Ebullated bed valve solutions

Proven expertise in hydroprocessing

VELAN
Quality that lasts.
A world leader in valve design, engineering solutions, and manufacturing

VELAN AT A GLANCE

History
- Founded in 1950

People
- Over 1,800 employees

Product line
A world-leading range of valves across all major industrial applications:
- High pressure gate, globe, and check
- API standard gate, globe, and check
- Metal-seated and resilient-seated ball
- Triple-offset butterfly and dual plate check
- API 6D & 6A
Including: actuators and steam traps

Quality
Velan holds major applicable approvals:
- ASME N/NPT
- ISO 9001
- ISO 14001
- OHSAS 18001
- PED
- API
- SIL
- TA-Luft
- Comprehensive quality programs that are compliant with the most stringent industry standards such as: ISO 9001, API Q1, NCA 4000, ASME NQA-1 and 10 CFR 50 Appendix B.

- Velan has been surveyed and audited by leading organizations around the world such as Bureau Veritas, API, ASME, NUPIC, Newport News Shipbuilding, and DCMA.
- Headquartered in Montreal, Velan has several international subsidiaries.

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Leading the way...

Velan is one of the world’s largest manufacturers of industrial steel valves, recognized as a leader in quality and innovation. Founded by A.K. Velan in 1950, our company leverages advanced engineering capabilities and innovation to continuously expand our offering of industrial valves.

Today, Velan gate, globe, check, ball, triple-offset, engineered severe service valves and steam traps are installed throughout the world, handling diverse applications in cogeneration, fossil, nuclear power, oil and gas, refining and petrochemicals, chemical and pharmaceutical, pulp and paper, LNG and cryogenics, marine, mining, water and wastewater, and HVAC industries.

Engineered solutions
Velan’s Engineering group has vast experience, sophisticated software, and testing tools that enable us to find solutions to any customer challenge.

Whether it is for valves to handle liquid helium at -458°F (-272°C) in the world’s largest particle accelerator at CERN, Geneva, four-way switch coker ball valves to handle one of the refining industry’s toughest services; or valves for main steam isolation service in an operating nuclear power plant, Velan has been selected by most of the world’s leading engineering construction firms and industrial end users.

A long-standing commitment to quality has kept Velan at the forefront of industry standards. Velan holds all major industry certifications, including ASME Section III, ISO 9001:2008, PED, and API 6A and API 6D. Many prominent companies have established partnerships or global supply agreements with Velan.

Velan uses the latest automation technology, including CNC machines and many special-purpose transfer machines, enhanced by proprietary production techniques. Thanks to a wide range of equipment, we can efficiently handle highly customized orders as well as large production runs.

A global manufacturing leader
Velan employs over 1,800 professionals, the majority of whom are located in North America. International production centers are complemented by a global sales and distribution network, offering personal customer service and quick access to stock worldwide. Because customer requirements for immediate deliveries have escalated in the last few years, Velan offers quick-ship in North America to supplement the inventories of our stocking distributors.

Total quality commitment
Velan is totally committed to offering products and services that exceed customer expectations. All Velan valves are designed and manufactured with an emphasis on low emissions, safety, simple maintenance, ease of operation, and above all, long, and reliable service life. In fact, several years ago when a leading North American repair shop did an analysis on the reliability and repairability of commodity valves, Velan finished first. Whether we are manufacturing commodity valves or specialty valves, we deliver excellent long-term value to our customers.

After sales service support
Velan products can be serviced by our experienced field service technicians, call +1 514-748-7748.

NPS 18 (DN 450) Class 2500 severe service Securaseal metal-seated ball valve for coal liquefaction plant in Inner Mongolia. This valve has been in service for over 10 years and continues to perform.
Velan: Valve solutions for hydroprocessing

Ebullated bed reactors are used in hydroconversion processes where a centrifugal ebulliating pump, along with a constant flow of residue and hydrogen, provides a looping flow in the reactor that maintains rice-like catalyst in suspension. This constant flow mixes the catalyst with liquid and vapor. Fresh catalyst can be injected, and spent catalyst withdrawn, to control the reaction at any time. This continuous process is particularly efficient to process heavy-oil with high metal and sulphur content.

This being a continuous process, most block valves isolate back-up equipment. The only exceptions are the catalyst injection and withdrawal valves.

<table>
<thead>
<tr>
<th>Process region</th>
<th>NPS (DN)</th>
<th>Valve type</th>
<th>Fluid conditions (metric)</th>
<th>Velan advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hydrocarbon feed</td>
<td>16 (400)</td>
<td>Securaseal R-series metal-seated ball</td>
<td>450 to 850°F at 2900 to 3400 psi (232 to 454°C at 200 to 234 Bar)</td>
</tr>
<tr>
<td>2</td>
<td>Hydrogen heater inlet and outlet</td>
<td>10 (250)</td>
<td>Y-pattern stop check</td>
<td>400 to 850°F at 2900 to 3400 psi (204 to 454°C at 200 to 234 Bar)</td>
</tr>
</tbody>
</table>
| 3              | Catalyst injection | 3 (80) | Double ball | 800 to 1100°F at 2900 to 3400 psi (427 to 593°C at 200 to 234 Bar) | • The double ball valve provides block and bleed while ensuring bi-directional sealing.  
  • The thermal protection reduces thermal stress and increases resistance to fatigue. |
| 4              | Catalyst withdrawal/ coke laden catalyst | 3 (80) | Double ball | 800 to 1100°F at 2900 to 3400 psi (427 to 593°C at 200 to 234 Bar) |  |
| 5              | Gas/liquid stations hydrogen vapor | 24 (600) | Securaseal R-series metal-seated ball | 800 to 900°F at 550 to 3200 psi (427 to 482°C at 38 to 221 Bar) | Purging with hydrogen avoids residue and catalyst fine build-up. |
| 6              | High pressure/high temp. letdown isolation | 16 (400) | Securaseal R-series metal-seated ball | 800 to 900°F at 3700 psi (427 to 482°C at 255 Bar) | Purging with VGO avoids residue and coke build-up. |
| 7              | Intermediate pressure/ intermediate temp. letdown | 16 (400) | Securaseal R-series metal-seated ball | 800 to 900°F at 600 psi (427 to 482°C at 41 Bar) | • The ASME section VIII bolted-joint avoids body seal leakage when purging.  
  • The cobalt-based hardfacing offers sulphidation corrosion protection and controls the grain size and passivation of base materials. |
| 8              | Low pressure/low temp. letdown | 16 (400) | Securaseal R-series metal-seated ball | 800 to 900°F at 600 psi (427 to 482°C at 41 Bar) |  |
| 9              | Fractionator bottom | 20 (500) | Securaseal R-series metal-seated ball | 800 to 900°F at 200 psi (427 to 482°C at 14 Bar) | Steam purging avoids coke fouling. |

Reference list available upon request.
Securaseal R-series metal-seated ball valves

**Design features**

1. **Body**
   - In addition to our wide range of forged valves, *Velan offers cast body for large sizes and high pressure classes up to NPS 12 (DN 300) Class 2500.*
   - Our **optimized body design** complies with industry standards (ASME B16.34 and API 608).

2. **Stem and packing chamber**
   - Robust blowout-proof stem.
   - The packing gland arrangement, which includes stem bushing, provides a fully guided stem at all times of operation. In addition, stem bushing reduces side thrust effect and stem wobbling.
   - **Our stem packing technology guarantees a low-emission stem seal in compliance with the highest industry standards.**

3. **Ball**
   - Ball and seat are lapped for 100% contact area providing **leak free performance.**

4. **Seats**
   - A robust Belleville type spring loads the upstream seat with enough force to provide good scraping action between the ball and seat. This maintains and **effective sealing over the life of the valve even at low differential pressures and/or when solids are present.**
   - The downstream seat is fully retained to prevent slurry ingress behind the sealing seat and avoid erosion which could lead to leakage.
   - **These features ensures tight shut-off under the toughest conditions.**

5. **Coating solutions**
   - Advanced coatings for all ball and seats (as well as the waterway bore when necessary) provides trouble free operation even in aggressive erosive and corrosive services.
   - Some of these processes provide a metallurgical bond between the coating and substrate. The result is greatly improved wear properties over similar coatings which rely on a mechanical bond between the coating and substrate. Coating hardness varies from 45 to 72 RC.

6. **Mounting bracket**
   - For pressure classes 900 and higher, valves are supplied for **direct mounting.** No additional bracket or coupling is required as they are included as standard with the valve.

**Material selection for metal-seated ball valves**

<table>
<thead>
<tr>
<th>Valve part</th>
<th>Fractionator bottom isolation</th>
<th>Steam isolation</th>
<th>Catalyst injection and withdrawal pressure letdown isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>WCB / A105</td>
<td>C12 / F9</td>
<td>F347 / CF8C</td>
</tr>
<tr>
<td>Ball</td>
<td>410 Cr. plated</td>
<td>410 + HVOF CrC</td>
<td>718 + S&amp;F Cobalt-based</td>
</tr>
<tr>
<td>Seat</td>
<td>410 + CoCr alloy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stem</td>
<td>410</td>
<td>410</td>
<td>660</td>
</tr>
</tbody>
</table>

Velan imposes rigorous quality control on its carbon and austenitic materials to mitigate or avoid HIC and naphthenic and sulphidic induced corrosion. All materials meet the most recent NACE requirements. Velan ensures optimized grain sizes and passivation of all machine surfaces to further ensure reliable performance in the most aggressive crude. Wear-resistant surface treatments are selected to **mitigate sulfidation corrosion**, including for highly sulphitic high temperature application.

**Additional features**

- **Bi-directional** sealing.
- All valves are inherently **fire safe** by design and materials of construction.
- **Field replaceable seats.** Downstream and upstream seats are removable making maintenance of the valve easy.

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*Note: CoCr alloy as used throughout this catalog refers to cobalt chrome hardfacing alloys as supplied by Kennametal Stellite™ and other approved manufactures.*
Securaseal R-series: for catalyst injection and withdrawal

Valves placed at the catalyst injection and withdrawal portion of the process enable the replacement of catalyst while the reactor is running. Typically, four catalyst lines are located at the bottom of the reactor to withdraw the catalyst, and four at the top to inject fresh catalyst. Each line has two ball valves before going to a manifold; one motorized and one manual. After the manifold, one motorized double ball valve ensures seal integrity of the injection manifold and the other ensures the integrity of the withdrawal manifold.

Catalyst injection and withdrawal valves are typically exposed to temperature swings from ambient up to 850°F (454°C) with 1 to 10 cycles per day. They require bi-directional sealing and are subject to thermal shock.

Double ball valves

To provide block and bleed and ensure bi-directional sealing, a double ball valve is typically designed with two ball valves integrated into one body. This specialty valve is provided with a dual operator that simultaneously opens and closes the two valves. The cavity in between the two balls can be either vented or pressurized when the valve is closed to ensure complete isolation of the catalyst manifolds.

Securaseal R-series: for vacuum residue (VR) feed pump isolation, filter isolation, and letdown isolation station

These block valves cycle to switch from one line to another to perform maintenance on a critical piece of equipment. Considering high-pressure and the presence of hydrogen, they operate in tandem to provide reliable shut-off. They are subjected to sulfidation corrosion and residue build-up in the cavity due to low cycling. The pressure letdown isolation valve are also exposed to catalyst fines (debris) formed in the ebullated bed reactor and that are carried over into the let-down stations.

ASME section VIII body seal: The bolted-joint design, as approved by licensors, offers reliable sealing when high-pressure and high-temperature hydrogen is working with vacuum and atmospheric residue.

<table>
<thead>
<tr>
<th>Purge type</th>
<th>Purge port location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On the spring side</td>
</tr>
<tr>
<td>2</td>
<td>Into the main body cavity</td>
</tr>
<tr>
<td>3</td>
<td>To the main body and seat spring</td>
</tr>
<tr>
<td>4</td>
<td>Connecting body to the upstream line</td>
</tr>
<tr>
<td>5</td>
<td>To end connection of valve (vacuum service only)</td>
</tr>
</tbody>
</table>

Sulphidation corrosion protection: Cobalt-based hardfacing, controlled grain size and passivation of the base material to combat corrosion. All materials are NACE compliant.

Purging to avoid residue build-up: Filter skid valves are typically purged with hydrogen while pressure letdown valves are purged with VGO. With over 30 years of experience in heavy oil upgrading with purging systems that keep critical areas free of coke build-up, we provide the optimal configuration, orifice selection and in-service monitoring where required.

Thermal protection

Catalyst injection and withdrawal valves are prone to thermal stresses. Cracking occurs due to the initial thermal stresses experienced when the valve is opened after several hours of having remained closed and therefore reached ambient temperatures. This phenomenon is especially observed during winter when the external temperatures drop as low as -40°F (-40°C) and the preheating systems fail. Adoption of a thermal protection has been proven to effectively mitigate this phenomena by reducing thermal stresses and increasing resistance to fatigue.
Pressure seal y-pattern globe and stop check valves

**Design features**

1. **Body**
   Velan’s innovative pressure seal design provides greater sealing force that is increased through internal pressure.
   The y-pattern globe design offers:
   - Low pressure drop compared to vertical globe valves, excellent resistance to the effects of thermal cycling, low torque stroking, and easy in-line repair.
   Valves are available in a wide range of materials including: WCB/A105, WC6/F11, WC9/F22, C12A/F91, C12/F9, CF8M/F316, CF3M/F316L, CF8C/F347, Incoloy 825, and Inconel 625.
   Velan offers equalizing and bypass pipes and valves in many different configurations to help ensure the valve will open under any operating conditions.

2. **Stem seal design**
   Evolved from extensive testing, offering a tight seal with little or no maintenance over long periods of time. The non-rotating stem requires lower operating torque.
   - Live-loaded packing keeps the stem tight (optional).
   - A stem expansion/contraction thrust unit available for high temperature applications (optional).

3. **Disc and seats**
   Disc is fully guided eliminating the effects of side thrust with CoCr alloy seating and guiding surfaces providing maximum resistance due to extreme temperature changes and piping loads.

4. **Impactor handwheel**
   Gives 3 –10 times more closing force than a standard handwheel resulting in smooth, easy operation and tight shutoff under extreme pressures.

**Material selection for pressure seal stainless steel y-pattern globe valves**

<table>
<thead>
<tr>
<th>Valve part</th>
<th>Fractionator bottom isolation</th>
<th>Steam isolation</th>
<th>Hydrogen heater inlet/outlet pressure letdown isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>WCB / A105</td>
<td>C12A / F91</td>
<td>F347 / CF8C</td>
</tr>
<tr>
<td>Disc</td>
<td>WCB / A105 + CoCr alloy</td>
<td>C12A / F91 + CoCr alloy</td>
<td>347 + CoCr alloy</td>
</tr>
<tr>
<td>Seat</td>
<td>Integral + CoCr alloy</td>
<td>Integral + CoCr alloy</td>
<td></td>
</tr>
<tr>
<td>Stem</td>
<td>XM-19</td>
<td>ASTM A565 Gr. 616HT</td>
<td>XM-19&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note: CoCr alloy as used throughout this catalog refers to cobalt chrome hardfacing alloys as supplied by Kennametal Stellite™, and other approved manufacturers.

**In critical hydrogen lines**

These valves are critical to isolate the high-pressure hydrogen line. They are prone to packing and gasket leakage during temperature swings leading to fire.

**Low-E packing arrangement**: Our fully qualified packing configuration includes live-loading and minimizes operational torque.

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Progressive thinking: Velan’s core technologies

Low emission valves with reliable sealing

Velan’s API 600, 602, 603, and 623 valves dual qualify to API 624 and ISO-15848 fugitive emission requirements while also having packing qualified to API 622. We offer emissions lower than 100 ppmv from both the valve stem packing and body bonnet gasket.

Fugitive emissions standards:
- ISO-15848
- API 622
- API 624 & API 641
- TA-LUFT

Seat-leakage standards:
- API 598
- MSS SP61
- ANSI/FCI 70-2 Class VI
- Fire safe

Several alliances to develop proprietary protective coatings

Velan is engaged in advanced research in different deposition technologies, using the services of independent laboratories for abrasion, sliding wear, bond strength testing, scanning electron microscopy and x-ray diffraction.

<table>
<thead>
<tr>
<th>Deposition processes</th>
<th>Coating materials</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hardness (HRc)</td>
</tr>
<tr>
<td>HVOF</td>
<td>CrC-NiCr</td>
<td>64-68</td>
</tr>
<tr>
<td></td>
<td>(WC)/Cr-Ni</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>WC-CoCr</td>
<td>70-72</td>
</tr>
<tr>
<td></td>
<td>WC-NiCr</td>
<td>70-72</td>
</tr>
<tr>
<td></td>
<td>CrO2</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>TiO2-CrO2</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>TiO2-CrO2-Ta</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>VEL-8</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>TiO2</td>
<td>60</td>
</tr>
<tr>
<td>Plasma spray</td>
<td>NiCrBo</td>
<td>58-63</td>
</tr>
<tr>
<td></td>
<td>NiWCrBo</td>
<td>59-63</td>
</tr>
<tr>
<td></td>
<td>CoCrBo</td>
<td>56-61</td>
</tr>
<tr>
<td>Spray &amp; Fuse</td>
<td>WWC</td>
<td>72</td>
</tr>
<tr>
<td>Chemical vapor</td>
<td>WC</td>
<td>45</td>
</tr>
<tr>
<td>Cladding</td>
<td>CoCr</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>CoMoCr</td>
<td>55</td>
</tr>
<tr>
<td>Plating</td>
<td>Hard chromium</td>
<td>66</td>
</tr>
</tbody>
</table>

- Excellent
- Good
- Satisfactory

Automation capabilities

Velan offers a wide range of products to address each customer’s application. Our valves can be equipped with electric, hydraulic, or pneumatic actuation. We also offer pre-installed switches, positioners, sensors (thrust and torque), and signal conditioners. We also offer:
- Integral control actuation and two-wire control.
-Overrides, limit stops, and most standard accessories.

Actuation feature to cycle on demand

- Valves can be supplied for direct mounting with no additional bracket or coupling.
- Drive train sizes are taking into consideration when selecting material and temperature.
- Actuators are oversized to ensure reliable valve cycling.

NEW!

Velan’s patent-protected cable drive actuator. A revolutionary new alternative for quarter-turn actuation.
The most comprehensive line of industrial forged and cast steel gate, globe, check, ball, butterfly, and knife gate valves and steam traps.

ASME pressure classes 150–4500 in carbon, alloy, and stainless steel

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