Remote Valve Diagnosis: a new approach to monitor critical ball valves performance

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Remote Valve Diagnosis (RVD) is a new proprietary system that monitors, acquires, registers and transmits critical ball valve performance information back to the maintenance personnel.

The purpose of RVD is to provide real time condition information from a valve within any location, providing an alarm in the case of malfunction.

STATE OF THE ART FOR CRITICAL VALVE DIAGNOSTIC SYSTEMS

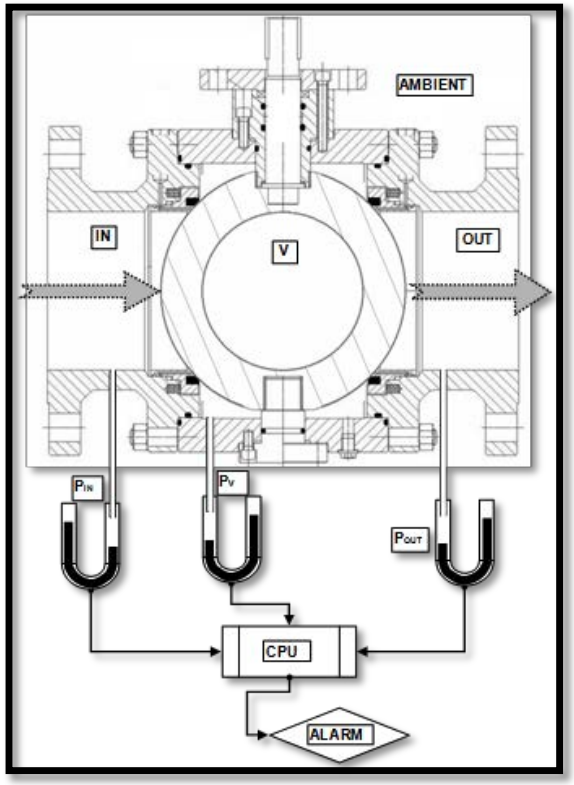
Manual test	Acoustic / Pressure oscillation technique	Partial stroke	Full stroke
• Periodic test • Requires shutdown of the process and special test equipment and personnel	• Automated or manual systems • Difficult data interpretation	• Periodic test • No information about possible leakage •Interference with plant process	• Periodic test • Requires shutdown of the process

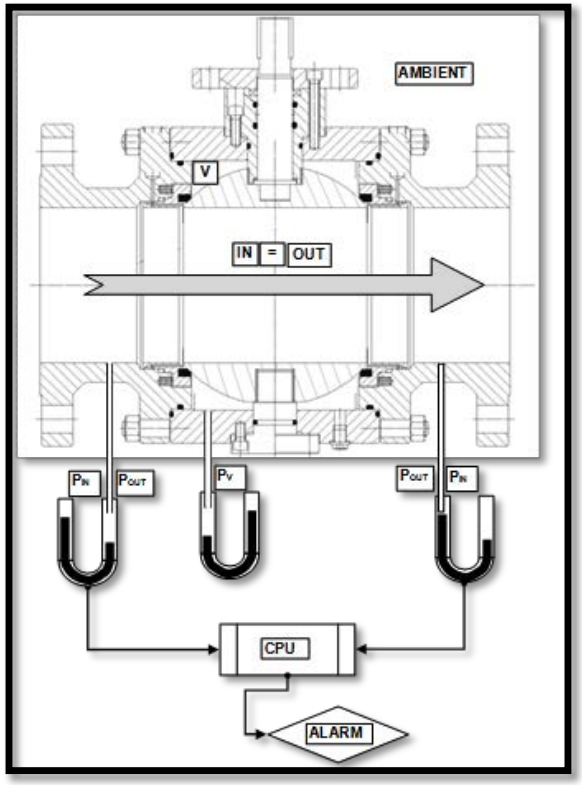
NEW APPROACH TO MONITOR CRITICAL VALVE PERFORMANCE

RVD

- Automated test continuously running
- No interference with plant process
- Information about valve seal integrity
- Simple analysis of the collected information

CLOSED VALVE

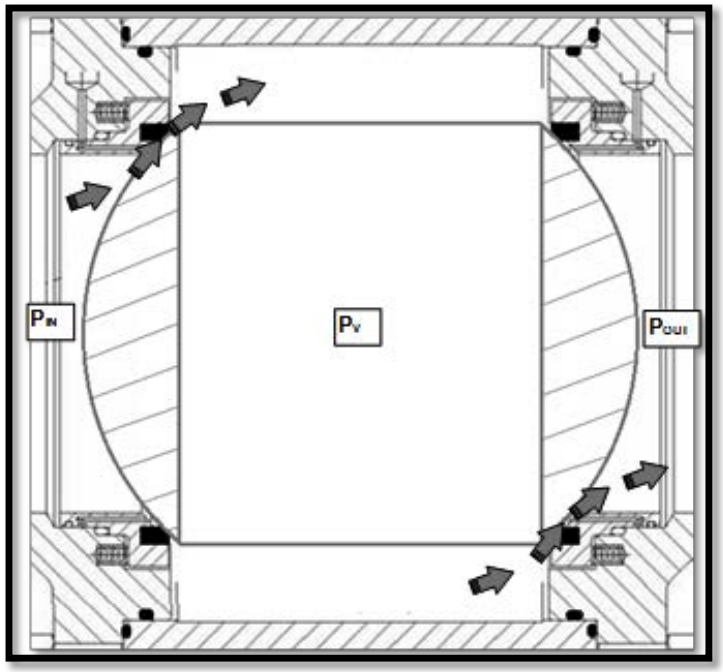


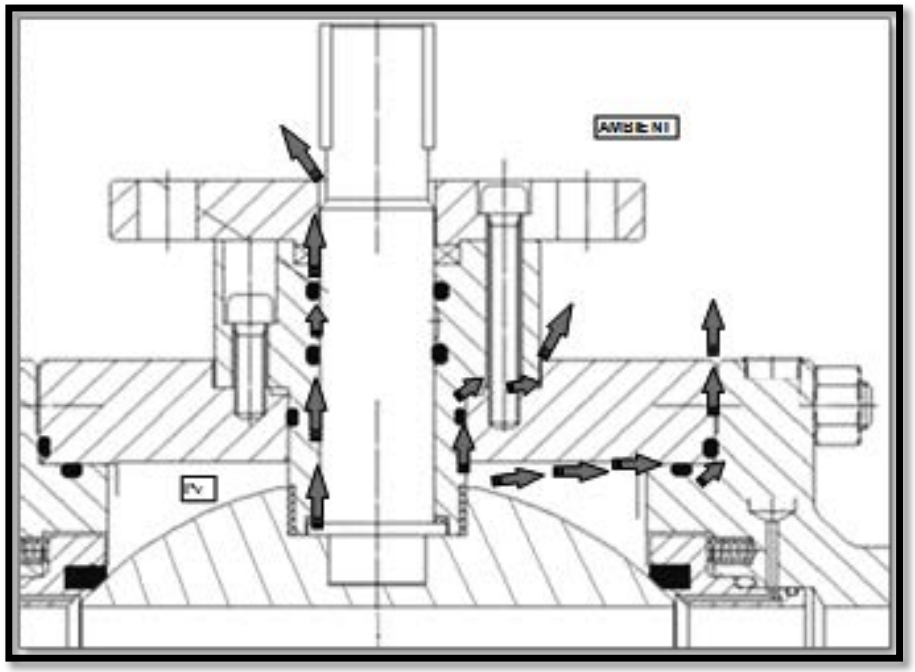


OPEN VALVE

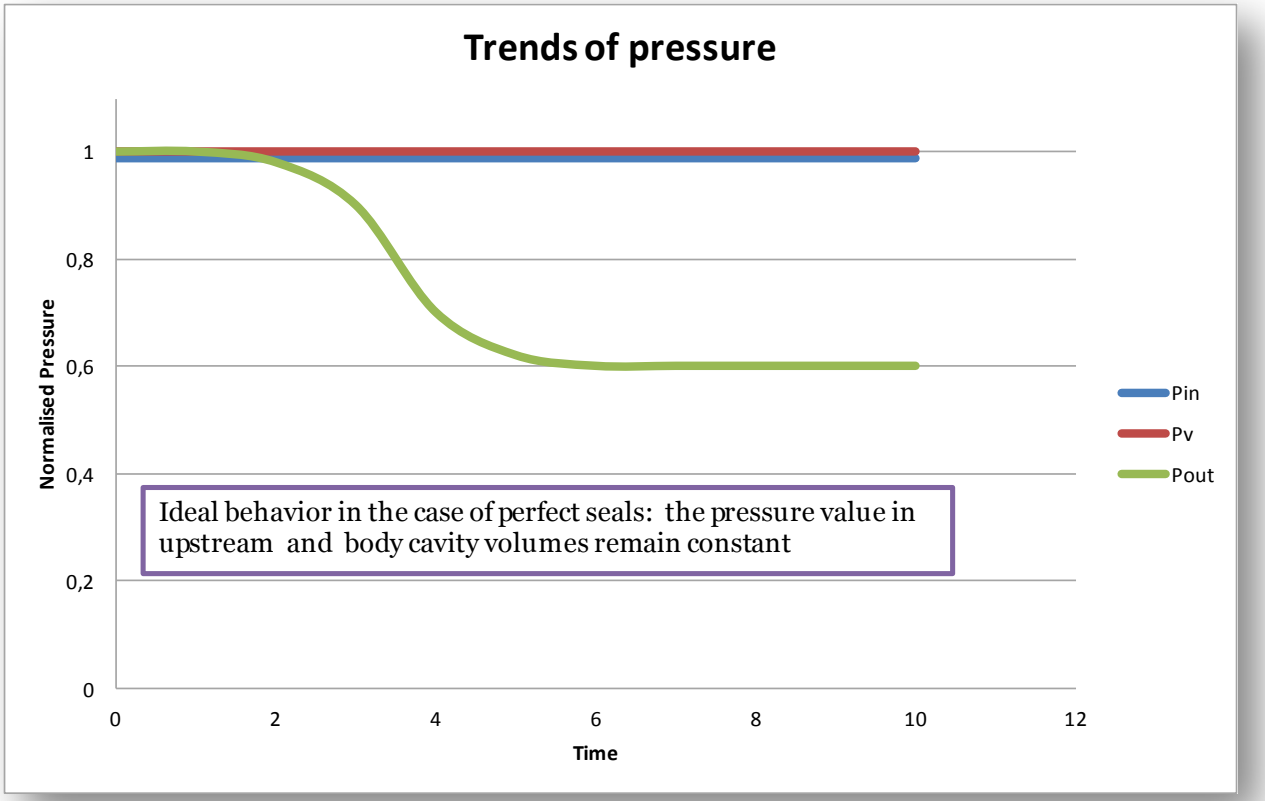
The seal leakage detection is based on the value of pressure recorded by sensors connected to the three inner volumes of a trunnion mounted ball valve.

The fault condition of the seals is detected appropriately processing pressure signals over time and comparing the trends of the pressures in the three volumes with reference curves acquired on a new valve.

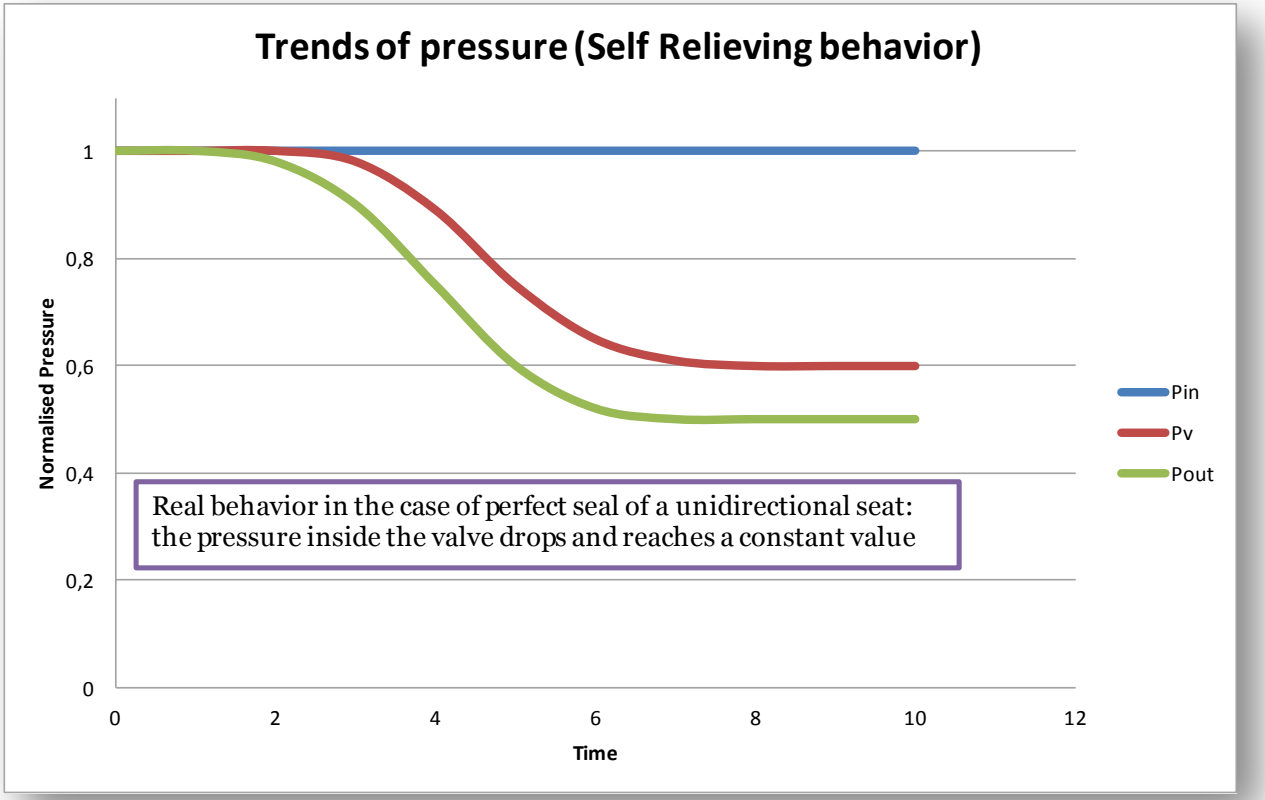




In the ideal case of perfect tightness of all sealings, the body cavity will maintain its constant pressure regardless of what happens in the line; in case of damage of a seat sealing, the pressure gradient will drive the flow of leakage through the seals.

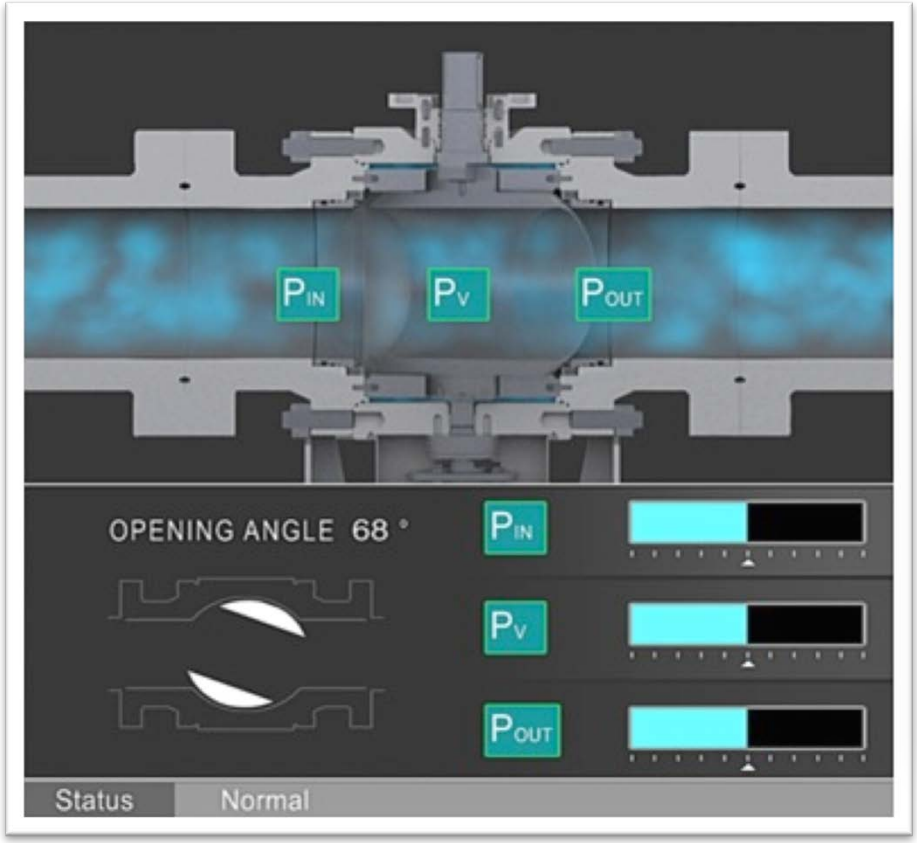


In perfect tightness condition, due to closing the valve, there will be a pressure drop in the outlet volume guided by the conditions of the plant, while the inlet pressure and the body cavity pressure will remain constant.

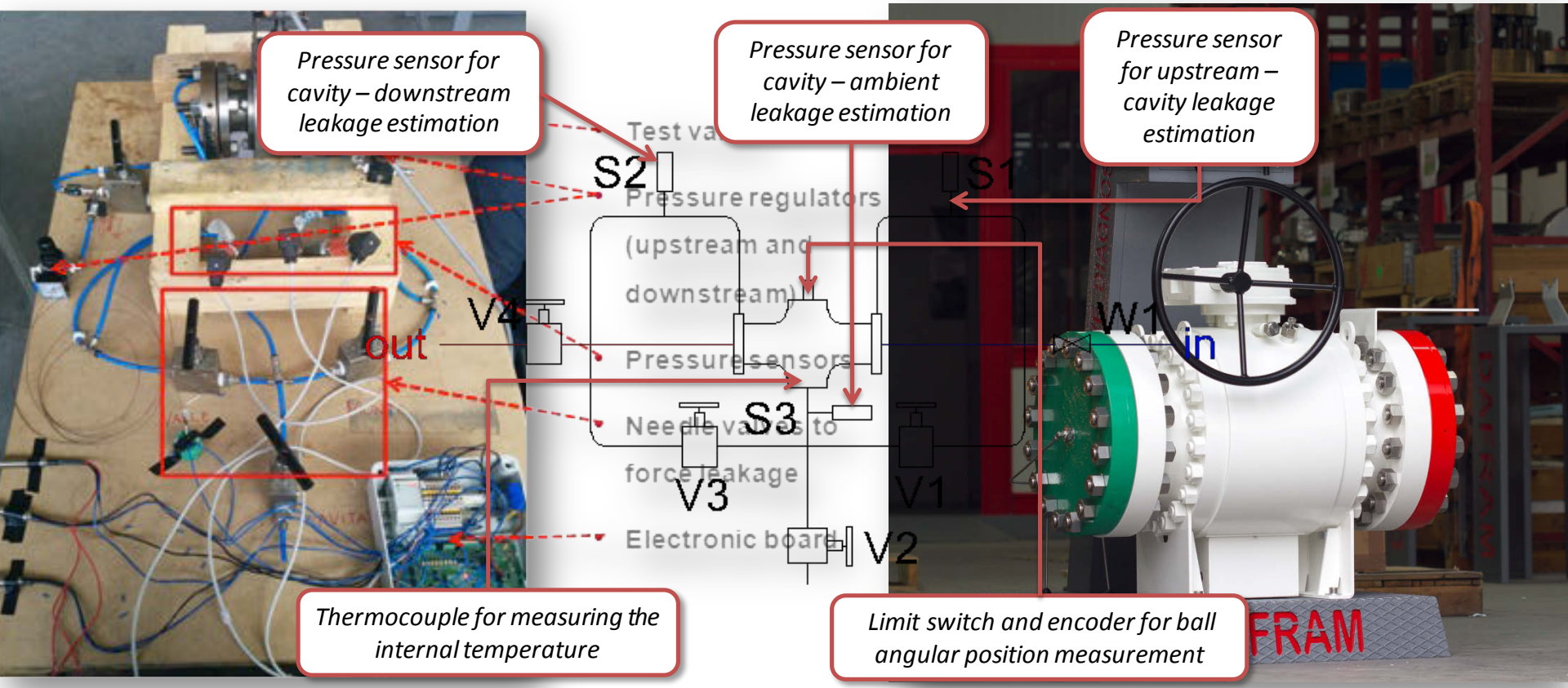


Actually, having assumed the seats unidirectional, there will exist an overpressure limit value between the body cavity pressure and the outlet pressure above which the seat normally releases the fluid downstream (Self Relieving behavior). So the pressure Pv follows Pout maintaining a constant pressure offset (ΔP self relieving)

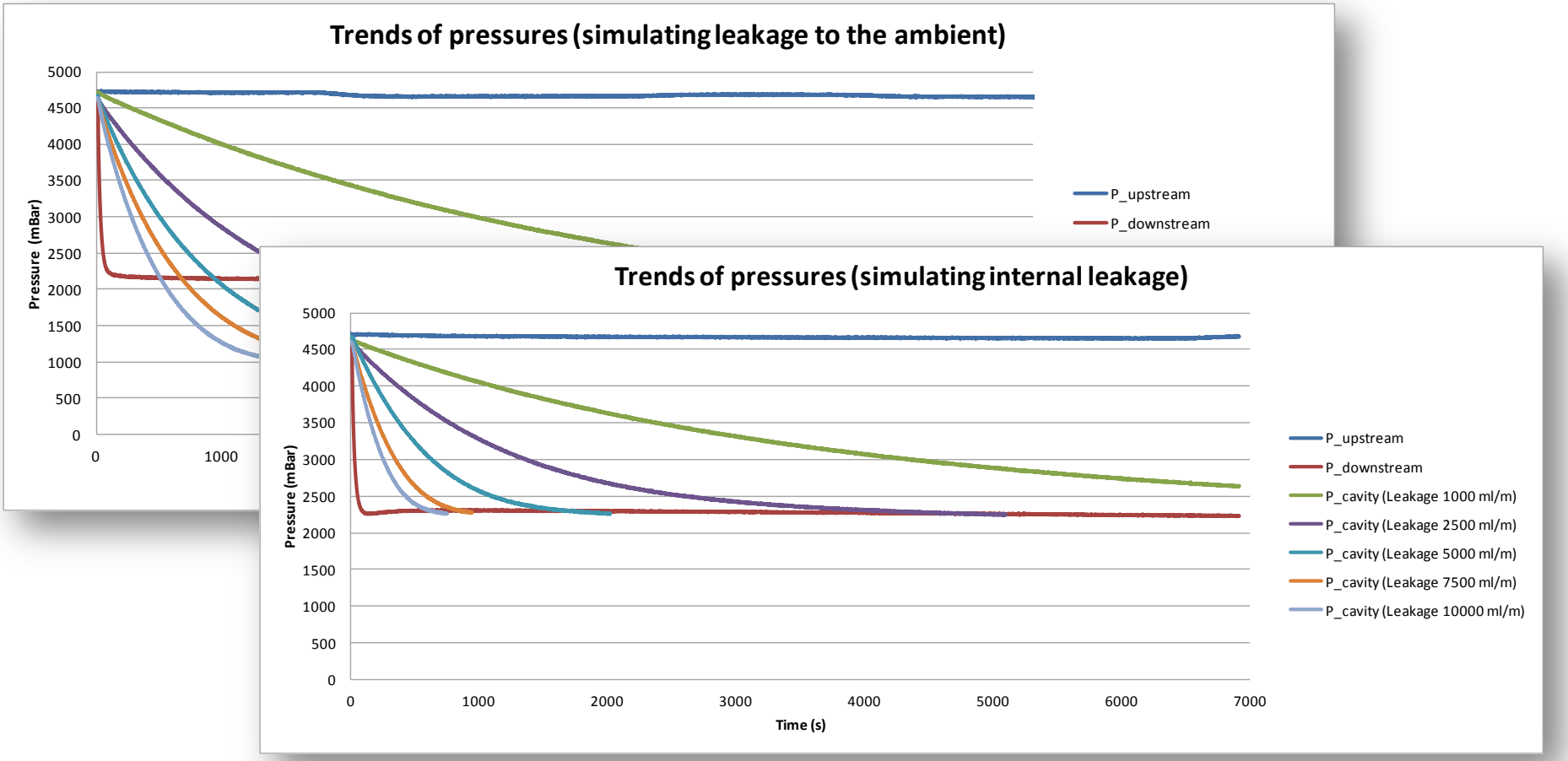
Starting from the study of typical trends of pressures inside the valve, Tre P Engineering developed for DAFRAM S.p.A. a complete system (hardware, software and a patent pending algorithm) for a reliable functional control of valves.



The pressure trends in the various sections have been analyzed considering conditions of perfect tightness and forcing a leak between the various volumes. Pressure values have been acquired through a dedicated electronic board.



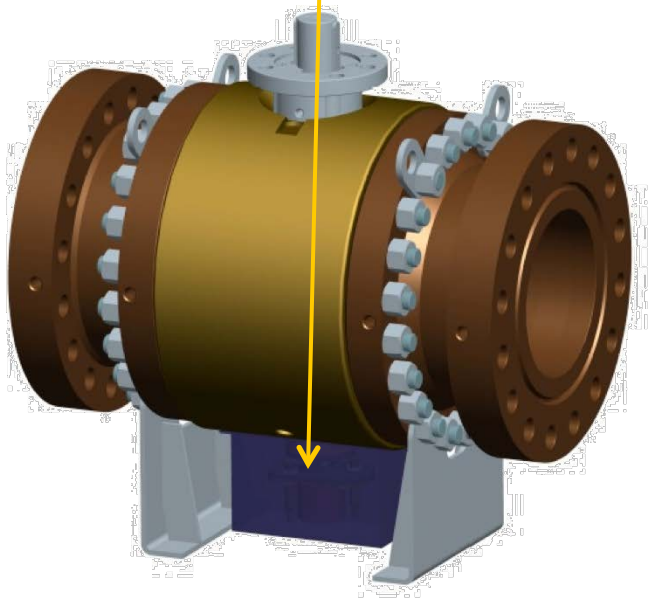
If a tightness change is detected the system provides an alarm to the operator, who can decide on how to best plan preventative maintenance on the valve.



The RVD system can also collect positional information for the obturator by means of:

- **High resolution encoder**
- **Three limit switches.**

This solution overcomes the inherent problems of mechanical gaps and torsional deformation of the drive chain related to traditional methods of measuring the position.

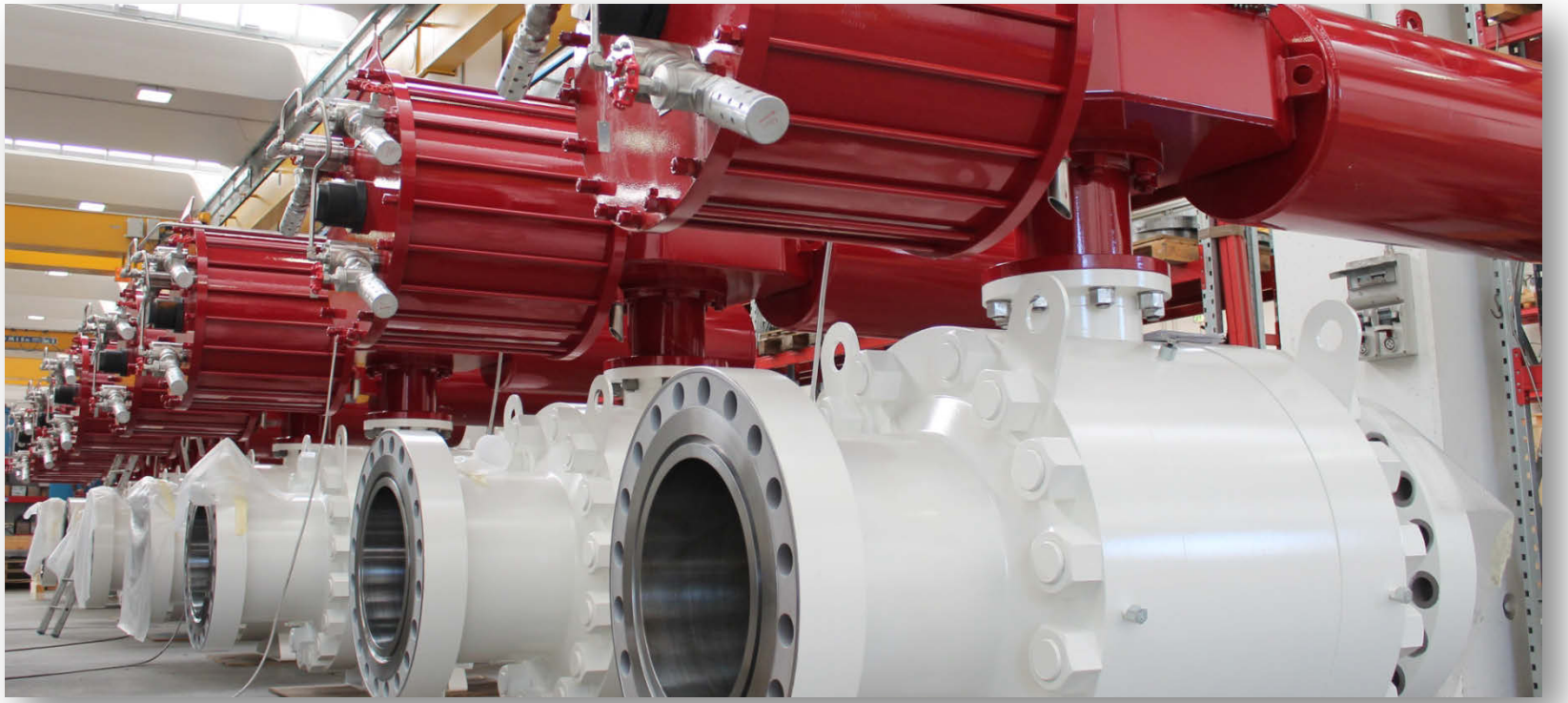


RVD data and actuator data can be compared indicating any torque drive issues before the transmission linkage fails.

RVD offers the possibility to add auxiliary sensors such as:

- **Thermocouples**
- **Accelerometers**
- **Gyroscopes**
- **Microphones**

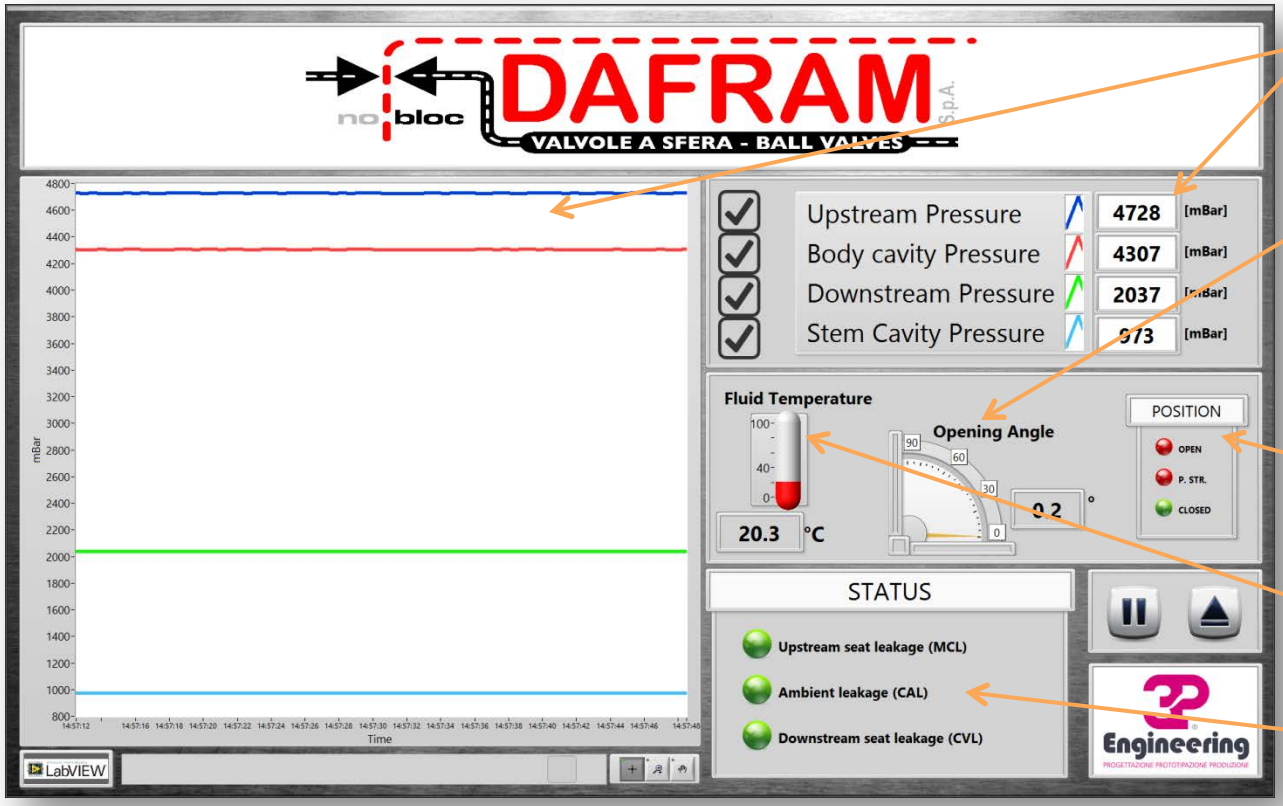
to detect shocks, excessive vibrations and cavitation.



The communication from RVD to the operator can follow the most usual standards in Oil&Gas industry, such as:

- HART
- MODBUS
- PROFIBUS
- FIELDBUS
- Bluetooth
- USB
- Ethernet

RVD is highly recommended for critical valve applications such as isolation, emergency shut-down, HIPPS and other critical valves.



Pressure sensors

Encoder

Limit Switches

Thermocouple

Fault conditions

Through a bluetooth connection it is possible to run a proprietary software that can monitor in real time the main values of the sensors connected with the electronic board. In addition to data monitoring the software is able to continuously highlight fault conditions executing TRE P algorithms.

MAIN ADVANTAGES OF RVD SYSTEM:

- **Parameters real time analysis**
- **Extremely sensitive leak detection system**
- **Reduced maintenance costs**
- **Accurate obturator position measurement**
- **Reduced plant downtime**
- **Enhanced safety**
- **Increased plant efficiency**
- **Diagnostics system in SIL qualifying procedure in order to provide SIL 3 certified valves**

Powered by:

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