Recent Changes in API and ISO Standards – Implications for Valve Manufacturers

Background

In the last few years, the American Petroleum Institute (API) and International Organization for Standardization (ISO) have brought about new standards and revised several standards that have prompted valve manufacturers to take concerted efforts in re-designing, adopting new manufacturing processes, type testing and qualifying their products. A lot of these changes in product standards such as API 623, API 600, API 602 and testing standards such as API 624, API 598, ISO 28921 and ISO 15848 have implications for both valve manufacturers and end users.

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API 600, Steel Gate Valves-Flanged and Butt-welding Ends, Bolted Bonnets, 13th Ed, 2015

As gate valves constitute 80% of the gate, globe and check requirements for refineries, any change in a gate valve standard has a major impact on the supplies for both valve manufacturers and end users.

Fugitive Emissions Compliance to API 624

API 600: 13th Ed, Clause 5.9.7 specifies that *"valves shall be qualified by type testing to meet the fugitive emissions requirements of API Std. 624".* Of all the standards released in recent times, API 624 fugitive emissions standard has had the maximum impact by virtue of the domino effect on the product standards API 600, API 602 and API 623. In addition, the EPA consent decree calls for newly installed valves to be Low-E certified and passing the API 624 test is an important step for valve manufacturers towards meeting the Low-E technology requirements. This makes it a level playing field for all valve manufactures as API 624 compliance is achieved only by strict adherence to GD&T and necessitates adoption of good engineering practices.

The best performing graphite packings are

engineered and qualified to API 622 (< 100 ppm without any adjustment) based on a higher axial stress. This poses new challenges to the conventional stuffing box design with combination graphite packing (die-formed center rings and braided end rings) such as adequacy of bolting strength, gland flange thickness, height of the gland follower and spacer. In addition, the design of the drive train components such as the stem-stem nut-retainer nut has to be robust to get through the mechanical and thermal cycling without any premature failure.

Pressure Seal Bonnet Design

The pressure seal bonnet design was last included in API 600 10th ed appendix A, which covered both style A and style B. Style A valves are in accordance with API 600 but with minimum wall thicknesses as per ASME B 16.34, smaller diameter seats and stem while style B valves are in accordance with API 600 (higher wall thickness than ASME B 16.34 and full bore). As subsequent editions (API 600 11th & 12th editions) did not include this appendix, MSS introduced the SP-144 in 2013 which was included in API 600 13th ed. API 600 13th Ed Clause 5.5.11 specifies that *"if pressure seal bonnet design is specified, the bonnet joint construction shall be in accordance with MSS SP-144 Style B, unless otherwise specified by the purchaser."*

Hardfacing Wedge and Body Guides

API 600: 2015 states that *"For sizes DN 650 (NPS 26) and above, as a minimum, wedge guides and body guides shall be hardfaced and machined with appropriate tolerances and clearances to allow for proper valve operation in any orientation, including the effects of wear or galling".* The hardfacing is to ensure the alignment of the gate and stem in all orientations without gate binding or galling. The API RP 591 5th edition specifies that valves 24" and above, prior to the start of the qualification testing, valve shall be stroked full open and closed with the stem in the horizontal position (flow in the horizontal direction) to confirm that the closure element does not hang up.

API 623, Steel Globe Valves-Flanged and Butt-welding Ends, Bolted Bonnets, 1st Ed, 2013

The important inclusions in API 623 vis-à-vis BS 1873, the globe valve design standard available hitherto are higher stem diameters considering yield strength for SS 316 series stems and operation requirements for stop check valves. In addition to the imminent inclusion of API 624 in the second edition of API 623, other changes that could be considered are non-rotating rising stem design and guided disc arrangement. A non-rotating rising stem design would have lower torque and lesser wear and tear of packing as the rotation of the stem is avoided. Similar to the horizontal orientation requirements addressed in API 600, it would be prudent to include similar disc guide requirements for globe valves as an unguided disc in a globe valve can lead to havoc when installed horizontally.

API 598, Valve Inspection and Testing, 10th Ed (draft)

API 598 10th edition is being prepared for publication and the major changes are as below in Table 1.

API 607, Fire Test for Quarter-turn Valves and Valves Equipped with Nonmetallic Seats, 7th Ed, 2016

There are 2 notable changes in the API 607 10th edition. If cavity pressure exceeds the

Table 1: Changes in API 598 10th Ed.

Change / Revision	Details of the change
Table 1 Pressure tests	2 tables in the earlier edition converted to 1 table for simplicity and ease of understanding
Parallel slide gate clubbed with Globe valves in Table 1 Pressure tests	LP closure test is optional for Parallel slide gate in sizes <=4" and <= Class 150; sizes >4", <=Class 600
Table 5, Note a: For the gas test 1 ml is considered equivalent to 100 bubbles	Conversion for bubbles to ml included as previous editions had conversions from drops to ml only
Bubbles per minute measurement based on a suitable calibrated measuring device	For better clarity and in line with ANSI FCI 70-2 guidelines for the measuring device

Table 2: Comparison of Cryogenic testing standards

Aspects	MSS SP-134: 2010	ISO 28921-1: 2013	ISO 28921-2: 2015
Testing scope	Production testing ≤ 12", ≤ Class 1500	Production testing (≤ Class 1500)	Type test (≤ Class 1500)
Mechanical cycles	5 cycles	5 cycles	200 cycles
Seat leakage (10" Class 600)	1000	750	750

stated manufacturer's allowable pressure, the test shall end and be reported as an invalid test. Secondly, if a range of valves is covered by testing of ferritic test valves then the type-testing coverage may be extended to cover austenitic or duplex materials by carrying out a further test on a SINGLE VALVE of each material.

ISO 28921, Isolating valves for Low-temperature Applications, Parts 1&2

BS 6364: 1984 – "Valves for cryogenic service", until recently, was the only standard available for guidelines on design, manufacturing and testing of low temperature valves. However this standard has become out-dated as it was last updated in 1998. In 2006, MSS published a standard on cryogenic service which was ANSI approved in 2015. More recently, ISO published a 2 part cryogenic service standard – first of which specifies requirements for Design, manufacturing and production testing and the second part specifies requirements for Type testing.

All these standards have many of the design and testing requirements in common except for differences in scope of the standard, extension column lengths, number of operations during low temperature test and allowable seat leakage values. Refer to Table 2.

ISO 15848-1, Industrial Valves - Measurement, Test and Qualification Procedures for Fugitive Emissions, 2nd Ed, 2015

There have been a couple of welcome changes in the ISO 15848 2nd edition which are:

1. Class AH allowable leakage has been changed from 1.78 x 10-8 to 1.78 x 10-7 mbar.l/s/mm stem dia. This change brings the Class AH in line with Shell Class AHS and consequently an advanced Stuffing box design could be used in lieu of Metallic Bellows for sizes >2".
2. Either bagging or vacuum method is now acceptable for Class BH and CH tests. It is practical to conduct Class BH/CH tests with bagging method rather than vacuum method because of the elaborate instrumentation and fixtures required for a vacuum test.
3. A new table has been introduced with leakage classes for methane in parts per million (Class AM ≤ 50 ppm; BM ≤ 100 ppm; CM ≤ 500 ppm). This change provides the flexibility for a valve manufacturer to test with Methane as an alternate to Helium with allowable leakage in ppm.

The one change that stands out is the change in endurance Class CO1 for on-off valves. The number of mechanical cycles for endurance class CO1 has been changed from 500 to 205 without any change in the number of thermal cycles. This change was intended to make ISO 15848 CO1 be at par with API 624. The first ballot of API 624 had 205 mechanical cycles and 2 thermal cycles but was changed to 310 mechanical cycles and 3 thermal cycles in the subsequent ballots.

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