



Process Equipment
Division

Tuchenhagen
Flow Components

24/7 PMO Valve Technical Brochure





24/7 PMO Valve™ Technical Brochure



24/7 PMO Valve™ Technical Brochure

Content	Page
.....	
Section 1 - General Technical Information	4
.....	
Section 2 – 24/7 PMO Valve™ Mixproof Valve Operation	5
.....	
Section 3 – Dairy Process Applications	8
.....	
Section 4 – 24/7 PMO Valve™ Control and Interlock Guidelines	9
.....	
Section 5 – Cost Saving Opportunities with 24/7 PMO Valve™	13
.....	
Section 6 – 24/7 PMO Valve™ Installation and Manifold Prefabrication	14
.....	



24/7 PMO Valve™ Technical Brochure

Section 1 - General Technical Information

- 1.1 The Tuchenhagen 24/7 PMO Valve™ has been designed to allow safe separation of non compatible products (such as milk or milk products & cleaning solution) and is approved by FDA (through the issuance of Memorandum M-b-353) to allow one housing of the valve and the corresponding valve seat as well as **the vent cavity** to be cleaned **while milk or milk products are present in the opposite valve housing and line.**
- 1.2 In process system designs which utilize the 24/7 PMO Valve™, the processor will greatly increase the throughput of the process system. This is due to the elimination of the downtime required by all other single seat and mixproof valves systems where the process operations **must be shutdown for valve and manifold cleaning.** **In the case of PMO Mixproof valve or double-block-and-vent single-seat valve systems, PMO regulations have UP TO NOW not allowed the cleaning of the vent cavity or a valve seat while Milk or Milk products are present in the valve under item 15p (B) section (6) of the PMO. This vent cavity cleaning restriction has been lifted for this 24/7 PMO Valve™ alone.**
- 1.3 The valve seats and vent cavity are cleaned by independent seat lifting of the respective Upper and Lower valve seats. The 24/7 PMO Valve™ design specifically provides a complete safeguard against commingling of product and CIP fluids by insuring that a vacuum always exists in the vent cavity area during Upper and Lower seat lifting operations.
- 1.4 The 24/7 PMO Valve™ is leak free during valve transition which eliminates the leakage or spillage normally associated with valve transition on non-leak free designs. The leak free design ensures that no product fluid enters the vent cavity during valve transition which minimizes the cleaning requirements of the valve internals and vent cavity.
- 1.5 The 24/7 PMO Valve™ is available in 1.5", 2", 2.5", 3" and 4"OD tube sizes. Other sizes may be available on request. The 24/7 PMO Valve™ holds a current 3A Sanitary Standard 85-00 certificate for Double-Seat Mixproof Valves.
- 1.6 The 24/7 PMO Valve™ can be interfaced with all major bus & network control systems as well as be used in standalone discrete 24 VDC or 110 VAC configurations with or without solenoid valves in the control module.

24/7 PMO Valve™ Technical Brochure

- 1.7 The 24/7 PMO Valve™ design has evolved from 30+ years of proven process experience with the Tuchenhausen VARIVENT® Valve line. The rugged VARIVENT® valve Housing design along with precision manufacturing and quality control processes, insure years of trouble free operation and minimize maintenance requirements.
- 1.8 The modular seat lifting actuator does not require field travel adjustment due to seal wear or after maintenance disassembly.

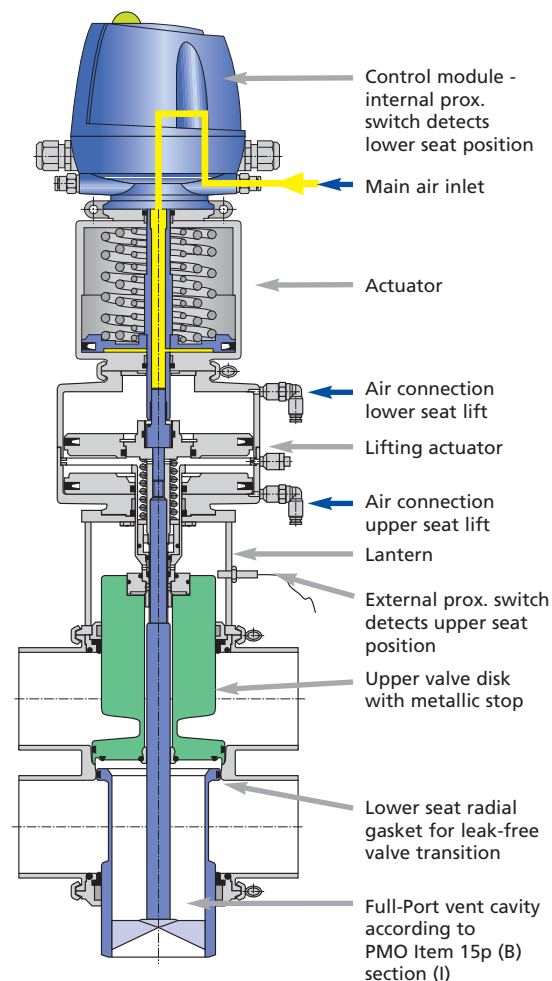
Section 2 – 24/7 PMO Valve™ Mixproof Valve Operation

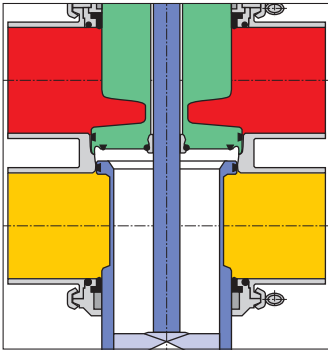
- 2.1 The 24/7 PMO mixproof valve consists of an upper and lower valve housing, with upper and lower blocking seats separated by a full-ported vent cavity between the two seats which is open to drain. The two valve seats and vent cavity safely separate the dissimilar fluids present in the upper and lower valve Housings.

The difference in the 24/7 PMO mixproof valve compared to all other mixproof PMO valves currently on the market is the patented new disk and seat design. This design ensures that a vacuum always exists in the vent cavity during vent cavity cleaning (by independent seat lifting). In addition, the design ensures that there is no direct liquid impingement on the opposing seat gasket during independent seat lifting.

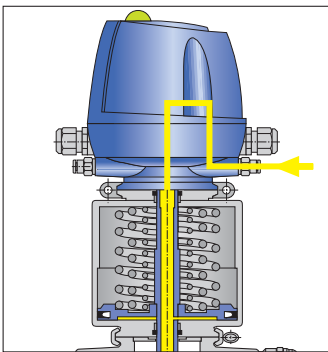
The vacuum measurement in the vent cavity during seat lifting as well as the prevention of any direct impingement on an opposing gasket were requirements set by the regulatory bodies in order to allow one valve housing and the vent cavity of the valve to be cleaned with product present in the opposite valve housing.

Prior to the development of the 24/7 PMO Valve™ from Tuchenhausen - in applications utilizing other approved PMO mixproof valves in PMO regulated industries - no valve seat or vent cavity cleaning could be carried out when product was present in the opposite valve housing under item s due to the unique design features described above.

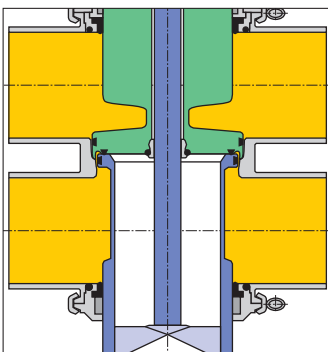




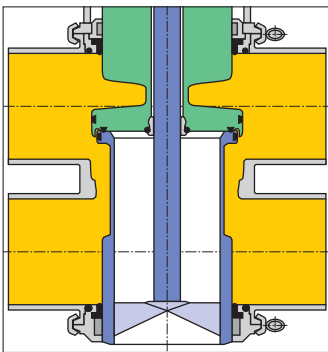
Closed position



Air supply during valve activation



Valve in transition



Open position

2.2 The 24/7 PMO mixproof valve has two (2) process operating positions:

- Valve Closed (Safe) position
- Valve Open position

2.3 Valve Closed or Safe Position:

The valve is held closed by the internal spring force inside the actuator. The valve is a double balanced (upper and lower seat) design which insures that any line pressure shocks or line surges up to 435 psi cannot open the valve. In the closed position, dissimilar fluids, including CIP solutions, can flow simultaneously across the upper or lower valve housings.

The valve seat positions are monitored in the closed or safe position by two proximity switches. The closed lower seat position is monitored by a proximity switch in the control module and the closed upper seat is monitored by a lantern mounted proximity switch. Both proximity switches must be in the closed or safe position during process and normal cleaning operations. If both switches are not in the proper position, then the process and or CIP operation shall not be allowed to proceed by the control system. If the proper (safe) valve position is lost during an operation then the operation must be halted by the control system.

2.4 Valve Open Position:

The valve is opened by providing air to the actuator. The air enters via the control module into the center shaft of the actuator.

The main valve actuator raises the lower seat until it comes in contact with the upper seat, thereby closing off the vent cavity between the upper and lower seats. The lower seat closes against the upper seat and continues moving upward until the valve shaft assembly reaches the full open position.

In the full open position process fluids can flow between the upper and lower valve Housings. A second proximity switch located in the control module can be used to detect and monitor the valve's full open position, although this is not a regulatory requirement.

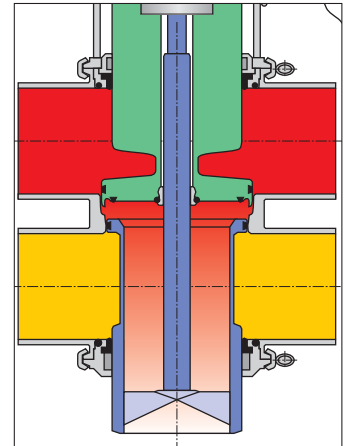
24/7 PMO Valve™ Technical Brochure

2.5 Valve & Process Line Cleaning – CIP:

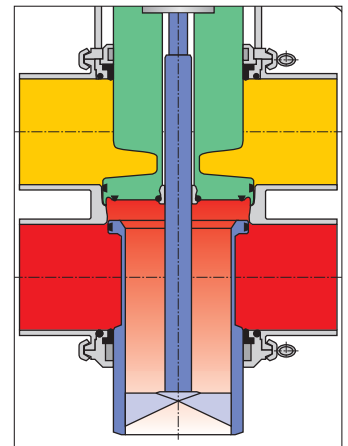
The 24/7 PMO Mixproof Valve can be cleaned-in place by allowing CIP to flow through the upper and lower valve housings while the CIP circuits of which these housings are a part of are being cleaned. During each recirculation step of the respective CIP programs, the upper and lower seats can be pulsed to allow the area under the valve seats as well as the vent cavity to be cleaned. The seat lift operations of the upper and lower seats are shown in the attached drawings. The upper seat will move upward approx. 2.5 mm and the lower seat will move downward approx. 6 mm during their respective seat lift operations.

The seat lifting is a pulsed action and the seat open time shall be limited to a maximum opening time of **10 sec for each seat lift pulse**. If required, multiple seat lift pulses may be used during each solution segment to clean the valve seat and cavity area.

Again, with a 24/7 PMO valving system while the CIP and seat lifting operations are occurring on the upper line, upper valve housing and seat area; normal process operations can be running on the lower line, and vice versa. If a valve alarm occurs during the CIP operation, the control system interlocks will stop the CIP operation and put the affected processing system into a safe condition until the issue is resolved.



Upper seat lift to clean the upper seat and the vent cavity



Lower seat lift (down) to clean the lower seat and the vent cavity



Section 3 – Dairy Process Applications

Utilizing a 24/7 PMO Mixproof valving system will provide added flexibility for the following typical plant systems by allowing safe multiple product transfer and CIP operations without the long shutdown time currently required:

- Dairy & By-product receiving systems
24/7 PMO Valve™ applications include safe isolation of tanker unloading and CIP operations. For facilities with multiple receiving systems, a 24/7 PMO based Mixproof valving system will provide added flexibility to clean both the tanker and transfer systems simultaneously.
- Raw product storage, batching and distribution systems
24/7 PMO applications include valve systems to provide safe isolation of raw product storage filling, batching, and discharge operations, as well as tank and line CIP operations. In this application a 24/7 PMO system will allow multiple process and CIP operations to be carried out simultaneously.
- HTST supply and discharge systems
24/7 PMO applications include HTST inlet valving groups to supply multiple products and CIP to the HSTS system, HTST discharge valve groups used to route multiple finish products and isolate CIP to the selected final product storage tanks.
NOTE: See Section 5 for more information & details.
- Pasteurized and final product storage systems
24/7 PMO applications include valve systems to provide safe isolation of finished product storage for filling and discharge operations, as well as tank and line CIP operations. In this application a 24/7 PMO system will allow multiple process and CIP operations to be carried out simultaneously.
- Filler supply systems
24/7 PMO applications include valving systems that are used to supply finished product to the fillers. In this application a 24/7 PMO system will allow multiple filling and CIP operations to be carried out simultaneously.
NOTE: See Section 5 for more information & details.

Section 4 – 24/7 PMO Valve™ Control and Interlock Guidelines

4.1 General Control and Interlocking Recommendations:

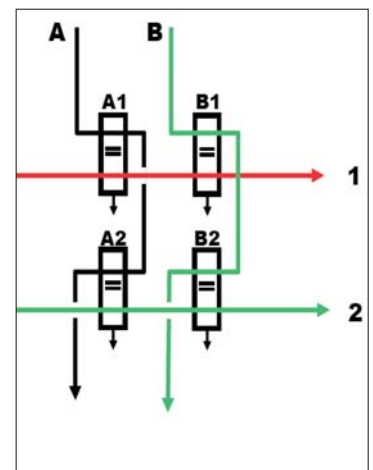
As with all PMO Mixproof valve systems, the closed positions of the valve upper and lower seats must be monitored when the valve is in the deactivated position to ensure that the 2 seats are indeed in the closed or safe position. When 1 housing of the valve is in cleaning mode, if both seats are not found to be in the closed position, the CIP supply pump (or source of CIP supply pressure) must be deactivated.

However, due to the removal of the PMO Item 15p (B) Section (6) vent cavity cleaning restriction by the regulatory authorities for the 24/7 PMO Mixproof valve alone, it is allowed to perform independent seat lifting of the respective seats in this valve while milk or milk products are present in the opposite housing. In this case, the loss of the closed position of the respective upper or lower valve seat during independent seat lifting does NOT require the CIP supply pump (or source of CIP supply pressure) to be deactivated.

4.2 Control System Interlocking Guidelines from M-b-353:

The following Control System Interlocking description is from M-b-353 (April 2007) for the new 24/7 PMO Valve™ Type M_O (06)

As a typical example of a PMO Mixproof Valve arrangement, Sketch 1 below shows a concept drawing of a 4-valve PMO Mixproof system design with 2 source or inlet lines (A and B) and 2 destination or outlet lines (1 and 2). Although this example is based on a 2 sources by 2 destinations concept, the number of sources and destinations is not relevant. For the purpose of describing the proper interlocking basis here, we will assume that Destination Outlet Line 1 (Red Color) is being cleaned while product is being transferred from Source Inlet Line B to Destination Outlet Line 2 (Green Color)



Sketch 1

Purpose: To allow for safe separation of pipelines operation of the new PMO Mixproof valve system by the Plant Control System.

Assumption: The current PMO regulation restricting the cleaning of the Mixproof valve cavity (by seat lifting of 1 seat) when there are Milk or Milk products in the opposite valve housing has been removed and this operation is allowed.

Background: Each PMO Mixproof valve will be installed with 2 Proximity switches, 1 each to detect the closed position of the Upper and Lower seats of the valve.

The switch used to detect the closed position of the lower seat is also used to detect the closed position of the valve itself.



24/7 PMO Valve™ Technical Brochure

4.3 CIP Interlocking Logic Examples:

4.3.1 Example of Cleaning a Process Line Circuit :

a. During a line cleaning program (for example, Line 1 (Red-color) in sketch 1), the following interlocks must be programmed into the Plant Control System:

i. The CIP Supply Pump (or Source of CIP Supply Pressure Note 1) can only be activated if there is NO valve Feedback alarm on the PMO Mixproof valves common to the active CIP circuit (in this case, Valves A1 and B1).

ii. The Feedback alarm is generated by ANY of the following conditions during the line cleaning program :

1. The Upper Seat Proximity switches of Valves A1 or B1 are OPEN (that is, the Upper Seat CLOSED Proximity switch signal is lost), OR

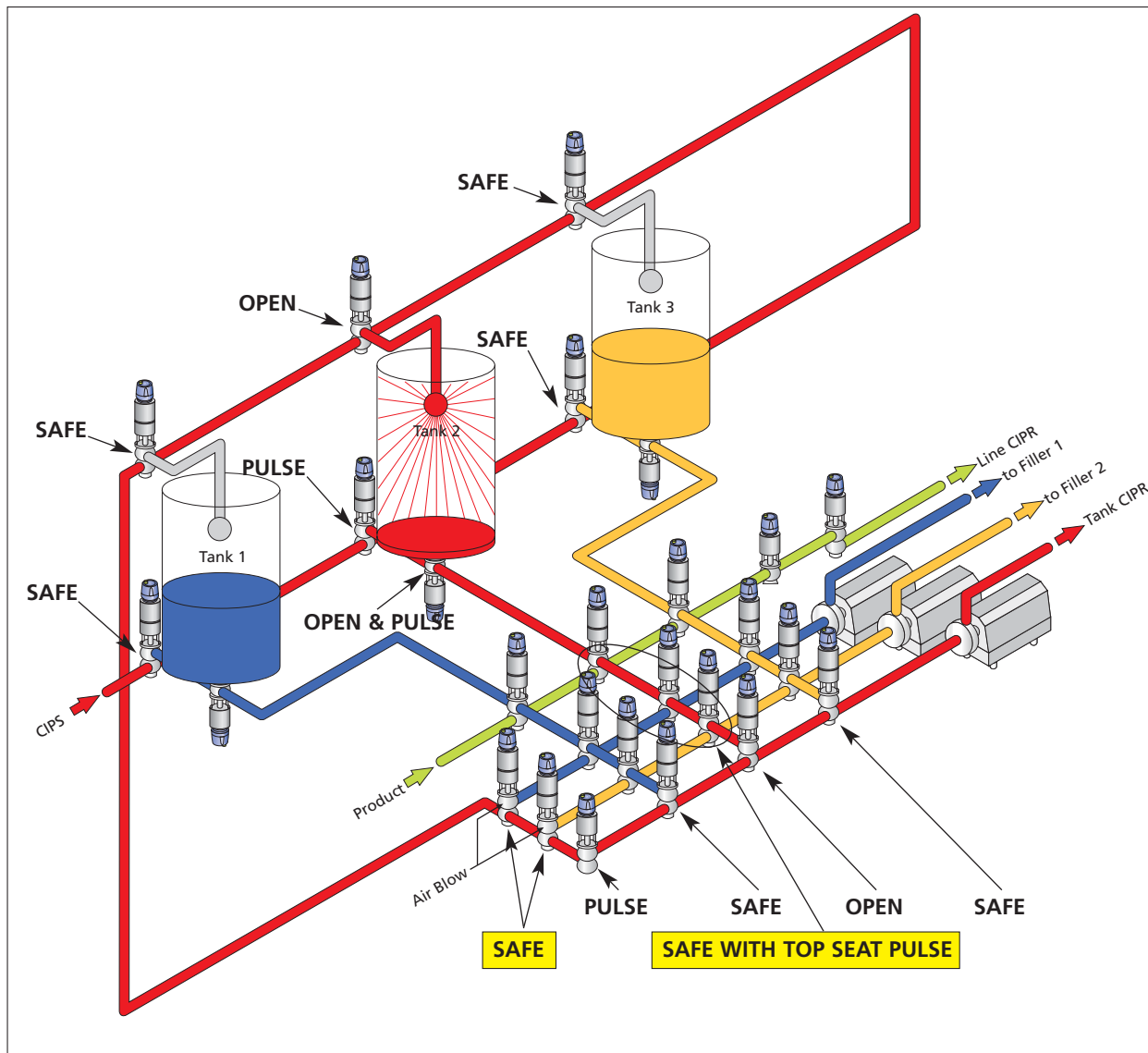
2. If the System Seat Lift Operation of EITHER of Valves A1 or B1 is NOT ON AND the Lower Seat Proximity switches of Valves A1 or B1 are OPEN (that is, the Lower CLOSED Proximity switch signal is lost), OR

3. If the System Seat Lift Operation of EITHER of Valves A1 or B1 is ON AND the Lower Seat Proximity switches of Valves A1 or B1 are OPEN (that is, the Lower CLOSED Proximity switch signal is lost) for longer than 10 seconds.

iii. The Feedback Alarm will remain in place and the CIP Supply Pump (or Source of CIP Supply Pressure) will be Deactivated until the Feedback alarm is Reset AND the conditions are in place to allow the CIP Supply Pump (or Source of CIP Supply Pressure Note 1) to be Activated again

Note 1: In many cases the "Source of CIP Supply Pressure" may be gravity feed from a tank or another pump that is augmenting the CIP supply system pressure. In these cases any valves or pumps which are providing the source of CIP supply pressure must be closed or deactivated. The CIP supply system must remain deactivated until the cause of failure is determined and the failure issue resolved; only then may the CIP system be reset and restarted.

4.3.2 Example of Controls Interlocking for Tank Filling and Emptying Piping Systems



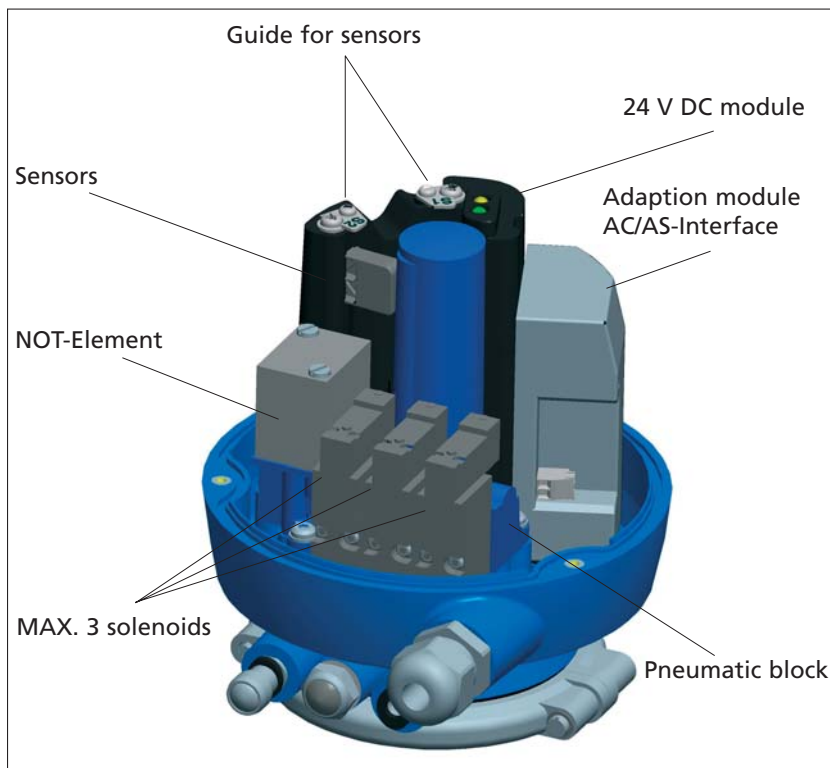
Tank 2 CIP Interlocks:

- All valves marked as SAFE must stay in this condition throughout CIP cycle (both Upper and Lower Seat Prox. switches in CLOSED position)
- Any SAFE valve failure in Tank 2 circuit will Abort CIP operation in progress
- Tank 2 outlet line valves are monitored for SAFE state & have additional interlock to allow 10 sec max pulse of top seat to CIP vent cavity (during this period, Lower Seat Prox. switch must be CLOSED)
- Other valves labeled with "PULSE" (Tank 2 Outlet & CIPS valves) are pulsed during CIP cycle to velocity cleaning Outlet Line

4.4 Control and Monitoring Options:

The 24/7 PMO Valve™ is controlled by the TVIS® M-1 control module, mounted on the top of the valve. In this control module (see across) are mounted the 3 solenoid valves – one for valve activation, one for upper seat lift operation and one for lower seat operation – as well as the proximity switch for lower seat position detection, required by Item 15p (B) of the PMO. In addition, as an option, a second proximity switch can be mounted to detect the valve full open position. Note that the position detection of the upper seat is accomplished by a lantern-mounted proximity switch, external from the TVIS® M-1 control module.

The 24/7 PMO Valve™ and TVIS® M-1 control module are also available with ASI and Devicenet network interfaces. These network interfaces can provide significant installation cost savings and reduced commissioning time over discrete hard wired I/O options for new installations.



TVIS® M-1 control module

Section 5 – Cost Saving Opportunities with 24/7 PMO Valve™

5.1 Dairy Plant with Multiple HTST Systems:

Most large dairy facilities have multiple HTST systems which are processing multiple products through each HTST system; for example, skim milk in one HTST and 2% milk through a second HTST. The HTST systems' supply and discharge come from multiple source and destination tanks via supply and discharge valve routing manifolds. Currently, single seat and PMO mixproof valve installations require down time to clean the HTST systems, the inlet and discharge piping and valve manifolds. During the cleaning operation a downtime is required to clean all the interface point between the system: HTST inlets; HTST discharges, etc. During this down time NO PRODUCTION can be run on the system while these interface points are cleaned.

By utilizing 24/7 PMO™ valves at these critical interface points, the systems can be cleaned **in parallel and no additional down time is required** to clean the valve seats and isolation vent cavities. In most plants this flexibility would provide an additional 2-3 hours of operating time on each HTST system. Installing a 24/7 PMO mixproof system will increase the plant daily throughput without installing larger or additional processing equipment such as another HTST system possibly at a cost of more than \$500,000.

5.2 Filler Supply Systems:

All of today's plants have multiple fillers that are used to package different products and multiple size containers. The final product tanks supply the fillers through common transfer lines and routing valve groups.

In most installations, fillers and supply tanks can normally be isolated and cleaned while processing a product from another tank to a different filler, but the main transfer lines and routing valve group must be shut down for 2-3 hours to clean the transfer lines and routing valve internals. During this downtime, no products can be run on the fillers unless a separate flow path has been installed for this sole purpose.

By installing a 24/7 PMO valving system for the product distribution to the fillers, these critical interface areas of the system can be then cleaned **in parallel with no additional downtime required** to clean the valve seats and vent cavities. In most plants this flexibility would provide an additional 2-3 hours of operating time on the filler system.

Installing a 24/7 PMO mixproof system will increase a plant's daily throughput without installing a larger or additional filler system, possibly at a cost of more than \$1M. Daily operating savings per filler would be in the range of \$6-10K per day based on the addition of 2-3 hours of filler run time per day.



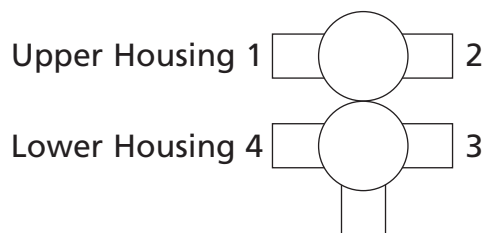
Section 6 – 24/7 PMO Valve™ Installation and Manifold Prefabrication

- 6.1 Standard Mounting Position: Normal installation of the 24/7 PMO mixproof is in the upright position and in no cases can the valve be mounted more than fifteen degrees (15°) from the vertical upright position in order to ensure complete drainability of the valve internals. Care must be taken to assure that the valve housing, the piping system and leakage outlet can drain properly.
- 6.2 Mixproof valves should be installed in an easily accessible location for ease of valve maintenance as well as visible indication of vent cavity leakage. For larger valves a lifting device is available for valve maintenance purposes.
- 6.3 Mixproof Valves installed in Manifolds or Valve Groups require proper fit-up of the valve housings, spool pieces and other fittings for successful manifold fabrication. Valve housing alignment and fit up prior to welding is critical to minimize stress during welding and to ensure the ability of the finished manifold to withstand expansion and contraction forces during the normal temperature deviations seen by the manifold during normal process and CIP operations.
- 6.4 Manifold assemblies need to have adequate frames and internal support members to support the valving, control panel and walkways. All process and CIP lines into and out of the manifold or valve group need to be adequately supported to eliminate any external stress on the manifold.
- 6.5 Leakage Cavity Drainage requirements: With all mixproof valves, the vent cavity leakage must be addressed during the process design. There will be cavity leakage from a leak-free mixproof valve under the following typical conditions: gasket failure, seat and cavity CIP. These fluids must be safely directed to a drain area using good drainage techniques such as drain pans, curbed floor drains, etc.

24/7 PMO Valve™ Technical Brochure

6.6 The following table has Cv values, for the 24/7 PMO Valve™:

	24/7 PMO Valve™ Cv Values					
	Flow Thru	Flow From	Flow Thru	Flow From	Flow During	Flow During
	Upper Housing	Upper to Btm	Btm Housing	Btm to Upper	Upper Seat Lift	Lower Seat Lift
	1 - 2	1 - 3	3 - 4	3 - 1	1 - 7	4 - 7
1.5" OD	58.53	15.71	62.34	14.04	1.72	2.56
2" OD	83.65	51.22	90.97	46.27	2.49	3.59
2.5" OD	117.59	85.49	147.39	82.12	3.28	4.84
3" OD	185.95	130.86	222.20	125.35	3.90	6.20
4" OD	385.81	246.48	381.69	245.49	2.96	6.23



Vent Cavity 7

6.8 The following Table has Overall Valve Stroke, Seat open area (for Particulate Throughput) & Valve Seat Lift Travel Data for 24/7 PMO:

Sizes	1.5"		2"		2.5"		3"		4"	
Total valve stroke	0.82"	21.0 mm	1.22"	31.0 mm	1.37"	35.0 mm	1.77"	45.0 mm	1.77"	45.0 mm
Upper seat lift	0.1"	2.5 mm	0.1"	2.5 mm	0.1"	2.5 mm	0.1"	2.5 mm	0.1"	2.5 mm
Lower seat lift	0.23"	6.0 mm	0.23"	6.0 mm	0.23"	6.0 mm	0.23"	6.0 mm	0.23"	6.0 mm
Max. particulate size *	0.25"	6.5 mm	0.4"	10.0 mm	0.4"	10.0 mm	0.74"	19.0 mm	0.74"	19.0 mm
Weight	37.4 lb	17.0 kg	46.2 lb	21.0 kg	70.4 lb	32 kg	113.3 lb	51.5 kg	134.2 lb	61.0 kg

* This is the maximum particulate size which can pass through the valve when the valve is in the full open position.

For more information
of our component range,
comprehensive and with all the details:

www.tuchenhagen.us



Process Equipment
Division

**Tuchenhagen
Flow Components**

A company of GEA Group

Tuchenhagen Flow Components, LLC · 90 Evergreen Drive · Portland, ME 04103
Tel: 1-207-797-9500 · Fax: 1-207-878-7914 · info@tuchenhagen.us · www.tuchenhagen.us