Solving Problems in the Molecular Sieve Process - Ethanol Industry

vanessa

Tyco Flow Control has worked with maintenance and plant operations personnel in the ethanol manufacturing process to solve Molsieve application valve related problems in existing plants.

With the help and feedback of our customers, Tyco has supplied the Vanessa metal seated Triple Offset rotary process valve for this application.

The Vanessa valve holds up to and performs well in the harsh Molecular Sieve process commonly found in these plants. The Vanessa valve, with its standard Stellite seat and Duplex SS seal ring, has proven to last longer and outperform the High Performance Butterfly Valves commonly being utilized in Molecular Sieve isolation.

Pictured above are Vanessa Fig. QTLs with Morin Series B Pneumatic Actuators, and Westlock Limit Switches

Molecular Sieve Process Overview

The Molecular Sieve Process is based on the adsorption characteristics of ZEOLITE and the principle that ZEOLITE's affinity for water changes at different pressures. Water is effectively absorbed in the pores of the ZEOLITE during loading and desorbed during regeneration of the molecular sieve bed.

Dehydration is done by turns: one bed is in dehydration service while the other(s) are regenerated. Regeneration techniques include thermal reactivation, pressure swing (PSA) and vacuum swing (VSA). (There are typically 3 Molecular Sieves at a 50 Mmgy plant.)

ZEOLITE is a mixture of Alumina, Silica, and Sodium Oxide.

The top of the Sieve Tanks (Pressure Side) will see a normal operating temp of 300°F, although you will see spikes from 280°F to 320°F. On the start up of a sieve, the valves in line will see temperatures of up to 600°F for a period of 1 - 3 hours. (8" and larger valves are typically found in this process.)

The bottom of the Sieve Tanks (Vacuum Side) normal operating temperatures will be approximately 280°F with spikes from 260°F to 300°F. Again on start ups, the valves in line will see temperatures up to 600°F for a period of 1 to 3 hours. (4" and 6" valves are typically used in 50 Mmgy plants.)

The actual media seen by valves at start up is a combination of ZEOLITE and Clay (the bedding mixture in a sieve tank) and condensed alcohol vapor. This aggressive media, combined with the elevated temperatures of the process, causes excessive wear of the soft seats and seals of typical HP Butterfly valves, resulting in premature valve failures.

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Features and Benefits of the Vanessa Valve

The Vanessa Rotary Process Valve is a Metal Seated Triple Offset design. The third offset eliminates the rubbing and thus wear on the seat and seal through the entire 90 degrees of travel. The traditional HP Butterfly Valve is only a single or double offset, and thus rubs during travel.

Additionally, the Vanessa valve utilizes a resilient, Duplex SS seal ring in the disc assembly to provide true ZERO Leakage shut off. ZERO Leakage means there is no visible leakage during test duration as per API 598 and/or API 6D. To obtain ZERO Leakage, the seal ring undergoes a radial hoop compression as torque is applied to the shaft. In the closed position, the seal ring and metal seat interface, creating an evenly loaded tight shutoff with the least amount of torque.

The Vanessa valve is inherently Fire Safe in its design and comes in a variety of body configurations including Wafer, Lug, Double Flanged ISO 5752, and Gate Valve Face-to-Face. The valve is offered standard in Carbon Steel WCB or Stainless Steel CF8M materials of construction.

The temperature limits of the standard Vanessa valve allow for temperatures up to 800°F. This metal seated valve is the perfect solution for the Molecular Sieve process commonly regarded as a trouble area in the Ethanol Process Industry due to its high temperatures and wear and tear on commonly used HP Butterfly Valves.

Design Standards

Quality Assurance	ISO 9001
Environmental Management System	ISO 14001
Compliance with	Pressure Equipment Directive PED 97/23/EC, category III. Cat. IV mod. H1 available on request.
Design	ASME B16.34, API 609, DIN 3840, EN 593
Face-to-Face	ISO 5752, EN 558, ASME B16.10, API 609
Flange Drilling	ASME B16.5, ASME B16.47, ISO 7005, DIN 2501, EN 1092
Testing	API 598, API 6D, ISO 5208
Fire Test	API 607, 4th Edition
Marking	MSS SP 25, EN 19

Pressure/Temperature

Pressure/Temperature Ratings in psig (ANSI B16.34)

Temp. °F	Class 150		Class 300		Class 600		Class 900		Temp. °C
	CS	SS	CS	SS	CS	SS	CS	SS	
-20 to 100	285	275	740	720	1,480	1,440	2,220	2,160	-29 to 38
200	260	240	675	620	1,350	1,240	2.205	1,860	93
300	230	215	655	560	1,315	1,120	1,970	1,680	149
400	200	195	635	515	1,270	1,030	1,900	1,540	204
500	170	170	600	480	1,200	955	1,795	1,435	260
600	140	140	550	450	1,095	905	1,640	1,355	316
650	125	125	535	445	1,075	890	1,610	1,330	343
700	110	110	535	430	1,065	865	1,600	1,295	371
750	95	95	505	425	1,010	845	1,510	1,270	399
800	80	80	410	415	825	830	1,235	1,245	427
850	65	65	270	405	535	810	805	1,215	454
900	50	50	170	395	345	790	515	1,180	482
950	35	35	105	385	205	775	310	1,160	510
1000	20	20	50	365	105	725	155	1,090	538
1050	–	20 (1)	–	360	–	720	–	1,080	566
1100	–	20 (1)	–	325	–	645	–	965	593
1150	–	20 (1)	–	275	–	550	–	825	621
1200	–	20 (1)	–	205	–	410	–	620	649

Notes
- WCB permissible but not recommended for prolonged use above 800°F [427°C].
- (1) For welding end valves only. Flanged end rating terminates at 1000°F [538°C].

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