Specification for Subsea Pipeline Valves

API SPECIFICATION 6DSS
THIRD EDITION, AUGUST 2017

API MONOGRAM PROGRAM EFFECTIVE DATE: AUGUST 1, 2018

ERRATA 1, MAY 2018
ERRATA 2, JULY 2018
ERRATA 3, SEPTEMBER 2022

ADDENDUM 1, APRIL 2019
(API MONOGRAM PROGRAM EFFECTIVE DATE: JULY 1, 2019)

ADDENDUM 2, JUNE 2022
(API MONOGRAM PROGRAM EFFECTIVE DATE: DECEMBER 1, 2022)

ADDENDUM 3, MARCH 2025
(API MONOGRAM PROGRAM EFFECTIVE DATE: SEPTEMBER 5, 2025)



Special Notes

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be utilized. The formulation and publication of API publications is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

All rights reserved. No part of this work may be reproduced, translated, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Contact the Publisher, API Publishing Services, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001.

Copyright © 2017 American Petroleum Institute

Foreword

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

The verbal forms used to express the provisions in this document are as follows.

Shall: As used in a standard, “shall” denotes a minimum requirement in order to conform to the standard.

Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required in order to conform to the standard.

May: As used in a standard, “may” denotes a course of action permissible within the limits of a standard.

Can: As used in a standard, “can” denotes a statement of possibility or capability.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually by API, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001.

Suggested revisions are invited and should be submitted to the Standards Department, API, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001, standards@api.org.

Contents

Page

1 Scope 1

2 Normative References 1

3 Terms, Definitions, Acronyms, Abbreviations, Symbols, and Units 3
3.1 Terms and Definitions 3
3.2 Acronyms, Abbreviations, Symbols, and Units 10

4 Valve Types and Configurations 12
4.1 Valve Types 12
4.2 Valve Configurations 13

5 Design 15
5.1 Design Standards and Calculations 15
5.2 Pressure and Temperature Rating 15
5.3 Sizes 16
5.4 Face-to-face and End-to-end Dimensions 16
5.5 Valve Operation 16
5.6 Operator Information 17
5.7 Pigging 19
5.8 Valve Ends 19
5.9 Valve Cavity Pressure Relief 21
5.10 Drains, Vents, Body Test Ports, Seal Test Port, and Body Connections 21
5.11 Stem/Seat and Cavity Injection Points 22
5.12 Drain, Sealant, and Vent Valves 22
5.13 Hand-wheels and Wrenches—Levers 22
5.14 Position of the Obturator 22
5.15 Position Indicators 23
5.16 Travel Stops 23
5.17 Valve Operator Interface Requirements 23
5.18 ROT System 24
5.19 Lifting Points and Supports 24
5.20 Drive Trains 24
5.21 Stem Retention 26
5.22 Body and Stem Seals 26
5.23 Valve Stem Seal Integrity Verification 26
5.24 Overpressure Protection 26
5.25 Pressure Cap 26
5.26 Stem/Shaft Protector 26
5.27 Hydraulic Lock 26
5.28 Corrosion/Erosion 26
5.29 Design Validation 27
5.30 Hyperbaric Performance 27

6 Materials 27
6.1 Material Specification 27
6.2 Tensile Test Requirements 28
6.3 Service Compatibility 28
6.4 Cast Material 28
6.5 Forged Material 29
6.6 Composition Limits 29

Contents

Page

6.7 Impact Test Requirements 30
6.8 Bolting 31
6.9 Cathodic Protection 32
6.10 Sour Service 32
6.11 Hydrogen-induced Cracking 32
6.12 Drain Connections 32
6.13 Heat Treating Equipment Qualification 32

7 Welding 34
7.1 Welding Consumables 34
7.2 Welding Procedure and Welder/Welding Operator Qualifications 34
7.3 Impact Testing 35
7.4 Hardness Testing 36
7.5 Repairs 36

8 Quality Control 37
8.1 Quality Control Procedures 37
8.2 NDE Requirements 37
8.3 Measuring and Test Equipment 37
8.4 Qualification of Personnel 38
8.5 Welding Inspectors 39
8.6 NDE of Repairs 39
8.7 Production Material Hardness Testing on Critical Parts 39
8.8 Marking, Age Control, and Storage for Nonmetallic Seals 40

9 Valve Assembly 41

10 Factory Acceptance Testing (FAT) 41
10.1 General 41
10.2 Stem Backseat Test 42
10.3 Hydrostatic Shell Test 43
10.4 Operational/Functional Test 43
10.5 Hydrostatic Seat Test 44
10.6 Cavity Relief Test 46
10.7 Draining 48
10.8 Low-pressure Gas Seat Test 48
10.9 High-pressure Gas Shell Test 48
10.10 High-pressure Stem Seal Integrity Testing 49
10.11 High-pressure Gas Seat Test 49
10.12 Check Valves 49
10.13 Installation of Body Connections After Testing 50
10.14 Testing of Body Connections 50
10.15 CP Continuity Test 50
10.16 Post-testing Corrosion Protection 50

11 Coating/Painting 50

12 Marking 51

13 Preparation for Shipment 53

14 Documentation 54
14.1 Minimum Documentation and Retention 54

Contents

Page

14.2 Documentation Provided with the Valve 54
14.3 Supplementary Documentation 55

15 Facility Requirements 55
15.1 Minimum Facility Requirements for the Assembler/manufacturer Category of Manufacturing 55
15.2 Conformance with Specification 56
15.3 Processes Requiring Validation 56

16 Purchasing Guidelines 56

Annex A (informative) Use of API Monogram by Licensees 57

Annex B (informative) Valve Configurations 58

Annex C (normative) Valve End-to-End and Face-to-Face Dimensions 69

Annex D (informative) Actuator—Gearbox Requirements 86

Annex E (informative) Guidance for Travel Stops by Valve Type 87

Annex F (informative) Design Validation 88

Annex G (informative) Hyperbaric Validation Testing 100

Annex H (normative) Pressure Boundary Bolting 104

Annex I (informative) Pressure-containing Castings and Forgings 105

Annex J (normative) Qualification of Heat Treating Equipment 106

Annex K (normative) Requirements for Nondestructive Examination 108

Annex L (informative) Supplementary Test Requirements 113

Annex M (informative) Isolation Valve Features 115

Annex N (normative) External Coating for End Connections 118

Annex O (informative) Marking Example 120

Annex P (informative) Supplementary Documentation Requirements 122

Annex Q (informative) Purchasing Guidelines 123

Bibliography 126

Figures

1 Typical Flange Dimensions 20
2 Bolt Hole Misalignment 21
3 Charpy V-notch WM Specimen Location 35
4 Charpy V-notch HAZ Specimen Location 35
5 Typical Identification Plate for a Valve with One Seat Unidirectional and One Seat Bidirectional 53
B.1 Expanding Gate/Rising Stem Gate Valve 59
B.2 Slab Gate/Through-conduit Rising Stem Gate Valve 60
B.3 Plug Valve 61
B.4 Top Entry Trunnion-mounted Ball Valve 62
B.5 Two-piece Bolted Ball Valve 63
B.6 Two-piece Welded Ball Valve 64
B.7 Full-opening Cast Swing Check Valve 65

Contents

Page

B.8 Full-opening Forged Swing Check Valve 66
B.9 Axial-flow Check Valve 67
B.10 Axial On-off Valve 68
F.1 Test Procedure for Pressure Temperature Cycle 98
J.1 Thermocouple Location—Rectangular Furnace (Working Zone) 107
J.2 Thermocouple Location—Cylindrical Furnace (Working Zone) 107
M.1 Block and Bleed—Type A 116
M.2 Block and Bleed—Type B 116
M.3 Double Block and Bleed—Type A 116
M.4 Double Block and Bleed—Type B 117
M.5 Double Isolation and Bleed—Type A 117
M.6 Double Isolation and Bleed—Type B 117
N.1 Raised Face 118
N.2 Ring Type Joint or Raised Face Ring Type Joint 118
N.3 Weld Face 119
N.4 Pipe Pup Weld Ends 119

Tables

1 Minimum Bore for Full-opening Valves 14
2 Minimum V-notch Impact Requirements for Carbon and Low-alloy Steels (Full-size Specimen) 31
3 Minimum V-notch Impact Requirements for Duplex and Super Duplex Stainless Steel (Full-size Specimen) 31
4 Chemical Composition of Nickel-based Alloy UNS N06625 34
5 Minimum Duration of Stem Backseat Tests 42
6 Valve Marking 52
7 Minimum Facility Requirements 55
C.1 Gate Valves—Face-to-face (*A*) and End-to-end (*B* and *C*) Dimensions 70
C.2 Plug Valves—Face-to-face (*A*) and End-to-end (*B* and *C*) Dimensions 73
C.3 Ball Valves—Face-to-face (*A*) and End-to-end (*B* and *C*) Dimensions 78
C.4 Check Valves—Face-to-face (*A*) and End-to-end (*B* and *C*) Dimensions 82
C.5 Axial On-off Valves—Face-to-face (*A*) and End-to-end (*B* and *C*) Dimensions 85
E.1 Valve Travel Stops 87
F.1 Design Validation for Valves 94
F.2 Room Temperature Gas Leakage Acceptance Criteria 95
G.1 Hyperbaric Qualification Test 100
K.1 NDE Requirements 109
K.2 Extent, Method, and Acceptance Criteria of NDE/item Examination Code 110
M.1 Isolation Valve Types 115
Q.1 Valve Datasheet 124

Introduction

This specification is the result of updating the requirements from API Specification 6DSS, Second Edition, including Errata 1.

The revision of API 6DSS, Third Edition, is developed based on input from the API 6DSS Task Group technical experts. The technical revisions have been made in order to accommodate the needs of industry and to move this specification to a higher level of service to the petroleum and natural gas industry.

In this specification, data are expressed in both U.S. customary (USC) and metric (SI) units.

Except as otherwise required by this specification, to determine conformance with the specified requirements, observed or calculated values are to be rounded to the nearest unit in the last right-hand place of figures used in expressing the limiting value, in accordance with the rounding method of ASTM E29 or ISO 80000-1, Annex B, Rule A.

This specification is not intended to inhibit a manufacturer from offering, or the purchaser from accepting, alternative equipment or engineering solutions for the individual application. This may be particularly applicable where there is innovative or developing technology.

Specification for Subsea Pipeline Valves

1 Scope

This specification defines the requirements for the design, manufacturing, quality control, assembly, testing, and documentation of ball, check, gate, plug, and axial on–off valves for application in subsea pipeline systems for the petroleum and natural gas industries.

This specification applies to ASME Class 150, 300, 600, 900, 1500, and 2500 valves intended for use in subsea pipelines. Use of these valves for any other purpose is outside the scope of this document.

2 Normative References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Technical Report 17TR11, *Pressure Effects on Subsea Hardware During Flowline Pressure Testing in Deep Water*

API Specification 20E, *Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries*, 2nd Edition

API Specification 20E, *Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries*, 3rd Edition

API Specification 20F, *Corrosion Resistant Bolting for Use in the Petroleum and Natural Gas Industries*, 2nd Edition

ASME B16.5 [1], *Pipe Flanges and Flanged Fittings: NPS 1/2 Through 24 Metric/Inch Standard*

ASME B16.10, *Face-to-Face and End-to-End Dimensions of Valves*

ASME B16.25, *Buttwelding Ends*

ASME B16.34, *Valves—Flanged, Threaded, and Welding End*

ASME B16.47, *Large Diameter Steel Flanges: NPS 26 Through NPS 60 Metric/Inch Standard*

ASME B31.4, *Pipeline Transportation Systems for Liquids and Slurries*

ASME B31.8, *Gas Transmission and Distribution Piping Systems*

ASME *Boiler and Pressure Vessel Code (BPVC)*, *Section II: Materials, Part D: Properties*

ASME *Boiler and Pressure Vessel Code (BPVC)*, *Section V: Nondestructive Examination*

ASME *Boiler and Pressure Vessel Code (BPVC)*, *Section VIII: Pressure Vessels; Division 1: Rules for Construction of Pressure Vessels*

ASME *Boiler and Pressure Vessel Code (BPVC)*, *Section VIII: Pressure Vessels; Division 2: Alternative Rules*

ASME *Boiler and Pressure Vessel Code (BPVC)*, *Section IX: Welding and Brazing Qualifications*

[1] ASME International, 2 Park Avenue, New York, New York 10016-5990, www.asme.org.