

Management of Change Guide for Replacement of Fisher™ A-Body Valves in Hydrofluoric Acid Service

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Management of Change

Management of Change (MOC) is a procedure used to proactively manage changes that have the potential to impact safety or the process within a plant. Evaluating new techniques for improving MOC approval procedures can have an impact on plant efficiency. Historically, upgrading obsolete products or replacing existing process control equipment had been delayed or abandoned due to the extensive paperwork involved in completing a complex MOC approval sheet.

Background

Historically, many Fisher A-body and other double-ported sliding-stem valves have been used in Hydrofluoric Acid Alkylation (HF Alky) units. They were used both in the UOP and Phillips licenses, but saw more limited usage in UOP's license due to the use of a screwed-in seat ring. With UOP taking on full ownership of both licenses, the A-body construction will see little use in new applications. Although the A-body has been a successful valve for these acidic applications, it is an inactive product, which results in challenges in constructing new valves, as well as maintaining existing constructions.

Emerson has partnered with UOP to determine a suitable replacement for A-body constructions in HF Alkylation units. This partnership led to the selection of the Fisher easy-e™ valve (utilizing post-guided trim of the EZ valve) and the Fisher Vee-Ball™ control valve. The easy-e valve can be used for most applications up to NPS 4. For valves NPS 6 and larger, it is desirable to use a Vee-Ball control valve solution. However, shifting from an A-body to a Vee-Ball valve is a significant change in control valve selection.

The purpose of this document is to simplify the transition from existing control valve A-body installations, which may be beyond their service life or no longer provide the control and reliability required, to the proven reliable Fisher Vee-Ball control valve.

Contained in this document are two sections. First, there is a question and answer section to help users complete Management of Change (MOC) approval documents when modernizing to a Fisher Vee-Ball control valve. Then, there is a side-by-side comparison of the Fisher A-body, Masoneilan 10000 (also a double-ported sliding-stem valve) and the Fisher Vee-Ball control valves. These comparisons demonstrate how users can safely and efficiently replace existing problematic or maintenance-prone double-ported sliding-stem valves with the Fisher Vee-Ball control valve.

Question & Answer Checklist

- Q:** Does the proposed modification cause any changes to the piping and instrumentation diagram (P&ID)?

A: Possibly. If the valve size changes, concentric reducers to the control valve inlet and outlet may need to be added to the P&ID.

- 2** Q: Does the proposed modification change process chemistry, technology, or operating and control philosophies?
A: No.
- 3** Q: Does the proposed modification change how the existing plant is operated?
A: No.
- 4** Q: Does the proposed modification change process flows?
A: No.
- 5** Q: Does the proposed modification change the process description?
A: No.
- 6** Q: Have the codes and standards to which the new equipment was designed changed?
A: No, although they may have been updated since the A-body was installed.
- 7** Q: Have the operating and design conditions (flow, temperature, pressure, process fluids) of the proposed modification changed?
A: No.
- 8** Q: Does the proposed modification change the materials of construction such as a change in material form (cast, forged) or alloy?
A: No.
- 9** Q: Does the proposed modification introduce new equipment items that require periodic predictive maintenance?
A: No. The new equipment items will require the same periodic maintenance as required by the old equipment items.
- 10** Q: Does the proposed modification change existing operator training requirements?
A: Yes. The Emerson sales network offers local training and support to ensure operators, maintenance personnel, and instrument technicians are fully trained on the Fisher Vee-Ball control valve.

- 11 Q:** Does the proposed modification change existing pressure relief cases?
A: Probably. If the replacement selection exceeds the maximum rated Cv of the existing A-body, then pressure relief cases will require review. Pressure relief valve sizing when sizing and selecting Fisher control valves for end-user applications is not considered. If the control valve is determined to affect upstream or downstream safety relief cases, review by the end user or third party is recommended.
- 12 Q:** Does the proposed modification introduce new equipment items that require spare parts, training manuals, maintenance procedures, or training to the maintenance department?
A: Yes. The new equipment requires spare parts, training manuals, maintenance procedures, and training to the maintenance department that are specific to the new Fisher equipment items.
- 13 Q:** Does the proposed modification permanently remove the spares for existing pieces of equipment?
A: Yes. The spare parts of the existing equipment items should be removed from the plant.
- 14 Q:** Does the proposed modification require welding work to be performed?
A: If flanged spacers or concentric reducers are allowed in the plant, no welding work should be required. Face-to-face dimensions and valve size will most likely change.
- 15 Q:** Does the proposed modification change the inspection scope or inspection interval?
A: No.
- 16 Q:** Have the materials of construction been reviewed to ensure that the metallurgy is correct?
A: Yes.

Fisher A-body, Masoneilan 10000, and Fisher Vee-Ball Control Valve Comparison

There are many physical differences between these control valve constructions. Due to the hazardous nature of hydrofluoric acid, there are advantages in the design of the Fisher Vee-Ball control valve for these acidic applications. Often when replacing a Fisher A-body or Masoneilan 10000 with a Vee-Ball valve, a Vee-Ball—one to two sizes smaller—will be required based on control valve sizing. This results in even greater differences between the existing and proposed valve.

Face-to-Face Dimensions

The Fisher A-body, Masoneilan 10000, and Fisher Vee-Ball control valve all have unique face-to-face dimensions.

	Fisher A-Body	Masoneilan 10000	Fisher Vee-Ball CL300 RF
NPS	Inches		
6	18.62	18.62	9.00
8	22.38	22.40	9.56
10	27.88	26.02	11.69
12	30.50	30.24	13.31

Table 1. Fisher A-body, Masoneilan 10000, and Fisher Vee-Ball CL300 RF Control Valve Comparison

The use of spool pieces or concentric reducers will likely be required if the customer is not replacing piping during the modernization.

Capacity

Due to the extreme differences in valve geometry and resulting sizing coefficients, each valve will need to be re-sized to use a Vee-Ball construction replacement. The table below provides examples of this. Control valve sizing shall be conducted using current Fisher sizing software.

	Fisher A-Body Hi-Lift V-Port	Masoneilan 10000	Fisher Vee-Ball
NPS	Cv		
6	438	450	1100
8	765	750	1820
10	1320	1160	3000
12	1760	1620	3980

Table 2. Fisher A-body Hi-Lift V-Port, Masoneilan 10000, and Fisher Vee-Ball Control Valve Capacity Comparison

Weight

Since it will likely be a smaller size, the Fisher Vee-Ball control valve will be significantly lighter weight than an A-body or Masoneilan 10000 construction.

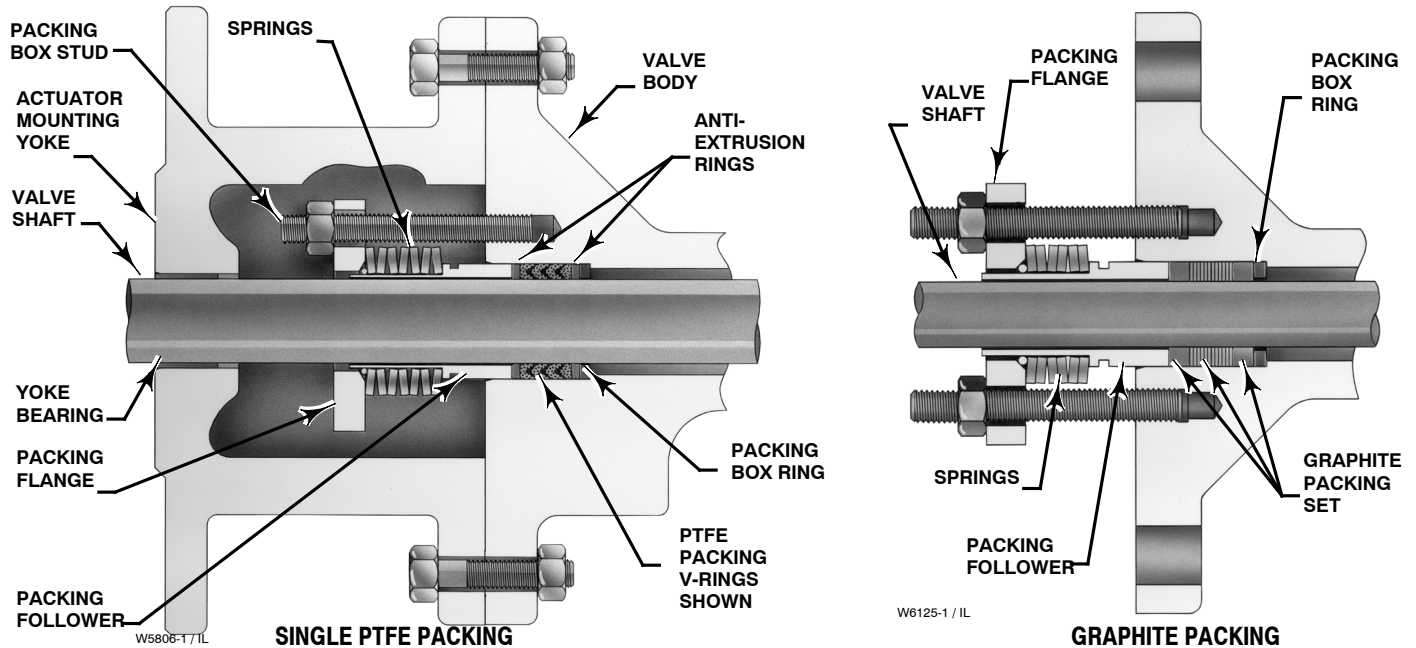


Figure 1. Typical ENVIRO-SEAL™ Packing Arrangements for Fisher Rotary Valves

Environmental Compliance

Many existing double-ported constructions may have packing selection that pre-dates low-emission packing technology. Historically, the Phillips license required a virgin stack of PTFE packing, while the UOP license required Chesterton Style 324 packing with a lubricator and isolator valve with polymer grease. Both of these packing styles are based on legacy process units that were constructed prior to the availability of low emission packing options. For HF alkylation units today, UOP has reviewed the Fisher ENVIRO-SEAL™ packing system and agrees it is suitable for this service. Typically, ENVIRO-SEAL PTFE or ENVIRO-SEAL Graphite packing are options. In either packing style, all metal packing parts shall be N04400 or a material compatible with HF acid, including packing studs and nuts.

Suitability for Hydrofluoric Acid Service

One of the main reasons for limiting the double ported design in the UOP licensed HF Acid Alkylation unit was due to the screwed-in seat ring. This feature is inherent to both the Fisher A-Body and Masoneilan 10000 valves. There are two reasons this seat ring is undesirable for HF Acid service:

Employee Safety

To enter an HF Acid unit, head to toe personal protective equipment (PPE) is required. It is desired that any potential trapped HF vapors be released while personnel is wearing their PPE. However, the screwed in seat ring cannot be removed until complete valve disassembly takes place—usually this is in an on-site maintenance shop or in an off-site valve service center. Although a user will do as much as possible to remove all trace amounts of HF acid from these valves, there is still a potential for vapors to be trapped between the valve body and the screwed in seat ring. See Figure 2.

Vibration

Some HF units experience high vibration for a variety of reasons. In these cases, the screwed in seat ring has been known to back out of the valve body. This can prevent the valve from closing and cause process upsets.

Both of these risks can be avoided by welding (tack weld or seal weld) in the seat ring in the double ported valve, however, the materials that the trim parts are made from in these valves can require difficult weld procedures. Users may have limited documentation on whether the seat ring has been welded into the valve body, which makes duplication of existing units more challenging.

The Fisher Vee-Ball valve body assembly and materials of construction have been reviewed part-by-part for suitability in HF Acid service. The diagram and parts list on the following page confirm selection for this application.

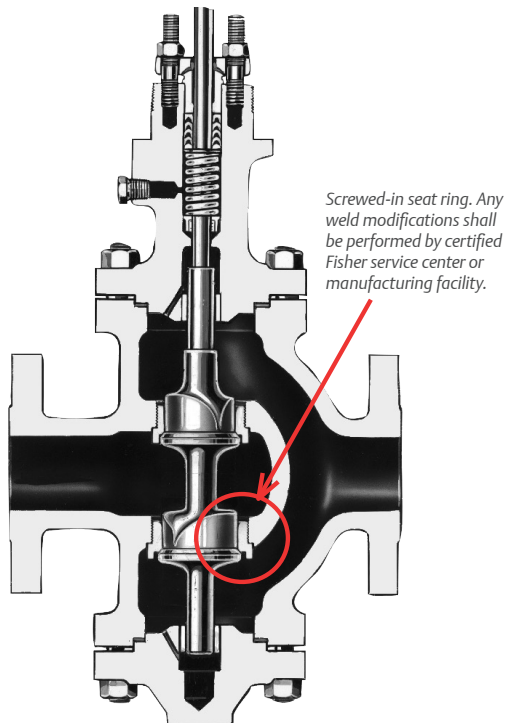
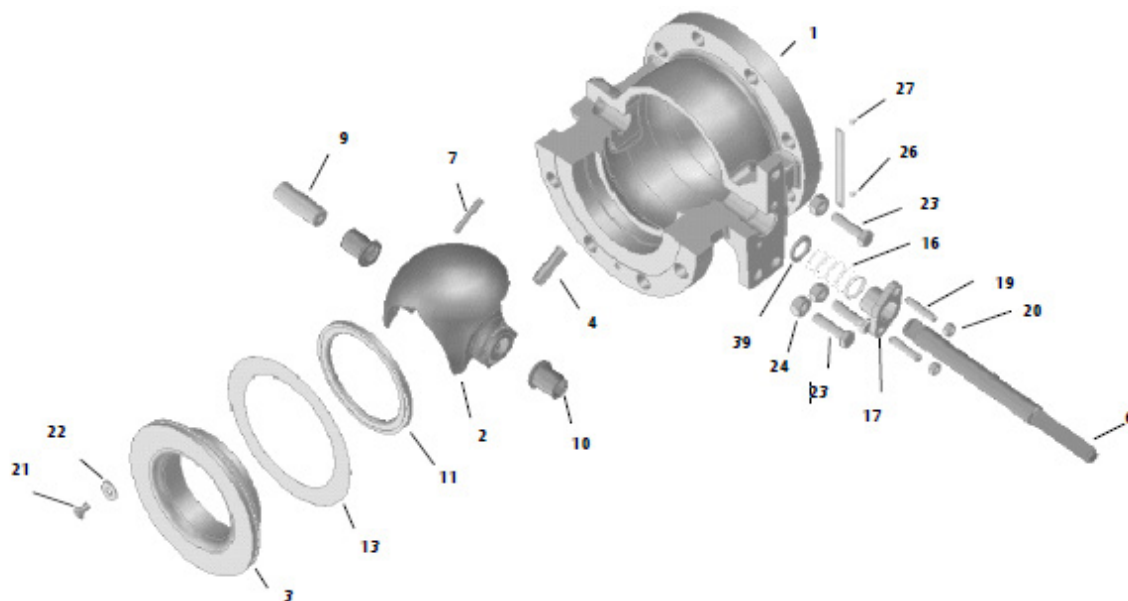


Figure 2. Screwed-in Seat Ring on an A-Body Valve



Key No.	Part Description	Material ⁽¹⁾⁽²⁾	Key No.	Part Description	Material
1	Valve Body	WCC per FMS20B113 ⁽⁵⁾ or SA516 Grade 70 per FMS20B106 ⁽⁵⁾ or M35-1	16	Packing Set ⁽¹⁾	⁽³⁾
2	Ball	M35-1	17	Packing Follower	N04400
3	Seat Protector Ring	M35-1	19	Packing Follower Stud	N04400
4	Taper Key	N05500	20	Packing Follower Nut	N04400
5	Drive Shaft	N05500	21	Seal Protector Screw	N04400
7	Groove Pin	N04400	22	Seal Protector Clip	N04400
9	Follower Shaft	N05500	23	Actuator Mtg Screw	B7M
10	Bearing	N04400/PTFE	24	Actuator Mtg Nut	2HM
11	Ball Seal	TCM Plus	25	Pipe Plug ⁽⁴⁾	N04400 for WCC Body; Consult factory for M35-1 Body
15	Gasket	Graphite Laminate	39	Packing Box Ring	Factory for M35-1 Body

1. All wetted internal parts to be constructed of Nickel-Copper Alloys (M35-1, M35-2, N04400, or N05500).

2. When replacing Fisher A-Body constructions, review sizing and design conditions. Capacity, shut-off classification, and dimensions (both face-to-face and overall envelope) will change. Spool pieces or concentric reducers may be required to maintain the take out dimensions of the A-Body being replaced if new piping will not be installed.

3. Historically, UOP specified Chesterton Style 324 packing with lubricator and isolator valve with polymer grease or manufacturer's recommendation for Hydrofluoric Acid. The Phillips license allowed a stack of virgin PTFE rings, and often also included the lubricator and isolator valve. However, both of these packing selections are based on legacy units that were constructed prior to the availability of low emission packing options. In both new and existing HF Alkylation units, ENVIRO-SEAL PTFE and Graphite packing are options with N04400 packing parts, with customer approval. Neither the Phillips or UOP specifications address ENVIRO-SEAL designs, since availability to the market occurred after the specifications were written. UOP has reviewed the Fisher ENVIRO-SEAL packing system and agrees it is suitable for this service.

4. Internal metal components of the packing system shall be N04400 or a material suitable for Hydrofluoric Acid. The packing box flange, studs, and nuts shall be N04400. Standard Belleville Springs in N07718 can be utilized. Provide one extra set of packing, two extra sets of body gaskets, and two extra sets of flange gaskets for shipment with this valve.

5. Valve body end tapping should be included in HF Alkylation Vee-Ball constructions. This option is added to reduce operator exposure to Hydrofluoric Acid vapor by allowing a means of removing the trapped gas before the valve enters a maintenance shop or service center.

Table 3. Fisher V150/V300 Vee-Ball Valves for HF Acid Service

Conclusion

Reliable Fisher control valves have been used in the process control industry for over 130 years. With a modern and efficient design, the Fisher Vee-Ball control valve offers multiple advantages that allow a user to transition from a legacy double-ported sliding-stem valve. This document should help speed up the MOC process.

Both end users and the sales office should exercise extreme care when specifying or entering an order for rotary valves to ensure proper material specifications throughout the entire bill of material. Rotary valves should be utilized only when specified and should not be substituted for globe valve specifications without approval by end user. An oversized actuator (1.5x required thrust) may also be considered to overcome any inevitable build-up.

Some end users have specified no rotary products in HF Acid service. Be sure specifications are reviewed before offering this solution.

Additional Resources

[Brochure: Fisher Vee-Ball Control Valves](#)

 <http://www.Facebook.com/FisherValves>

 <http://www.Twitter.com/FisherValves>

 <http://www.YouTube.com/user/FisherControlValve>

 <http://www.Linkedin.com/groups/Fisher-3941826>

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