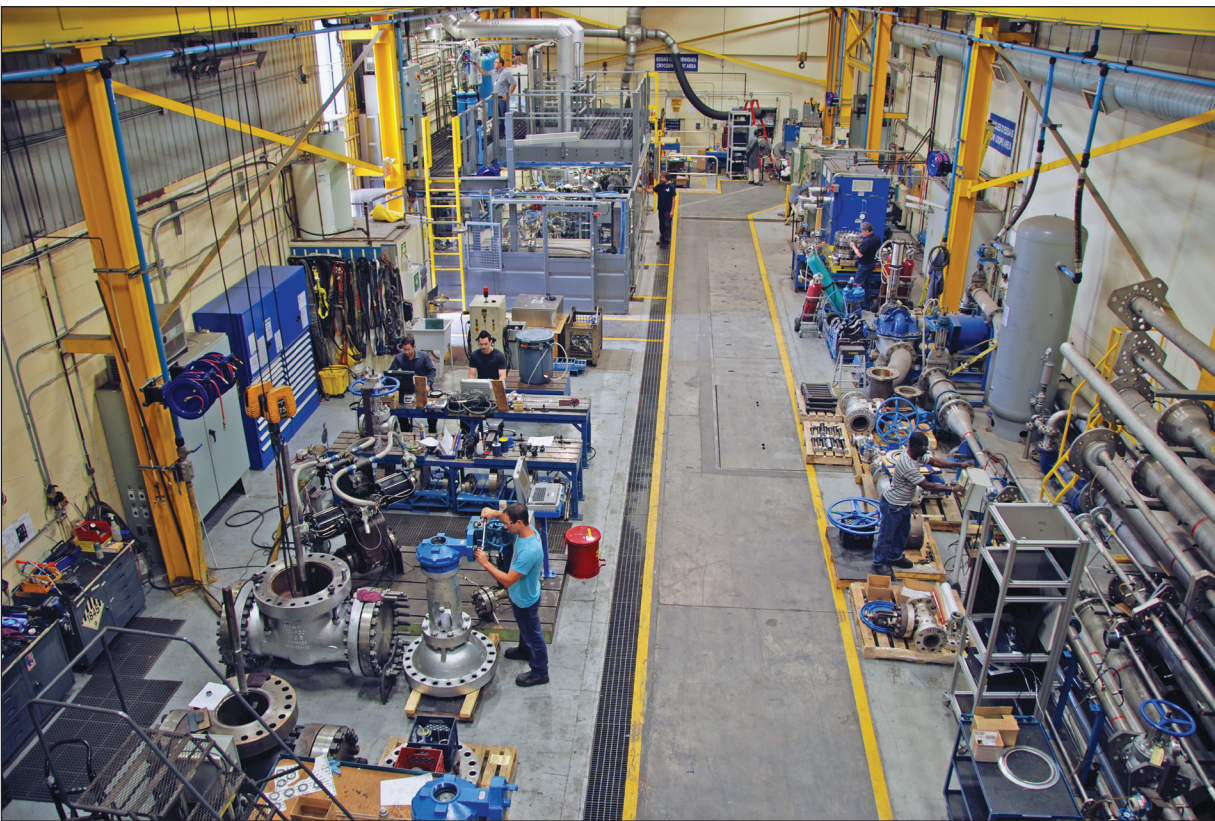
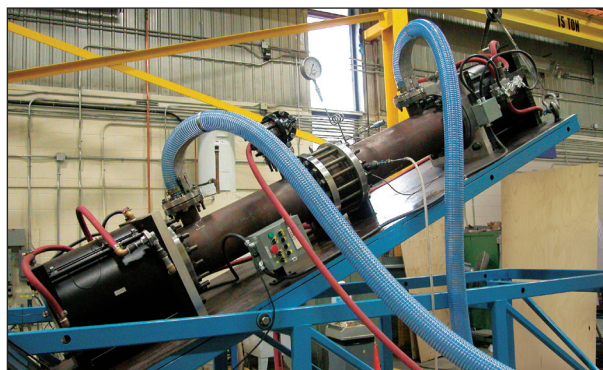
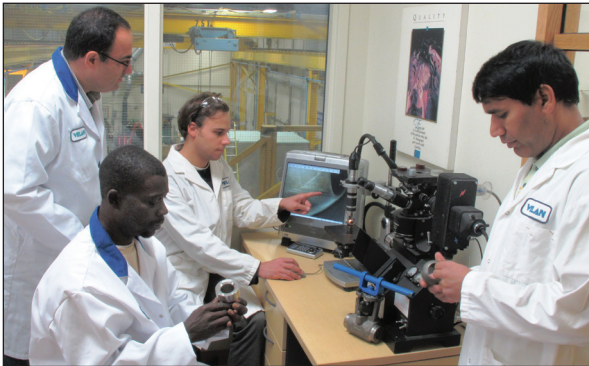


Velan Research and Development Testing and Qualification Services



Velan R&D services include:

- **Project management**
- **Design and analysis**
- **Experimental prototyping and lab simulation**
- **Performance evaluation**
- **Product release or launch**

VELAN
Quality that lasts.

Project management

- Scoping
- Business case
- Specification review
- Phase

Design and analysis

- Detailed design
- Finite element analysis and computational fluid dynamics
- Mathematical model
- Design of experiments
- Qualification program

Experimental

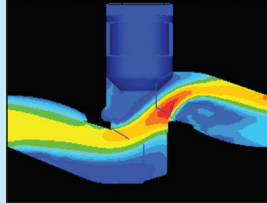
- Prototyping
- In-lab process simulation
- Standardized testing
- Customized testing

Performance evaluation

- Data analysis
- Characterization
- Root cause analysis
- Significant results determination
- Solution determination

Product release or launch

- Technical support



Velan R&D Services

With over 65 years of expertise, we pride ourselves on our ability to deliver above and beyond standard testing. The R&D group is a key part of the Velan engineering team, and the services we provide include technical project management, design and analysis, standard and customized experimentation work, performance evaluation, and turn-key support from project initiation to program completion.

We provide customized testing programs that will help develop and qualify our valves to client's specifications and qualification needs.

Velan has three R&D test lab facilities offering a wide range of testing capacities, including steam boilers, superheaters, flow loops, cryogenic stands, cycling stations, and diverse test fluids.

We also work closely with specialized third-party labs, which allows us to design extensive qualification programs to meet your most exacting needs.

Typical test fluids		
Fluid	Temp. (°F)	Pressure (psi)
Steam	1,150	2,700
Water	-	16,000
Nitrogen gas	1,200	20,000
Helium gas	1,200	20,000
Methane gas	500	600
Liquid nitrogen	-320	Atm.
Slurry	-	16,000

Standard tests	Typical industries serviced			
	Nuclear	Defense	Severe service	Commodity
Baseline / valve signature / Puff tests (QSS and smart stem)	✓	✓	✓	
Cryogenic tests			✓	✓
Environmental simulation (aging) and autoclave tests (Ph, P, T, Humidity, etc...) ⁽¹⁾	✓	✓	✓	
Fire tests			✓	✓
Flow characterization tests (Cv, curve, lift, closing time, etc...)	✓	✓	✓	✓
Fugitive emissions tests (API 624, API 641, ISO-15848, Ta-Luft, etc...)			✓	✓
High speed actuation tests	✓		✓	
Hydro tests (shell, seat, packing, backseat)	✓	✓	✓	✓
Line break tests (blowdown) ⁽¹⁾	✓			
Material properties and tribological testing (mechanical properties, galling, wear, COF, etc...)	✓	✓	✓	✓
Pipe load testing	✓	✓		
Seismic tests ⁽¹⁾	✓	✓		
Shock tests ⁽¹⁾		✓		
Slurry tests	✓		✓	
Static side load tests	✓			
Thermal binding tests	✓	✓	✓	✓
Thermal shock tests	✓	✓	✓	
Valve life qualification (cycling with process simulation)	✓	✓	✓	✓

(1) Test typically performed at specialized 3rd party labs

Defense industry

Velan has a long history of manufacturing valves designed specifically for the defense industry. Our defense valves are designed to military specifications and are subjected to extensive qualification test programs.

While the testing that is performed on military applications is very similar to that for nuclear service, military valves must also be subjected to mechanical and thermal shock tests.



The USS Dwight D. Eisenhower, one of several nuclear-powered Nimitz-class aircraft carriers standardized on Velan valves and steam traps.

Nuclear industry

Velan has been producing nuclear valves since the 1950s, and has pioneered many valve technology innovations that later became industry standards.

This extended experience and engineering know-how allows us to provide optimal



Seismic qualification testing⁽¹⁾



Baseline diagnostic testing at elevated temperatures.

designs that meet the latest industry standards. Velan R&D remains committed to developing and qualifying valves for this ever-evolving industry.

Seismic qualifications are performed to meet current regulations as well as specific customer requirements. Tests include cycling and resonant searches in order to ascertain the natural frequency of the valve and demonstrate it will withstand an earthquake.

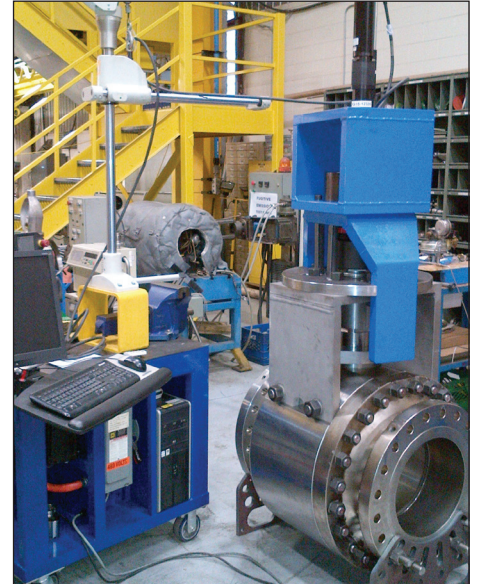
Other important tests include blowdown testing which validates the valves safety performance capacity to a line break simulation. Also, baseline diagnostics testing allows us to compare valve signature to established parameters, and plays a significant role in future preventive maintenance decision making process.



Line break testing (blowdown)⁽¹⁾

Severe service processes

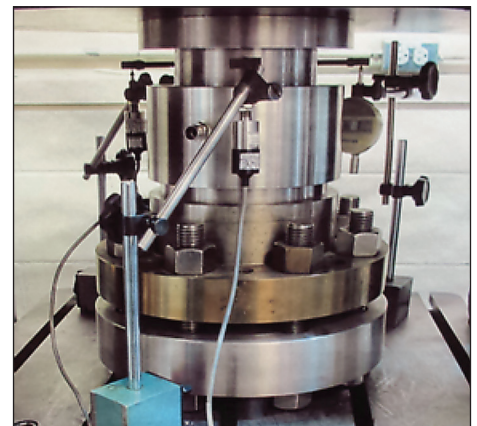
Velan's severe service valves are custom designed to handle applications that can't be adequately handled using established materials and commercial valve designs. As a result, severe service valves require significant R&D to address the specific performance requirements for processes in which a valve undergoes harsh conditions such as high speed actuation, high temperature, acid leach, slurry, and more.



Valve qualification testing.

At Velan R&D, we revel in the unique challenges of this industry and innovate to produce high performance valves. Using a cost-conscious methodology, we make best use of existing research data, often complemented with everything from tribometers to focused fixture testing to full valve qualification testing.

To support this program, we are actively engaged in coating and material research to find specific solutions for sliding wear performance requirements that will provide long and reliable valve service life.



Fixture testing.

Fugitive emissions

The present stuffing box and gasket joint are based on the R&D work done in the early 1970s. Velan's short packing lengths and live-loading were introduced to the industry and zero "visual" leakage was achieved with the introduction of better packing materials.

With improved test methods, the gland and gasket systems have been refined to the point where near zero fugitive emissions are possible today.

Velan strives to offer qualification solutions to meet the most stringent industry standards such as API 622, API 624, API 641, ISO-15848-1/2, and Ta Luft.



API 624 fugitive emissions qualification testing.

Cryogenic testing

Velan is an industry leader in the cryogenic field, and has supplied cryogenic valves to a wide range of applications ranging from standard commercial LNG (liquefied natural gas) processes to specialized liquid helium valves used to cool particle accelerator magnets (at CERN, for example). As such, we can provide complete cryogenic testing and qualification services.



Some of the 2,500 Velan cryogenic valves for liquid helium installed in the Large Hadron Collider (LHC) at CERN.

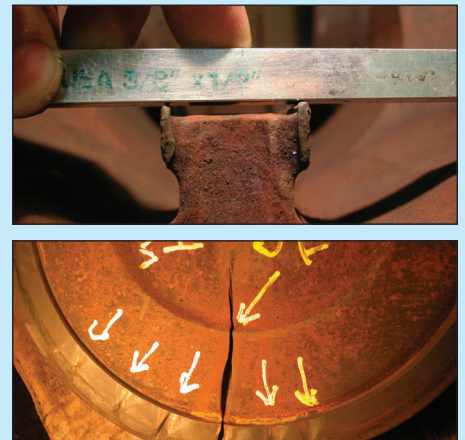


Cryogenic testing.

Root Cause Analysis

Velan provides field engineering support long after the valve is delivered. For severe service applications and challenging process/equipment performances, Velan can provide failure root cause analysis support to address and improve customer valve performance challenges.

Right: Corrosive and erosive applications.



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