:
 - High altitude atmospheric sampling balloon / Plane and space vehicle.
 - Boat or submarine equipment / Mobile laboratory / Portable equipment.

Select between 3 types of actuation mechanism:

A) Standard Actuator Body:

- Single acting, Single inlet port, Pneumatic actuation

B) Pneumatic double actuation:

- Double actuating mechanism:
 - Allow lower actuating pressure to be use.
 - Ex: Carrier pressure of 100 psi = 30 psi of actuation pressure
 - Carrier pressure of 300 psi = 50 psi of actuation pressure
 - Allow full control of switching time.
 - Choice of N.C and / or N.O configuration or a mix of them.

C) First electrical driven diaphragm valve, Cam Driven Actuator Body:

No actuation gas required for actuation !

- Available with different flow switching scheme:
 - load / isolate / inject
 - load / pressurize / inject → No carrier and column head pressure variation.
 - Custom flow switching sequence.
- Actuation could be done manually or by any rotary actuator.
 - Allows electrical actuation.
- This will allow you to retro fit AFP® valves onto existing rotary pneumatic or electric actuators.

5- Diaphragm Design:

- Polyimide treated core.
- Can be coated with; Teflon / Gold / Nickel...
- Custom coated for custom applications.
- Keyed to fit only one way.
- Easy to change and return to factory specs. 100% guarantee.

6- Manufacturing / Quality:

- 100% helium leak tested.
- Internal parts traceability.
- Valve Pre-conditioning: this allows the elimination of atmospheric contaminants from the wetted internal surface.

MAFP[®] Analytical Flow Products

SHORT TUTORIAL AND TECHNICAL NOTE ON THE ELD-V/MDVG FAMILY



DIAPHRAGM VALVE PAST, PRESENT AND FUTURE

Diaphragm based valves have been a very attractive solution for many chromatographers, mainly due to the space saving and performance expectation. However these valves were plagued with a bad reputation that they deserved, since their analytical performance has been poor. This is the story from the past.

Same concept since more than a half century

NEW ERA



**A.B. Broerman 1961,
Phillips Petroleum**

What's new

- Replaces old fashion plate valves and former conical rotary valves
- Built in actuator (saves space over the rotary model)



Around 1995, VICI

What's new

- Size reduction
- 1/16" fittings
- Two spring loaded pistons
- Available with internal sampling loop



Around 1997, VICI

What's new

- Size reduction
- Single screw assembly
- Plastic or polymer moulded plungers
- Same working concept as the 1961 design



2007, AFP

What's new

- Completely new plunger and actuator design
- Purging groove design
- Pressure adjusting screw
- Multi-layer diaphragm
- Tight Manufacturing & control procedure



2010, AFP

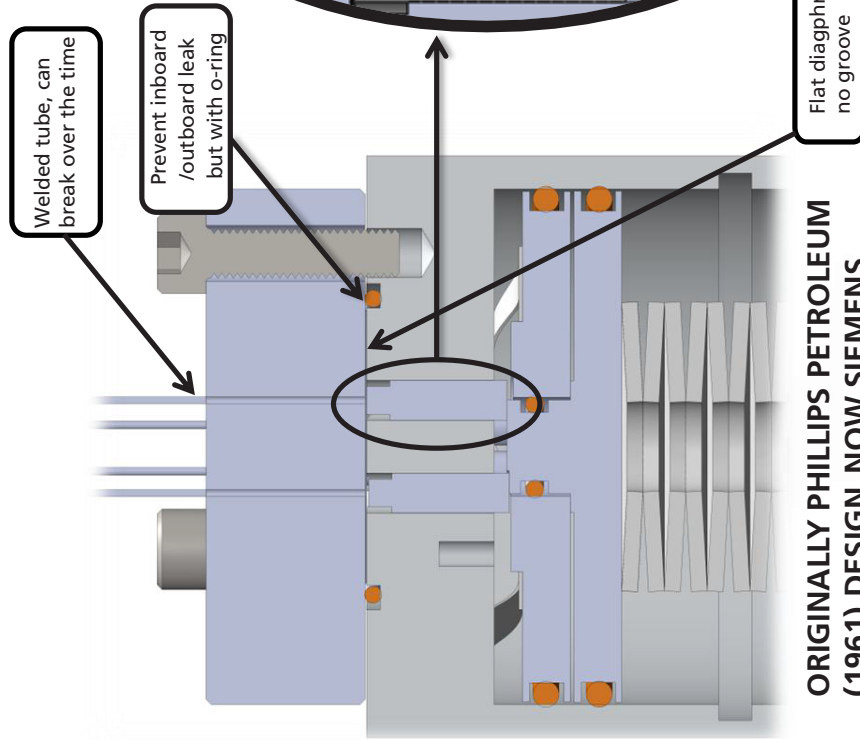
What's new

- Compatible with NeSS™ mounting platform
- Open architecture

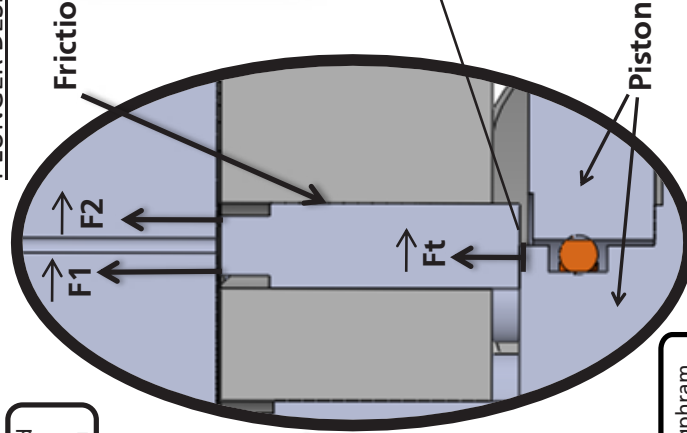
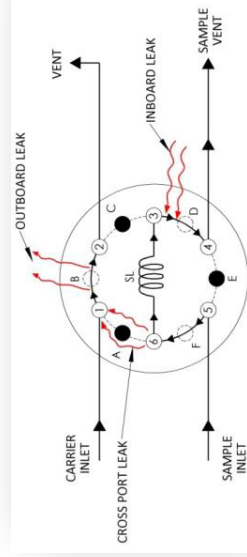
* Covered by four (4) patents pending.

EXISTING VALVE DESIGN OVERVIEW & RELATED PROBLEMS

SIEMENS SERIE 11



PLUNGER DESIGN VARIATION



- Free moving plungers
- Unequal sealing force on the diaphragm ($F1 > F2$), because the piston pushes only on the half portion of the plunger's surface.
- Friction

EXISTING VALVE DESIGN OVERVIEW & RELATED PROBLEMS

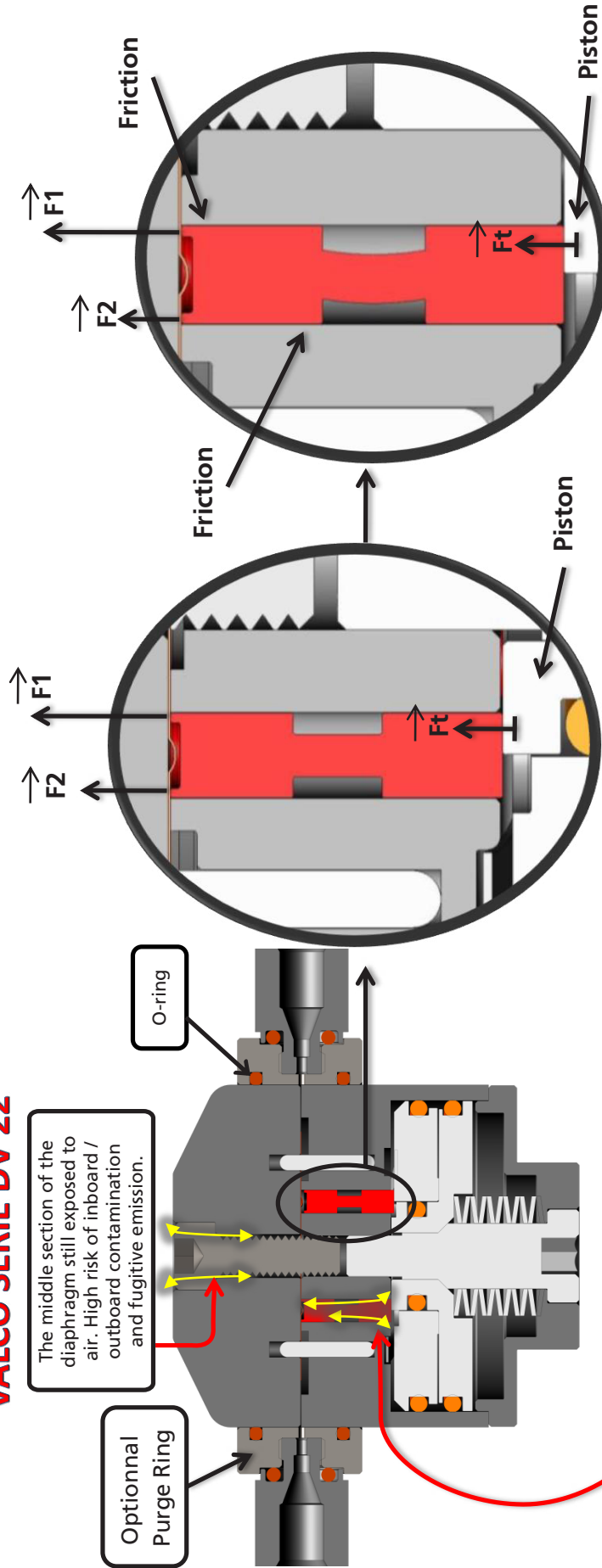
VALCO SERIE DV 22

The middle section of the diaphragm still exposed to air. High risk of inboard / outboard contamination and fugitive emission.

Optionnal Purge Ring

O-ring

The purge ring will not prevent permeation through the diaphragm from the actuation gas

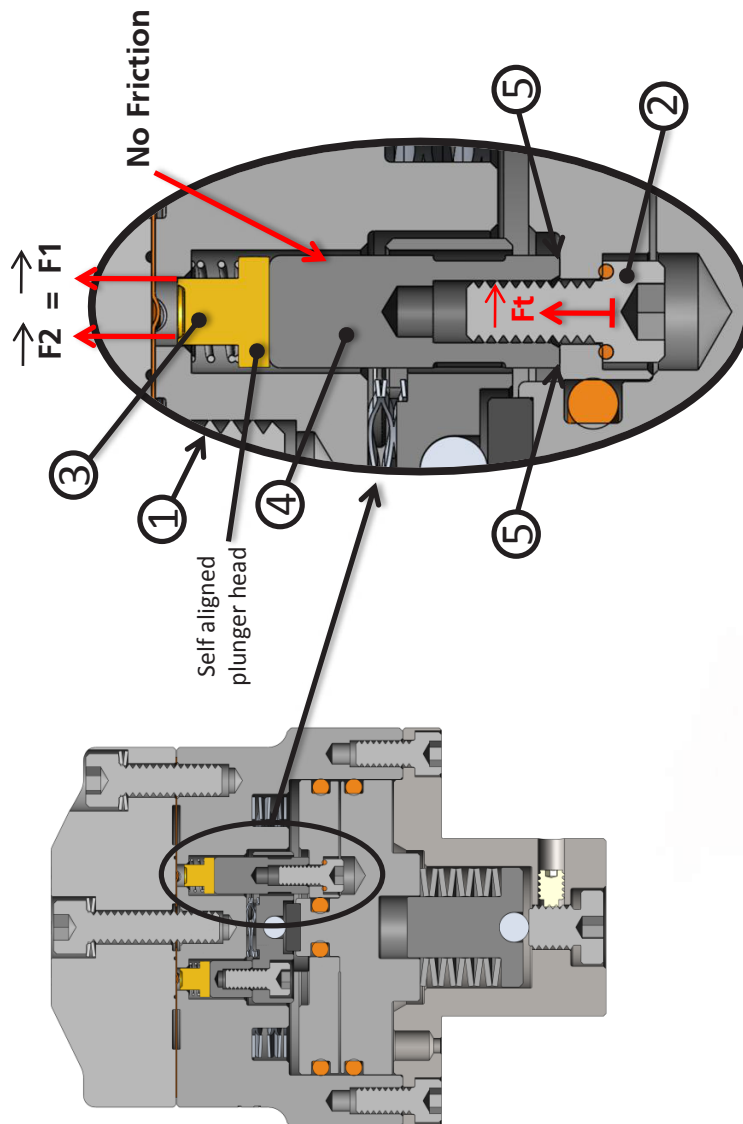


- Polymer base plunger
- Large tolerance variation in length
- Free moving plungers
- Unequal sealing force on the diaphragm ($F1 > F2$), because the piston pushes only on the half portion of the plunger's surface.

- Plunger middle section will bend to compensate for plunger length variation. This phenomenon accentuates the problem of unequal sealing force.
- Friction : particles generation

PLUNGER DESIGN SPRING RETURN & SELF ALIGNED

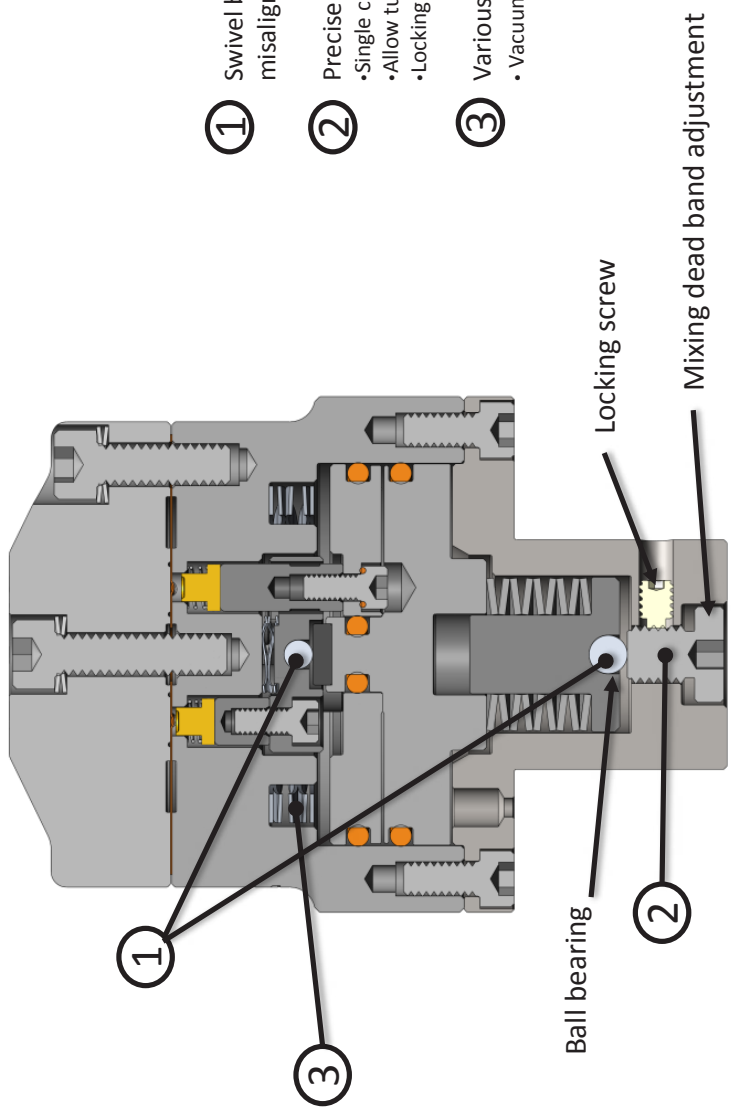
- ① Two parts plunger self aligned designed.
- ② Plungers are fixed to the pistons with a sealed screw. The valve can be use in any position and under vibration condition.
- ③ Precisely machined in low friction alloy to avoid wearing and ensure a long lifetime.
- ④ Precisely machined in stainless steel, no friction with the valve's cylinder
- ⑤ Force is applied to the total surface area resulting in an equal sealing force on the diaphragm ($F_1 = F_2$)



ACTUATION MECHANISM DESIGN

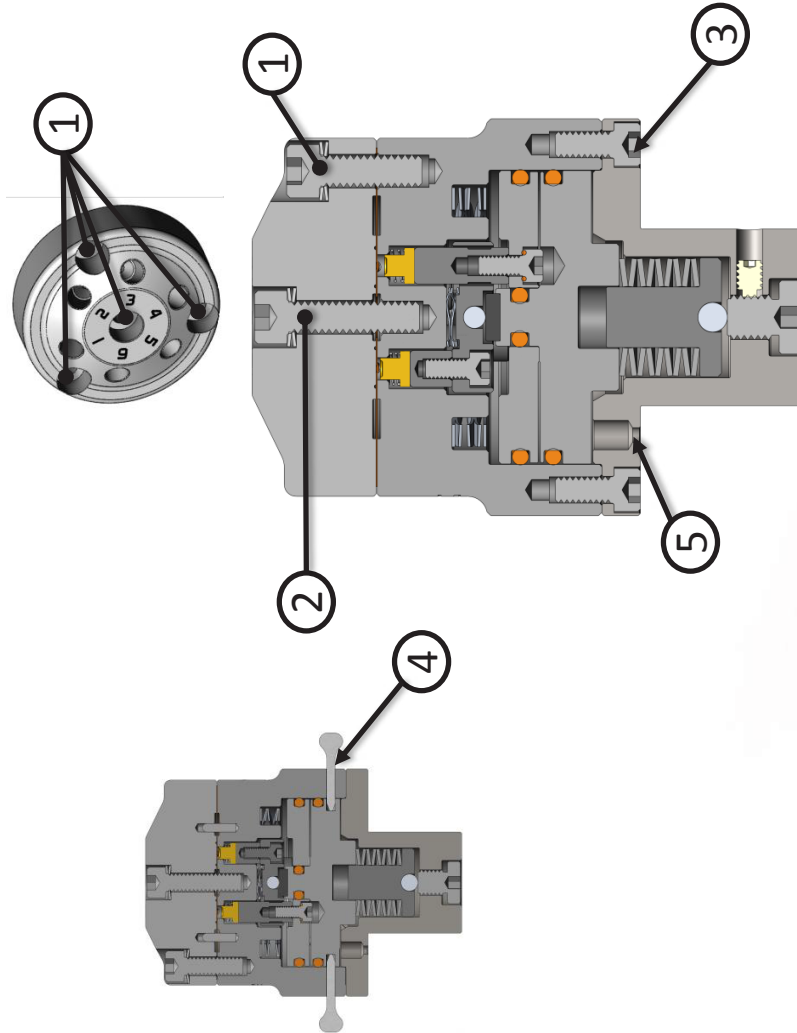
STANDARD ACTUATION MECHANISM:

- Single acting (spring return)
- Tilt compensated design, based on steel ball single contact point load transfer
- Compensation for long term wearing



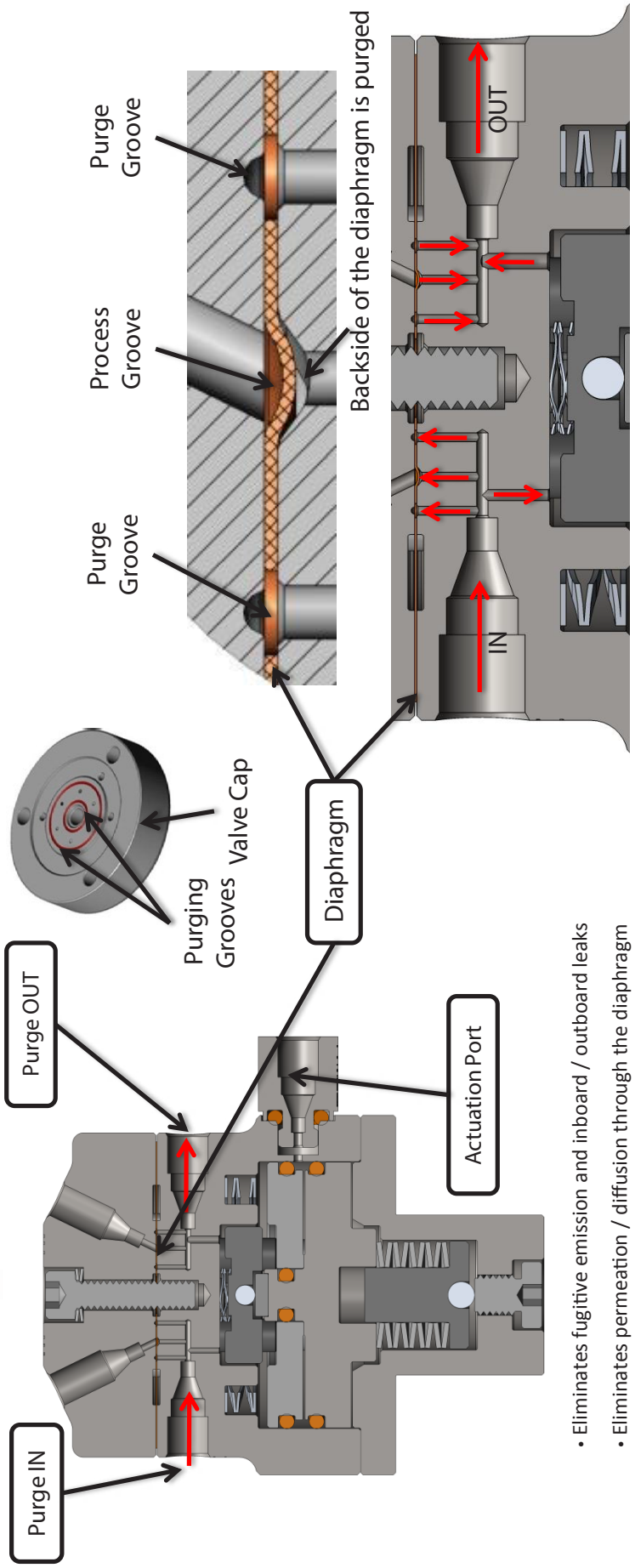
- 1** Swivel ball bearing design that compensate for any misalignment
- 2** Precise pre-load actuating pressure tuning mechanism
 - Single contact load transfer compensation for misalignment
 - Allow tuning of the non-mixing zone
 - Locking screw to keep the factory tuning
- 3** Various spring configuration:
 - Vacuum and standard

VALVE BODY DESIGN



- ① 4 Holding screws on the valve head to preserve the sealing integrity
 - It makes sure to maintain proper sealing alignment
- ② Temperature compensation spring washer to avoid excessive compression of the diaphragm, at high temperature
- ③ 4 Independent holding screws for the bottom cap, independent from the pressure adjusting screw
- ④ Relief pin:
 - Ease the replacement of the diaphragm
 - Ideal for long term storage
- ⑤ Vent hole in the bottom cap to prevent actuating pressure built-up

UNIQUE PURGE DESIGN

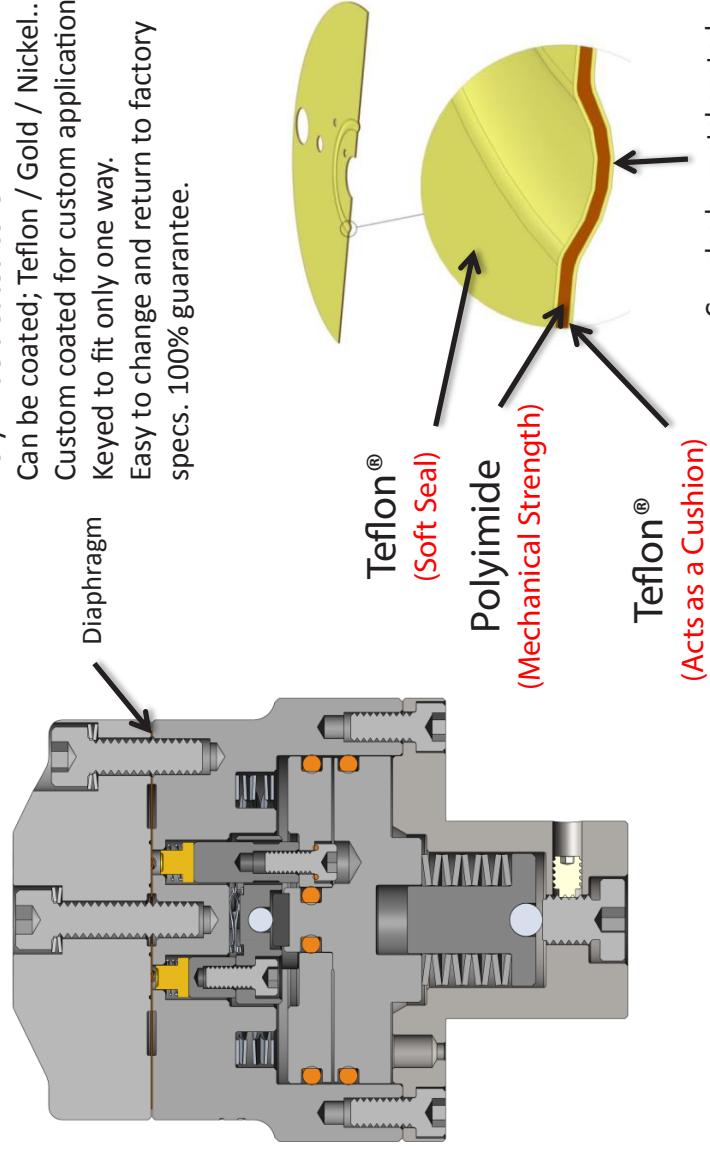


- Eliminates fugitive emission and inboard / outboard leaks
- Eliminates permeation / diffusion through the diaphragm
 - No more peaks
 - Ideal for low level impurities measurement.
- Allows vacuum application for GC / MS systems and sub atmospheric sampling
- Allow safer operation with hazardous gases.
- Allows real time monitoring the valves health, self diagnostic.
- Prevents unwanted and costly system shutdown

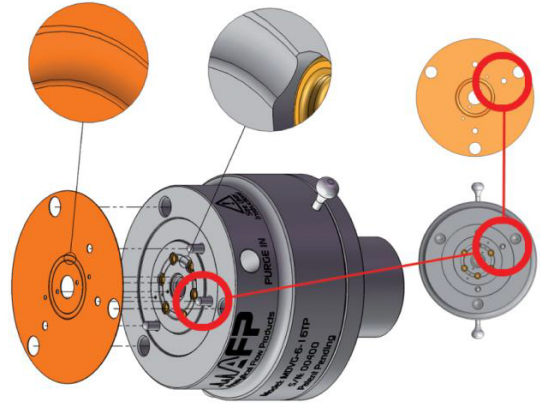
All these grooves are connected

DIAPHRAGM DESIGN

Polyimide treated core.
 Can be coated; Teflon / Gold / Nickel...
 Custom coated for custom applications.
 Keyed to fit only one way.
 Easy to change and return to factory specs. 100% guarantee.



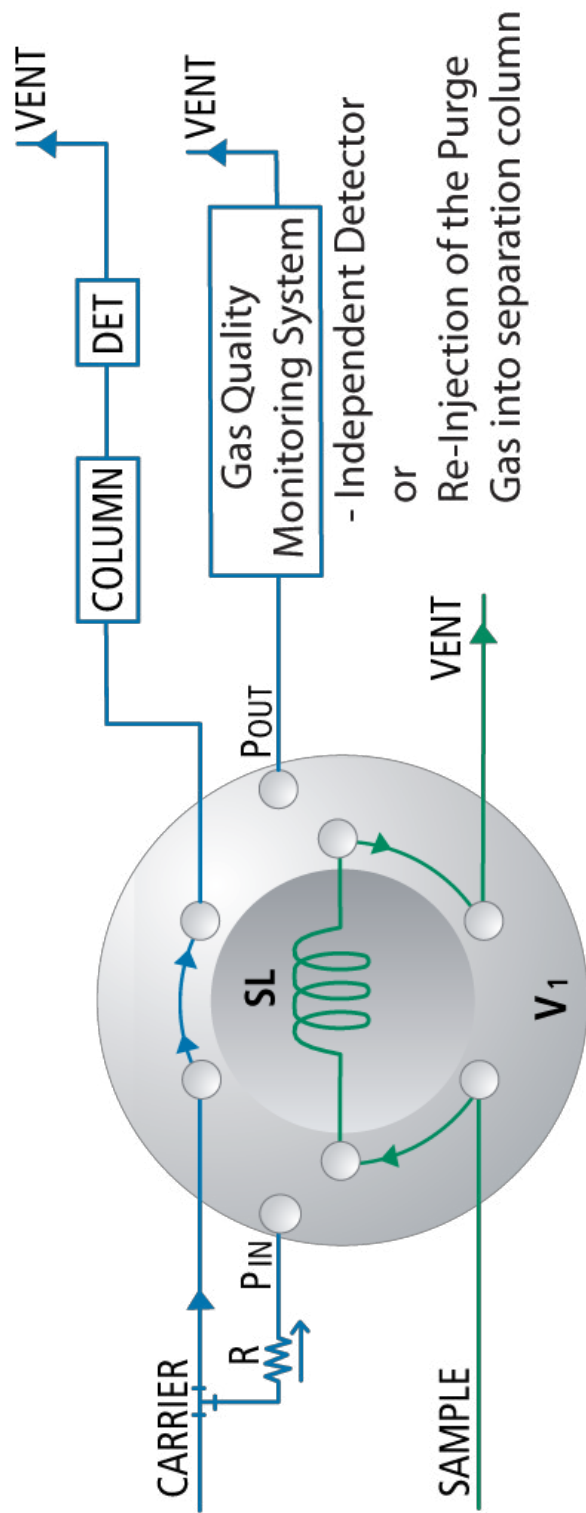
Can also be metal coated
 Extra protection against
 diffusion or permeation.



Fool proof design to fit the
 diaphragm only in one way

- 3 choices of diaphragm:
- LT (low temperature) : Polyimide with teflon layer
 - MT (medium temperature) : Treated polyimide
 - HT (high temperature) : Treated polyimide

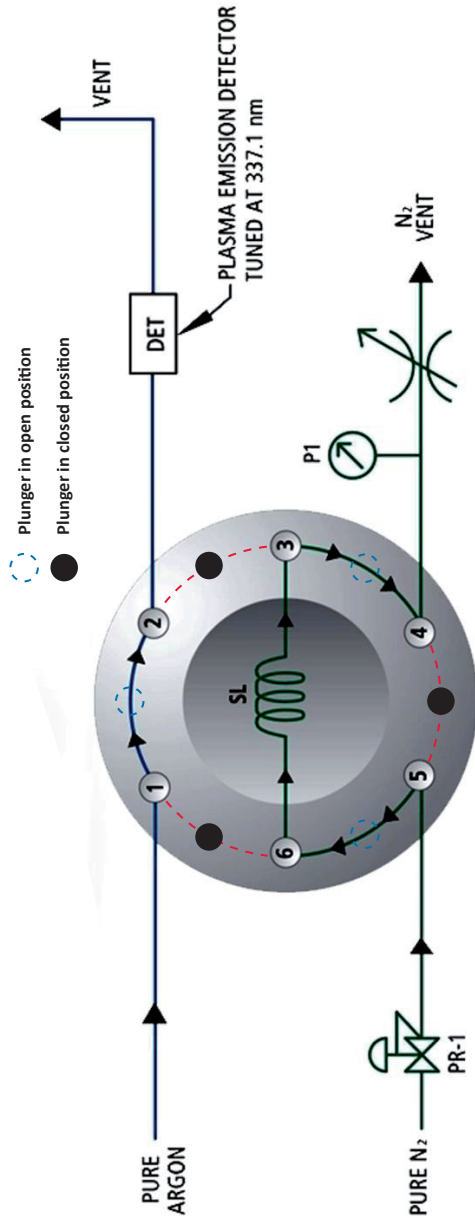
SELF DIAGNOSTIC EXAMPLE



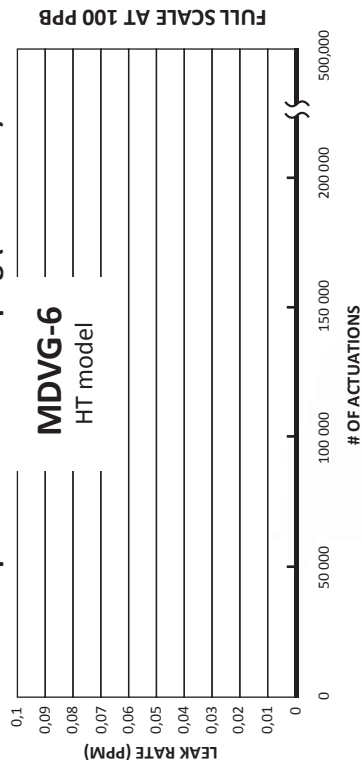
For more information please refer to application note AN-04

IMPROVED PERFORMANCE RESULT

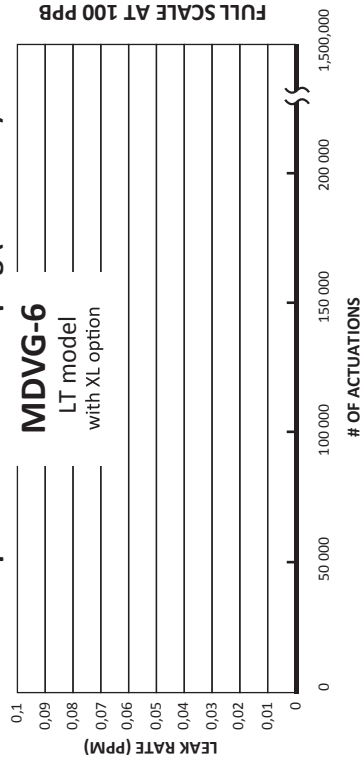
Test done by third party lab



Test pressure P1 at 500 psig (3445 kPa)



Test pressure P1 at 500 psig (3445 kPa)



Has many advantages over the old design

**ELD V1 / ELD V2 / MDVG-SERIES
(WITH PNEUMATIC ACTUATOR)**



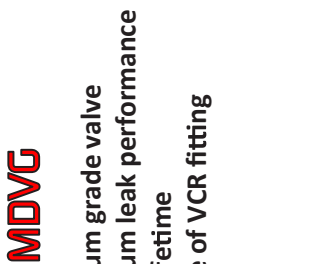
ELD V-1

- Optimized for cost
- Sensitive application
- Standard grade valve



ELD V-2

- Better leak performance and lifetime
- Medium cost, High performance grade valve



MDVG

- Premium grade valve
- Premium leak performance and lifetime
- Choice of VCR fitting

Leak rates:

-Cross Ports: (Maximum pressure)	9.0 x 10⁻⁹ Atm-cc/sec He	4.7 x 10⁻¹¹ Atm-cc/sec He	3.0 x 10⁻¹² Atm-cc/sec He
-Cross Ports: (100 Psig)	5.0 x 10⁻¹⁰ Atm-cc/sec He	9.4 x 10⁻¹² Atm-cc/sec He	6.0 x 10⁻¹³ Atm-cc/sec He
- In/Outboard:	1.0 x 10⁻¹⁰ Atm-cc/sec He	4.7 x 10⁻¹² Atm-cc/sec He	3.0 x 10⁻¹³ Atm-cc/sec He

Equivalent in years to fill a cube of 1 cc
At the 100 Psi working pressure

63 years

3 370 years

52 800 years

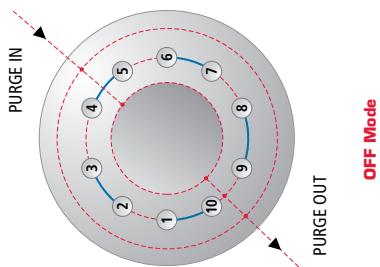
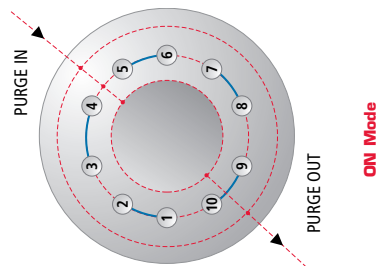
Estimated working lifetime: [years]
(Based on a cycle time of 5 minutes, 24 hours, 365 days/ year)

2

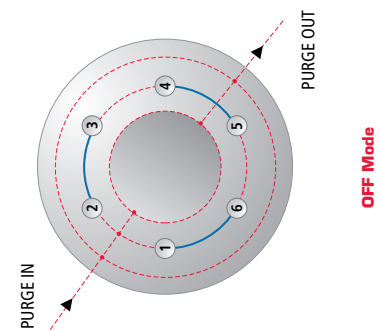
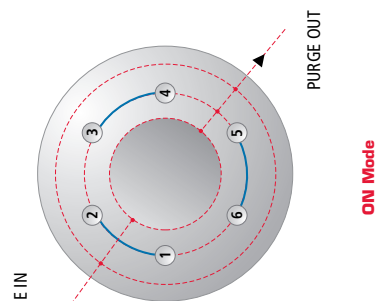
3

5

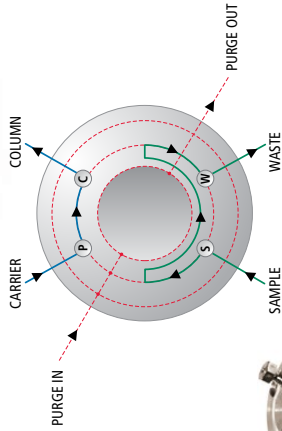
MDVG-10



MDVG-6



MDVG-4-ISL-SERIES
(INTERNAL SAMPLING LOOP)

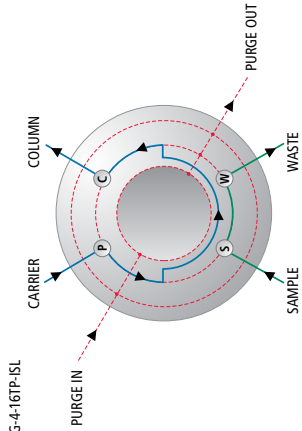


OFF Mode

The sample is injected into the sampling loop



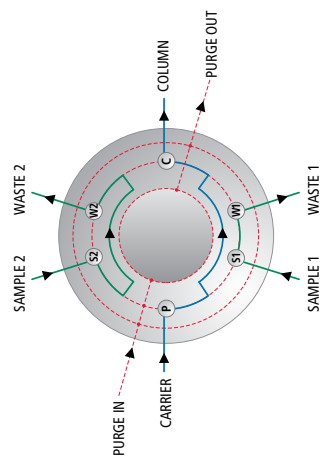
MDVG-4-16TP-ISL



ON Mode

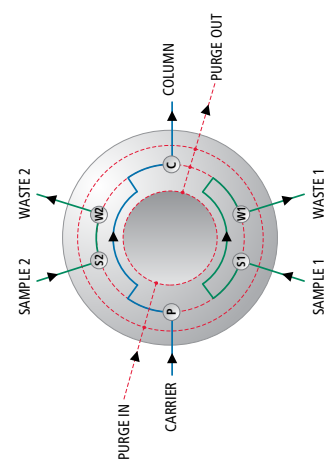
The sample is injected into the column

MDVG-10-ADSL-SERIES
(ALTERNATE DOUBLE SAMPLING LOOP)



OFF Mode

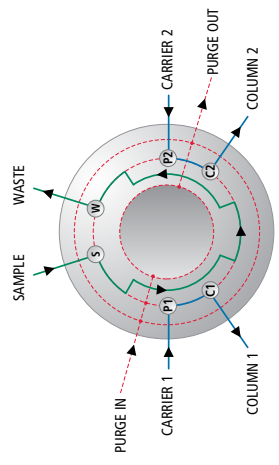
Sample #1 is injected into the column • Sample #2 is loaded into the sampling loop



ON Mode

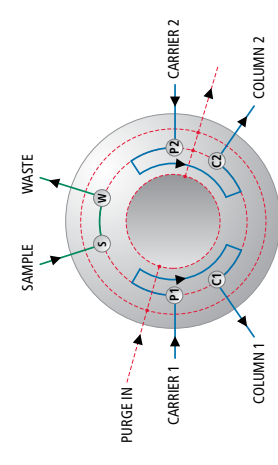
Sample #1 is loaded into the sampling loop
Sample #2 is injected into the column

MDVG-10-SDSL-SERIES
(SIMULTANEOUS DOUBLE SAMPLING LOOP)



OFF Mode

Sample is loaded into the double sampling loop



ON Mode

Sample is injected into the column #1 and column #2

Available Internal Sampling Loop volume: **0.5µl, 1.0µl, 1.5µl, 2.0µl, 3.0µl, 5.0µl**

**CADV-SERIES
(WITH CAM BASE ACTUATOR)**

FIRST ELECTRICAL DRIVEN GC DIAPHRAGM VALVE

CADV: Allows a direct upgrade of the existing GC equipped with rotary valves, allowing the system to benefit from the GC diaphragm valve features

**3 positions:
Load / Isolated / Inject**

Can be used with the syringe adaptor for sample loop filling

Sequential injection mode available. Eliminate baseline upset upon injection.



CADV installed on a electric actuator



CADV with base mounted handle



CADV installed on a VICI® pneumatic rotary actuator

CUSTOM CONFIGURATIONS

MANUFACTURING & CONTROL PROCEDURE

- Fully 100% inspected and tested using helium mass spectrometer, makes sure that each valve meets the specifications
- Parts traceability, long term follow up

Polymer head



VCR 1/8"



Private label and licensing



Tube connection



Tube connection



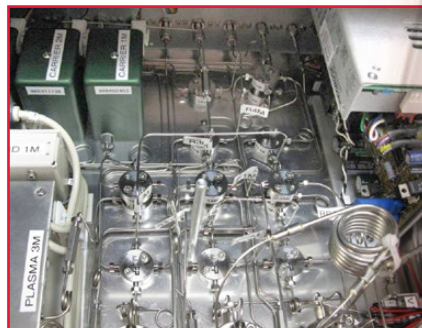
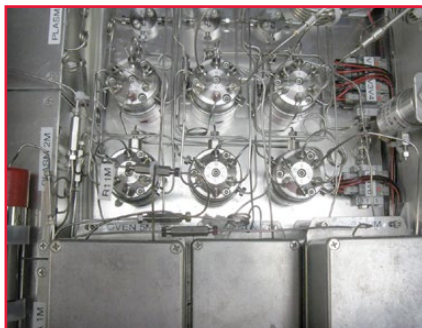
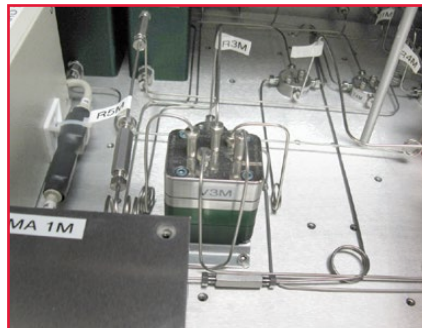
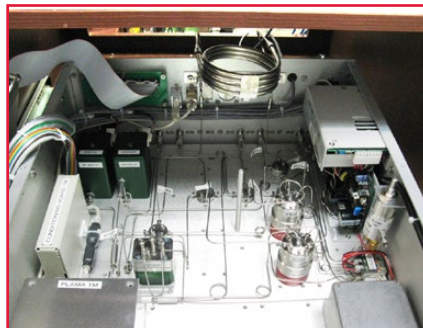
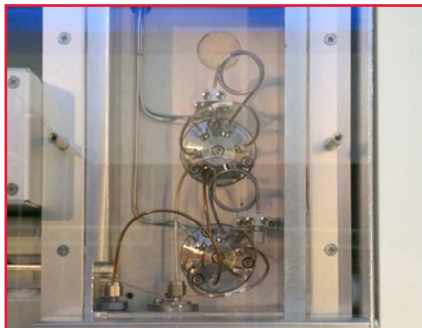
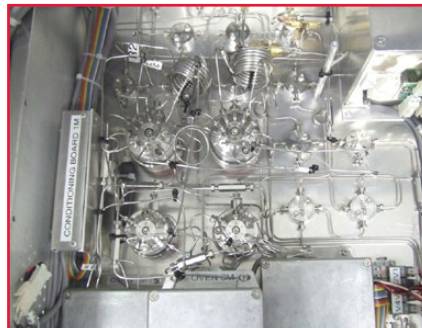
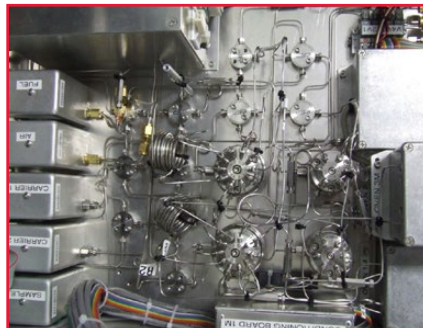
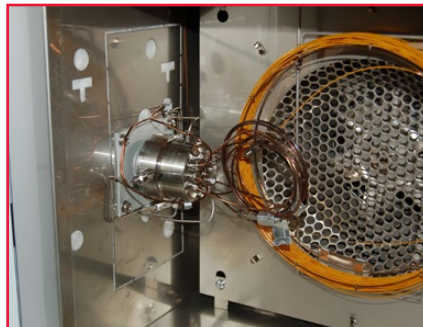
Special surface treatment



Double actuation mechanism



PHOTO GALLERY





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