BRAVA: optimized and proven technology to improve Total Cost of Ownership

The current uncertain oil & gas climate requires a flexible and resilient approach in an extremely competitive landscape. Innovation and solution driven thinking is crucial in leapfrogging self-imposed boundaries, leveraging technologies and practices developed and matured in similar industries or embracing newly developed capabilities.

By Roberto Bolzonella

The PV BRAVA is based upon well-proven and reliable technologies from other industries, such as aerospace, power generation and oil and gas (drilling), to be applied on valve design and construction.

With such an approach, focusing on total cost optimisation through the adoption of novel architecture, PetrolValves came out with an innovative concept of a ball valve (not limited to this type). This patent pending concept, with the acronym BRAVA, is a stepping stone in rethinking the traditional boundaries, with the aim to reduce weight and dimensions. At the same time, this valve will be easier to maintain and service over the lifecycle, according to the company.
"In addition, the novel ball valve is part of an holistic integrated approach aimed to reduce the overall project CAPEX and OPEX, minimise the execution risks and optimise the asset lifecycle through the adoption of a modular, integrated and smart sensing approach, that encompasses all the asset lifecycle costs."

Existing and proven technology

The PV BRAVA (Boltless Reliable Advanced VAlve) technology is based on a compression retaining ring technology, widely adopted and tested in complex and challenging compression services in the oil & gas industry. "In other words, it is not a new concept but we have adopted this technology for BRAVA. It makes sense to do so. Because bolting is so common in the industry, nobody but us came up with the idea."
BRAVA's 'secret' is the retaining ring concept which, due to its particular shape, acts as a shoulder which retains the body closures lateral flanges and / or bonnet, simplifying the overall architecture while improving the required functionalities. This position assures a continuous contact during any service condition and external loads as well as the ring wedges itself into place between the valve housing and the retained part. Due to a further shim retaining system (wedges, solid or split ring) that aims to keep it in position during all valve operations, it locks everything in place. PetrolValves, through an extensive Finite Element simulation and test-to-learn campaign, has developed a simplified architecture equivalent of a pressure boundary joint assembly, capable to ensure a tight fit to withstand any shifting, shrinking that may occur during service due to pipeline loads, such as tensile stressing, shear forces or bending moment.

Same functionalities, less weight

PetrolValves states that BRAVA has many advantages compared to conventional, bolted systems. The advantages can be grouped in terms of CAPEX and OPEX. On the CAPEX-side, we have succeeded to lower cost, shorten delivery times and reduce weight/dimensions. Also for the OPEX, we have made progress by simplifying the design, thus reducing installing and maintaining the valve. In essence, we have reduced the TCO. Furthermore, we have reduced the CO2-footprint considerably, mainly because BRAVA requires less material and machining. Finally, the optimized dimensions also

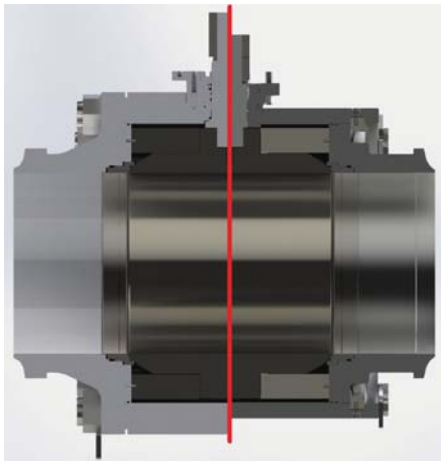
BRAVA's main design features:

- API 6D or API 6A
- ASME B16.34
- Fire safe
- Full / Reduced bore
- Bidirectional / Unidirectional
- Self relieving / Double piston
- Anti-blowout stem
- Antistatic device
- Double Block & Bleed
- Double Isolation & Bleed
- Metal-to-metal seating

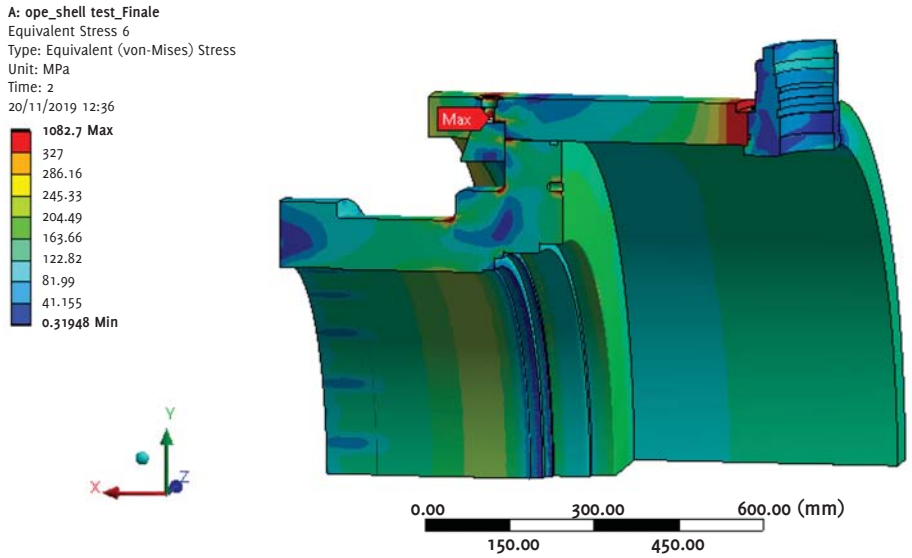
With the above testing completed, PetrolValves aims to test the BRAVA-valve in the field. "We are in close contact with various end users so we are confident that the BRAVA-valve can prove its worth in operation."

About the author

Robert Bolzonella is an R&D-engineer at PetrolValves, a leading manufacturer of valves and actuators for the oil and gas industry. Formed in 1956, PetrolValves is an Italian and privately held company that has grown to a midsize company with sales, services and manufacturing facilities throughout the world.



Standard execution (bolted) vs. PV BRAVA (36" 600# ball valve for topside application).



Calculation and verification through FEA.

contribute to the overall BOP (Balance of Plant) thanks to the optimization of the piping layout and overall plant design.

As for the specific design changes, the absence of bolts implies that the valve body closure wall thickness can be sized to withstand pressure loading only. It provides the most favorable solution with respect to thickness and radial width, as it may transfer large axial load. Also, the extra joint flange lap for bolts installation is not needed.

The above exercise leads to a significant reduction in weight, on average 25 per cent savings (depending on size, pressure class and material section). Due to its design, BRAVA's assembly time can be reduced by 30 per cent. Another cost-cutting factor is that servicing and maintenance requirements are simpler, requiring less spare parts, tools and further reducing OPEX.

"We wanted to design and manufacture a valve that has the same functionalities as – in this case – a ball valve and is able to compete on price with conventional products from the competition. As there are cost-savings both at the manufacturing end (material use, supply chain costs, machining) and the end user side (reduced maintenance costs), this will be part of negotiation process. We are open to suggestions."

Seamless integration

It is also important to note that BRAVA is based on tested and proven technology and has been designed for an easy/seamless integration into existing process configurations. BRAVA has been employed for a ball valve (side-entry, top-entry), as mentioned before. However, the concept is also suitable for other types, such as wedge, slab and expanding gate valves, globe and chock valves, nozzle, tilting and swing check valves.

These valves are in use in many general industrial and applications, such as oil & gas onshore plants, LNG-terminals, offshore platforms, subsea installations, floating platforms (FPSO, FLNG, FSRU), petrochemical & chemical and power.

In the specific case of the BRAVA-ball valve, this is suitable for any valve configuration compatible and interchangeable with a traditional ball valve, as mentioned before. The valve design and configuration is also in compliance with API6D and main internationally recognized design standards (DN › 8" | Press Rating › 600#.).

Petrolvalves BRAVA represents one step in innovation to move the needle in the valve industry, to anticipate market and customer needs in terms of simplification, weight reduction, shorter delivery times, easy assembly and on site installation, service asset lifecycle improvement and regional touch for speed and execution. PetrolValves has always paid great attention on being close to its customers, understanding their evolving needs and focusing on continuously improving customer satisfaction through cost optimization and achieving operational excellence. We can make this happen through innovation. This is not only about technical breakthroughs. It is also about incremental innovations or continuous improvement. We have adapted our strategy to remain not only competitive in an extremely cost-driven market but on the other hand we aim to offer solutions to improve our customers' Total Cost of Ownership. BRAVA is a perfect example of this strategy.

Bending test (12" 900# ball valve for subsea application).

From calculation and Finite Element Analysis, the PV BRAVA technology has been resulted fully equivalent to "standard" valves performances (based on pressure rating and size). The valve functionality is not affected, as well as material selection or sealing solutions remain the same. This technology aims to drives the benefits presented on this paper, without compromising on valve performance. Furthermore, to demonstrate reliability in working condition, a final validation of this technology has been carried out performing intensive testing activities on two prototypes valves:

- 36" 600# side-entry trunnion mounted ball valve (topside) - a complete factory Acceptance Test (FAT) has been done after assembling the valve, to verify the leakage rates from the body and the seats are within the accepted limits required by API 598.The hydrostatic shell test, has been performed exceeding the test pressure required by the standard to overstress the joint system (1.7 x WRP) without affecting body gaskets sealing capability.
- 12" 900# side-entry trunnion mounted ball valve (subsea) – On the second valve prototypes, it has been decided to verify the PV BRAVA loads-capacity in one of the widest range of service condition, such as qualification test program for subsea service, pipe loads included. The valve has successfully completed the full testing procedure:
- 200 cycles PR2 Test in accordance with API 6A / ISO 10423 – Edition 2010 – Annex F (Temperature range -29°C / +121°C)
- 200 cycles Endurance Test in accordance with API 17D / ISO 13628-4 – Edition 2011
- 200 cycles Hyperbaric Test in accordance with API 17D / ISO 13628-4 – Edition 2011 (2,000m water depth)
- External Bending Moment Test in accordance with a leading O&G company specification (magnitude causing a load 2/3 of initial SMYS).