



Materials System Specification

04-SAMSS-047

11 October 2010

High Performance Butterfly Valves (Including Triple-Offset)

Document Responsibility: Valves Standards Committee

Saudi Aramco DeskTop Standards

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Revised paragraphs are indicated in the right margin

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I Scope

This specification- along with the purchase order- defines the minimum requirements for resilient or metal seated, steel, double flanged and lug type high performance butterfly valves, including the triple-offset type, in accordance with API STD 609 Category B.

Valves covered by this specification shall be suitable for wet sour liquid or gaseous hydrocarbon services with design temperatures (a) between -18 and 425°C for metal seated valves, and (b) between -18 and 120°C for soft seated valves.

Additional requirements for special applications are covered in the following Appendices:

Appendix A: Low Temperature Services from -45 to -18°C

Appendix B: Cryogenic Temperature Services from -196 to -45°C

II Conflicts and Deviations

- A. Any conflicts between this specification and other applicable Saudi Aramco Materials System Specifications (SAMSSs), Engineering Standards (SAESs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.
- B. Direct all requests to deviate from this specification in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

III References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this specification shall comply with the latest edition of the references listed below, unless otherwise noted.

A. Saudi Aramco References

Saudi Aramco Engineering Procedure

[SAEP-302](#)

*Instructions for Obtaining a Waiver of a
Mandatory Saudi Aramco Engineering
Requirement*

Saudi Aramco Materials System Specifications

<u>04-SAMSS-003</u>	<i>Additional Requirements for Low Temperature Valves</i>
<u>04-SAMSS-035</u>	<i>General Requirements for Valves</i>
<u>04-SAMSS-048</u>	<i>Valve Inspection and Testing Requirements</i>

Saudi Aramco Form and Data Sheet

<i>SDS-xxx</i>	<i>Smart Data Sheet for Steel High Performance Butterfly Valves</i>
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B. Industry Codes and Standards

American Petroleum Institute

<i>API SPEC 6FA</i>	<i>Specification for Fire Test for Valves</i>
<i>API STD 607</i>	<i>Testing of Valves – Fire Type-testing Requirements</i>
<i>API STD 609</i>	<i>Butterfly Valves — Double Flanged, Lug- and Wafer-Type</i>

American Society of Mechanical Engineers

<i>ASME B16.34</i>	<i>Valves - Flanged, Threaded, and Welding End</i>
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American Society for Testing and Materials

<i>ASTM A105</i>	<i>Standard Specification for Carbon Steel Forgings for Piping Applications</i>
<i>ASTM A216</i>	<i>Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High Temperature Service</i>
<i>ASTM A351</i>	<i>Standard Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts</i>
<i>ASTM A395</i>	<i>Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures</i>
<i>ASTM A536</i>	<i>Standard Specification for Ductile Iron Castings</i>

ASTM A743 *Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application*

British Standards Institute

BS 6364 *Specification for Valves in Cryogenic Service*

International Standards Organization

ISO 5752 *Metal Valves for Use in Flanged Pipe Systems*

ISO 10497 *Testing of Valves – Fire Type-testing Requirements*

National Association of Corrosion Engineers/International Standardization Organization

[*NACE MR0175/ISO 15156*](#) *Petroleum and Natural Gas Industries – Materials for Use in H₂S Containing Environments in Oil and Gas Production*

IV Notes to Purchaser

In addition to the valve requirements specified in this SAMSS or approved modifications, the following information, at minimum, shall be considered and included in purchase requisitions/orders as applicable:

1. Valve size
2. Pressure class
3. Ends connection lug or flanged (flanged w/raised face or ring joint)

Commentary Note:

Refer to [04-SAMSS-035](#) for flanged valves greater than NPS 24.

4. Double offset or triple offset design
5. Face-to-face dimensions, if non-standard
6. Operation requirements (gear or power operator)

Commentary Note:

Manufacturer should be advised to provide a stem of sufficient length if it is anticipated that the valve may be retrofitted with an electrical actuator.

7. Above ground or buried service; stem extension length from center line of pipe operation
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8. Seating, if other than soft seating for the double offset design
9. Low temperature or cryogenic services (see appendices)
10. Orientation of installed valve, if other than stem-vertical
11. Special internal or external coatings
12. Other than standard wet sour hydrocarbon services (see appendices)
13. Other than standard materials (Refer to Saudi Aramco Engineering Standards for other permitted materials)

V Modifications to API STD 609, Butterfly Valves: Double Flanged, Lug- and Wafer Type

The following paragraph numbers refer to API STD 609, Sixth Edition, 2004, which is part of this specification. The text in each paragraph below is an addition, exception, modification, or deletion to API STD 609 as noted. Paragraph numbers not appearing in API STD 609 are new paragraphs to be inserted in numerical order.

Section 1 – Scope

- 1.1 (Modification) This specification only covers two types of butterfly valves in steel construction as follows:
 - a. Category A is excluded from the scope. It is understood that requirements pertaining to this type are deleted from subsequent sections.
 - b. Category B, double offset. (The single offset design is not acceptable).
 - c. Category B, triple offset
- 1.2 (Modification) Only lug and double flanged configurations are covered. The wafer type is not permitted.
- 1.2 (Addition) Other flange standards and/or bolt-hole patterns are permitted only when specified explicitly in the purchase order.
- 1.3 (Addition) Valves shall meet the applicable requirements of [04-SAMSS-035](#).

Section 3 – Pressure Temperature Rating

- 3.3.1 (Modification) The manufacturer shall confirm the suitability of the soft seats for the intended services.

Section 4 – Design

- 4.1.2 (Modification) Valves shall be qualified fire-safe to either API SPEC 6FA or API STD 607 or ISO 10497.
- 4.1.5 (Addition) Where a lever is used, the valve shall be open when the lever is parallel to the pipe.
- 4.1.6 (Addition) valves class 600 and lower shall be designed for bi-directional dead-end service.
- 4.1.7 (Addition) if spring tension pins are used, they shall be tack welded.
- 4.2.1 (Modification) The minimum wall thickness of the body and bonnet shall be in accordance with ASME B16.34. The body shall be able to withstand loading (moment and axial forces) induced by the connected pipes, without distortion to the internals.
- 4.2.5 (Addition) Forged bodies shall be forged close to final shape. Rolled and forged bar shall not be used.
- 4.2.6 (Addition) The body shall be one piece construction; a horizontal split body construction is not acceptable.
- 4.2.7 (Addition) The disk shall be capable of withstanding the maximum differential pressure, in either flow direction, as per the appropriate pressure designation.
- 4.2.8 (Addition) The valve stem shall be blow-out resistant.
- 4.2.9 (Addition) The stem shall be furnished with two bearings one at the top and the other at the bottom of the disc.
- 4.2.10 (Addition) Provisions for mounting an extended stem or an actuator/gearbox shall be incorporated in the design.
- 4.2.11 (Addition) The valves shall be anti-static. The design shall ensure electrical continuity between the stem, disk and the body.
- 4.2.12 (Addition) The disc shall be attached to the stem by means of keyways for cryogenic and temperature higher than 200°C. Pins are accepted with tack weld.
- 4.3.1 & 4.3.2 (Modification) Face- to- Face dimensions shall be as listed in Table 1 below:
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Table 1 – Face-to-Face Dimensions

VALVE TYPE	VALVE SIZE	STANDARD
LUG	NPS 24 & Below	API STD 609 Table 2 (A)
LUG	NPS 26 and up	ISO 5752 Table 1 Series 16
FLANGED CL150/300	NPS 2 and up	ISO 5752 Table 1 Series 13
FLANGED CL 600	NPS 2 and up	ISO 5752 Table 1 Series 14
FLANGED CL 900	ALL SIZES	6- 16" ISO 5752 Table 1 Col 14 18"-o 40" ISO 5752 Table 1 Col 3 ISO 5752 Table 1 Series 8
FLANGED CL 1500	ALL SIZES	MANUF'S STD as approved by Saudi Aramco's Engineer

- 4.3.4 (Modification) The flange facing finish shall be in accordance [04-SAMSS-035](#).
- 4.5.1 (Addition) *The shaft shall be a through shaft of one piece construction.*
- 4.7.1 (Addition) *For triple eccentric design, the seal ring shall be held securely but not rigidly in place by a retaining ring bolted to the valve disc or body.*
- 4.8.5 (Addition) The following butterfly valves shall be provided with a gear operator:

Table 2 – Gear Operator Requirements

ANSI Pressure Class	NPS (inch)
150	14 and larger
300	12 and larger
400	10 and larger
600	8 and larger
900	6 and larger
1500	4 and larger
2500	3 and larger

- 4.8.6 (Addition) All actuation devices shall comply with the applicable sections of [04-SAMSS-035](#).

Section 5 – Materials

5.2.1 (Modification) Unless otherwise specified, materials shall be provided as listed in Table 3 below:

Table 3 – Materials

PART	DOUBLE OFFSET VALVE	TRIPLE OFFSET VALVE Carbon Steel	TRIPLE OFFSET VALVE Stainless Steel
Body	Carbon steel, ASTM A216-WCB or WCC, or A105	Carbon steel, ASTM A216-WCB or WCC, or A105	Stainless steel, ASTM A351 CF8M
Disc	Carbon steel, ASTM A216-WCB or WCC, or A105 w/ENP	Carbon steel A216-WCB or A105 w/ENP	Stainless steel, ASTM 351 CF8M
Shaft & pins	17-4 PH, 316B SS, Nitronic 50, K-Monel 500, Inconel 718, ASTM A479 UNS S41000	17-4 PH, 316B SS, Nitronic 50, K-Monel 500, Inconel 718	ASTM A479 XM 19 Nitronic 50
Seat Ring	PEEK/316 SS	Stellite 6 or 21	Stellite 6 or 21
Disc seal ring	Not Applicable	Laminated 316SS or Duplex UNS S31803 w/Graphite	Laminated 316SS or Duplex UNS S31803 w/Graphite
Shaft packing	Graphite	Graphite	Graphite
Seat retainer ring	Carbon steel	Carbon steel	Stainless steel
Gaskets	316 SS/Graphite	316 SS/Graphite	316 SS/Graphite

5. (Addition) All parts, welds and heat-affected zones of welds exposed to line fluids shall meet the hardness and heat treat requirements as specified in [NACE MR0175/ISO 15156](#). This includes materials under overlays, platings or coatings.

5.2.2 (Addition) the valve seat ring shall be replaceable or integral with the valve body or disc. For replaceable seat ring a spiral wound gasket shall be provided between the seat ring and the body or disc.

5.4 (Addition) The packing shall consist of two braided graphite anti-extrusion rings top and bottom and a minimum of three die –formed graphite rings in the middle.

Section 6 – Examination, Inspection, and Testing

(Addition) The triple offset design shall exhibit zero leakage during the high and low pressure seat tests. Refer to [04-SAMSS-048](#) for additional requirements.

Section 7 – Markings

(Addition) Refer to [04-SAMSS-035](#) for additional requirements.

Section 8 – Packaging and Shipping

(Addition) Refer to [04-SAMSS-035](#) for additional requirements.

Revision Summary

30 March 2008
25 October 2009
11 October 2010

New Saudi Aramco Materials System Specification.
Editorial revision to replace cancelled SAES-A-301 with ISO 15156.
Editorial revision to reflect the changes in committee members list.

Appendix A – Low Temperature Services from -45 to -18°C

(Addition - Applicable only when specified)

Additional requirements for valves for low temperature service from -45 to -18°C:

- 1) The valves shall meet the requirements of [04-SAMSS-003](#).
- 2) The trim shall be stainless steel AISI Type 304 or 316.

Appendix B – Cryogenic Temperature Services from -196 to -45°C

Additional requirements for valves for cryogenic temperature service from -196 to -45°C:

- 1) The valves shall be made entirely of stainless steel AISI Type 304 or 316.
- 2) Seat insert material shall be PCTFE/KEL-F instead of RTFE for double offset valves.
- 3) Valves shall be provided with an extended bonnet as per BS 6364
- 4) Cryogenic testing may be specified, if required, with numbers of valves to be tested generally at 10% of lot only. It should be added to [04-SAMSS-048](#).