

ERRATA
(AUGUST 1, 1994)

Specification for Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Services

API SPECIFICATION 14D (SPEC 14D)
NINTH EDITION, JUNE 1, 1994



American Petroleum Institute
1220 L Street, Northwest
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Front Cover of the Specification.

The effective date should be changed from June 1, 1994 to April 1, 1995.

Inside the front cover. Add the following:**Conformance to API's Environmental Mission and Guiding Principles.**

This specification has been reviewed to determine if it conforms to API's Environmental Mission and Guiding Principles.¹ It has been determined that because this specification directly addresses safety and environmental issues, it does conform to API's Environmental Mission and Guiding Principles. The following guiding principles have been determined to be especially relevant to this specification:

- To recognize and to respond to community concerns about our raw materials, products, and operations.
- To operate our plants and facilities, and to handle our raw materials and products in a manner that protects the environment and the safety and health of our employees and the public.
- To make safety, health, and environmental considerations a priority in our planning and our development of new products and processes.
- To counsel customers, transporters, and others in the safe use, transportation, and disposal of our raw materials, products, and waste materials.
- To participate with government and others in creating responsible laws, regulations, and standards to safeguard the community, workplace, and environment.
- To promote these principles and practices by sharing experiences and offering assistance to others who produce, handle, use, transport, or dispose of similar raw materials, petroleum products, and wastes.

Add the following footnote to the bottom of the inside of the front cover:

¹Charter and Bylaws of the American Petroleum Institute, American Petroleum Institute, Washington, D.C., April 3, 1991.

Page 7, Table 104.1, Referenced Standards. Add:

ASTM A703/A703M: Standard Methods and Definitions for Mechanical Testing of Steel Products.

Page 9, Section 200. Add the following definition:

Valve Bore Sealing Mechanism — Those internal valve parts which close off the flow through the valve bore, such as gates, balls, plugs, poppets, flappers, and their respective seats.

Page 14, Table 403.4, Adjustment Factors for Sub-Size Specimens. Change the Adjustment Factor for Specimen Dimension 10mm x 7.5mm to: 0.833

Page 15, Section 403.4c(2) Oil Quenching. Delete this section and change Section 403.4c(3) to Section 403.4c(2).

Page 16. Add Section:

404. Class 3S — Metals for Sulfide Stress Corrosion Cracking Service. SSV/USV materials for sulfide stress cracking service in direct fluid contact (as defined by NACE MR-01-75) shall comply with the requirements of NACE MR-01-75 and section 403.

Page 16, Section 404. After adding new Section 404 as instructed above, renumber present Section 404 to Section 405 and renumber remaining Sections accordingly. New Section 405 should read: **Class 3C — Metals for Chloride Stress Cracking Service.** (PLEASE NOTE: While the sections of this section are renumbered, for simplicity, this errata will still refer to the old section numbers for other changes to this section.)

Page 16, Section 410.2c Size Requirements. Change the second paragraph to read:

Forging — size not required to exceed 2½ inches (63mm) ER. Casting — size not required to exceed size shown in ASTM A 703.

Page 19, Section 502.3b. Add the following sentence to the end of the section:

A WPS for each base material, which is not listed in an ASME Section IX P-number grouping, shall be specifically qualified for the manufacturer's specified base material.

Page 19, Section 502.3f. Insert the following after the first sentence:

One set of three (3) test specimens each shall be removed at the ¼ thickness location of the test weldment for each of the weld metal and base material HAZ. The root of the notch shall be oriented normal to the surface of the test weldment and located as follows:

- Weld Metal Specimens (3 each) 100% weld metal.
- HAZ Specimens (3 each) include as much HAZ material as possible.

Page 19, Sections 502.4c and 502.4d. Delete these sections.

Page 23, Section 605.1. Add the following table and renumber the present Table 605.1 to 605.2.

TABLE 605.1
QUALITY CONTROL REQUIREMENTS FOR VALVE PARTS

	See Appropriate Section		
	Bodies Bonnetts and Stems	Valve bore Sealing Mechanisms	Nonmetallic Seals
Tensile Testing	605.2a		
Impact Testing	605.2b		
Hardness Testing	605.2c		605.4c
Dimensional Verification	605.2d		605.4a
Traceability	605.2e		
Chemical Analysis	605.2f		
Visual Examination	605.2g		605.4b
Surface NDE	605.2h 605.2i		
Weld NDE — General	605.2j	605.2j	
— Examination Visual	605.2j(1)	605.2j(1)	
— NDE Surface	605.2j(2)	605.2j(2)	
— Repair Welds	605.2j(3)	605.2j(3)	
— NDE Volumetric	605.2j(4)		
Documentation			605.4d

PLEASE NOTE: Section numbers referenced in the table are the new Section numbers

Page 24, Section 605.2e Traceability. Change the first sentence to read:

Job lot traceability is required.

Page 25, Section 605.2j(2) Weld NDE — Surface. In the first sentence change: " $\frac{1}{16}$ " to " $\frac{1}{8}$ ".

Page 25, Section 605.2j. Change reference from Table 605.1 to 605.2.

Page 26, Section 605.3. Add Section:

605.3 Valve Bore Sealing Mechanism. Table 605.1 lists the quality control requirements for valve bore sealing mechanism.

Change present Section 605.3 to 605.4 in all places.

Page 27, Section 606.2b. Add Section:

606.2b Valve Bore Sealing Mechanism. Valve bore sealing mechanism records shall be required according to Section 605.3.

Renumber present 606.2b to 606.2c and revise to read:
Non-metallic Sealing Material. Non-metallic sealing material records shall be required according to Section 605.4.

Renumber Section 606.2c to 606.2d.

Page 33, Section 904.9. Renumber to Section 904.8b and revise to read:

The Test Agency must meet the criteria of API Spec

14D and applicable requirements of API Spec Q1 or the criteria of ASME SPPE-2: *Accreditation of Testing Laboratories for Safety and Pollution Prevention Equipment Used in Offshore Oil and Gas Operations*.

Test agencies must be licensed by API or accredited in accordance with the requirements of ASME SPPE-2, *Accreditation of Testing Laboratories for Safety and Pollution Prevention Equipment Used in Offshore Oil and Gas Operations*, in order to test SSV/USV equipment that is intended to be marked with the API Monogram or the ASME SPPE OCS Symbol. See Appendix D of this specification for API licensing procedures or contact ASME for SPPE-2 accreditation criteria.

Page 36, Section 905.7e, third line. Change "or" to "of".

Page 40, Section 908.1b, first sentence. Revise to read:

"Drift Test. The SSV/USV valve opening of each full bore SSV/USV valve shall be checked for proper bore alignment by passing a drift mandrel of the dimensions shown in API Spec 6A . . ."

Delete Table 908.2 from page 42.

Page 41, Table 908.1. Revise as shown:

- I. SSV/USV Acutator Seat Test
- V. Primary Seat Test
- Secondary Seat Test
- Tertiary Seat Test

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FOREWORD

The purpose of this specification is to provide requirements for wellhead surface safety valves and underwater safety valves. A wellhead surface safety valve (SSV) or an underwater safety valve (USV) is used as one means of assuring well stream shutoff.

API RP 14H: Recommended Practice for Installation, Maintenance, and Repair of Surface Safety Valves and Underwater Safety Valves Offshore, also provides guidelines for recommended installation, operation, maintenance, and testing procedures for SSVs/USVs.

This standard was developed as an API Specification under the jurisdiction of the API Exploration & Production Department Committee on Standardization of Offshore Safety and Anti-Pollution Equipment (OSAPE), and was prepared with the guidance of the API, the Offshore Operators Committee (OOC), and the Western States Petroleum Association (WSPA).

The API OSAPE Committee has the following scope:

API Specifications and Recommended Practices for safety and anti-pollution equipment and systems used in offshore oil and gas production, giving emphasis when appropriate in such standards to manufacturing, equipment testing, and systems analysis methods.

Other publications formulated by this committee are:

Spec 14A: Specification for Subsurface Safety Valve Equipment

RP 14B: Recommended Practice for Design, Installation, Repair, and Operation of Subsurface Safety Valve Systems.

RP 14C: Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems on Offshore Production Platforms.

RP 14E: Recommended Practice for Design and Installation of Offshore Production Platform Piping Systems.

RP 14F: Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms.

RP 14G: Recommended Practice for Fire Prevention and Control on Open Type Offshore Production Platforms.

RP 14H: Recommended Practice for Use of Surface Safety Valves and Underwater Safety Valves Offshore.

RP 14J: Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities.

Attention Users of This Publication: API Specifications usually include bar notations in the margin to indicate items that have been changed from the previous edition. These bar notations have not been included in this document due to the extensiveness of revisions made in this edition. Every Section of this document includes revisions from the previous edition.

This is the Ninth Edition of this publication and supersedes all previous editions. It includes changes to the Eighth Edition, August 1991, as approved by letter ballot.

This Standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

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SECTION 100

SCOPE

101. PURPOSE. This Specification covers flanged valves, or valves with other industry accepted non-threaded end connections, and multiple completion or block type valves used as wellhead surface safety valves (SSV). This Specification also covers underwater safety valves (USV) to be used on or near underwater wellheads.

102. CLASSES OF SERVICES. Included are minimum acceptable standards for materials, manufacturing, and testing of SSVs/USVs for four classes of service. To qualify, a SSV/USV valve must pass the verification test specified in Section 400. Also included are minimum acceptable standards for materials, manufacturing, and performance of lockopen devices. The four classes of service are as follows:

102a. Class 1. Standard Service. This class of SSV/USV is intended for use on oil or gas wells that do not exhibit the detrimental effects caused by corrosion (stress corrosion cracking or metal loss) or sand erosion or fouling.

102b. Class 2. Sandy Service. This class of SSV/USV is intended for use on oil or gas wells where a substance such as sand could be expected to cause a SSV/USV valve failure. This valve must also meet the requirements of Class 1 Service.

102c. Class 3. Stress Corrosion Cracking Service. This class of SSV/USV is intended for use on oil or gas wells where corrosive agents could be expected to cause stress corrosion cracking. This SSV/USV class must meet the requirements for a Class 1 or Class 2 SSV/USV, whichever is applicable, and be manufactured from materials that are resistant to stress corrosion cracking. Within this service class there are two subclasses: 3S for resistance to sulfide stress cracking, and 3C for resistance to chloride stress cracking.

102d. Class 4. Metal Loss Corrosion Service. This class of SSV/USV is intended for use on oil or gas wells where corrosion could be expected to cause a SSV/USV failure due to corrosive metal loss. This SSV/USV class must meet the requirements for a Class 1 or Class 2 SSV/USV,

whichever is applicable. This class requires the use of materials that are resistant to metal loss corrosion.

103. VERIFICATION TESTING. The verification testing requirements in this Specification are not represented as duplicating actual well conditions.

104. REFERENCED STANDARDS.

104.1 GENERAL. This specification includes by reference, either in total or in part, other API, industry, and government standards listed in Table 104.1.

NOTE: Only those standards listed in Table 104.1 are considered part of this Specification. Documents (subtier) that are referenced by those standards are not considered part of this Specification.

When the latest edition is specified it may be used on issue and shall be mandatory six months from the date of revision. The replaced edition may be used up to six months from the date of the latest revision.

104.2 REQUIREMENTS. Requirements of other standards included by reference in this Specification are essential to the safety and interchangeability of the equipment produced.

For information on submitting Equivalent Standards for inclusion in this Specification, contact the API Exploration & Production Department, 700 North Pearl, Suite 1840 (LB-382), Dallas, Texas 75201-2845.

104.3 EQUIVALENT STANDARDS. Other nationally or internationally recognized standards shall be submitted to and approved by API for inclusion in this Specification prior to their use as Equivalent Standards.

105. UNITS OF MEASURE. A decimal/inch system is the standard for the dimensions shown in this Specification. Nominal sizes will continue to be shown as fractions. This change from previous editions of *API Spec 14D* reflects current widespread industry practice. It is not intended that this modify the fractional dimensions or tolerances from earlier editions. Table 304.1 gives fraction to decimal equivalence. For the purposes of this Specification, the fractions and their decimal equivalents are equal and interchangeable. Metric conversions are described in Appendix A.

106. APPENDICES. Appendices are for information only except where cited as requirements in the text.



Documents

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SCOPE (continued)

TABLE 104.1
REFERENCED STANDARDS

Latest editions are applicable, unless otherwise so noted.

Refer to Section 104.1.

1. *ANSI B 1.1: Unified Standard Inch Screw Threads*
2. *ANSI B 18.2.2: Square and Hex Nuts*
3. *API Manual of Petroleum Measurement Standards*, Chapter 10, Section 10, Section 4: "Sediment and Water"
4. *API Manual of Petroleum Measurement Standards*, Chapter 15: "Guidelines for the Use of the International System of Units (SI)"
5. *API RP 13B: Standard Procedure for Field Testing Drilling Fluids*
6. *API RP 14H: Use of Surface Safety Valves and Underwater Safety Valves Offshore*
7. *API Spec 5CT: Casing and Tubing*
8. *API Spec 6A: Wellhead Equipment*
9. *API Std. 5B: Threading, Gaging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads*
10. *API Spec 5L: Line Pipe*
11. *ASME Boiler and Pressure Vessel Code*, Sect. V, Nondestructive Testing, Article 5, "UT Examination Methods For Materials, and Fabrication" . . . Para. T522 & T542
12. *ASME Boiler and Pressure Vessel Code*, Section VIII, Division 1
 - a) Part UG-101: "Proof Tests to Establish Maximum Allowable Working Pressure"
 - b) Appendix 4: "Rounded Indication Charts Acceptance Standard for Radiographically Determined Rounded Indications in Welds"
13. *ASME Section VIII, Division 2: "Pressure Vessels — Alternate Rules"*
 - a) Appendix 4: "Design Based on Stress Analysis"
 - b) Appendix 6: "Experimental Stress Analysis"
14. *ASME Boiler and Pressure Vessel Code*, Section IX, "Welding and Brazing Qualifications"
15. *ASTM A 193: Alloy Steel and Stainless Steel Bolting Materials For High Temperature Service*
16. *ASTM A 194: Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service*
17. *ASTM A 307: Carbon Steel Externally Threaded Standard Fasteners*
18. *ASTM A 320: Alloy Steel Bolting Materials for Low Temperature Service*
19. *ASTM A 380: Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems*
20. *ASTM A 370: Standard Methods and Definitions for Mechanical Testing of Steel Products*
21. *ASTM A 388: Recommended Practice for Ultrasonic Examination of Heavy Steel Forgings*
22. *ASTM A 453: Bolting Materials, High Temperature, 50 to 120 ksi Yield Strength, with Expansion Coefficients Comparable to Austenitic Steels*
23. *ASTM A 609: Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof*
24. *ASTM E 10: Standard Test Methods for Brinell Hardness of Metallic Materials*
25. *ASTM E 18: Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*
26. *ASTM E 92: Standard Test Method for Vickers Hardness of Metallic Materials*
27. *ASTM E 94: Standard Practice for Radiographic Testing*
28. *ASTM E 140: Standard Hardness Conversion Tables for Metals*
29. *ASTM E 165: Standard Practice for Liquid Penetrant Inspection*
30. *ASTM E 186: Reference Radiographs for Heavy-Walled 2 to 4½ in. (51 to 114 mm) Steel Castings*
31. *ASTM E 280: Reference Radiographs for Heavy-Walled 4½ to 12 in. (114 to 305 mm) Steel Castings*
32. *ASTM E 428: Standard Recommended Practice for Fabrication and Control of Steel Reference Blocks Used in Ultrasonic Inspection*
33. *ASTM E 446: Reference Radiographs for Steel Castings up to 2 in. (51 mm) in Thickness*
34. *ASTM E 709: Standard Recommended Practice For Magnetic Particle Examination*
35. *ASTM E 747: Standard Method for Controlling Quality of Radiographic Testing Using Wire Penetrators*
36. *MSS SP-55: Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components (Visual Method)*
37. *MIL-H-6875H: Heat Treatment of Steels Aircraft Practice Process*, Section 3
38. *MIL-STD-105D: Sampling Procedures and Tables for Inspection by Attributes*
39. *NACE Standard MR0175: Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment*
40. *SAE AS 568A: Aerospace Size Standard for O-Rings*
41. *ASTM D1418: Practice for Rubber and Rubber Latexes*
42. *SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing — '84, or latest edition*

NOTE: Other nationally or internationally recognized standards shall be submitted to and approved by API for inclusion in this Specification prior to their use as Equivalent Standards.

SECTION 200

ABBREVIATIONS AND DEFINITIONS

The following abbreviations are used in this Specification.

AISI	American Iron & Steel Institute
ANSI	American National Standards Institute
ASME	
SPPE	Refers to the program described in ASME SPPE 1 and 2
ASNT	American Society for Nondestructive Testing
API	American Petroleum Institute
AQL	Acceptance Quality Level
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
MIL-STD	Military Standard, USA
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
NACE	National Association of Corrosion Engineers
NDE	Nondestructive Examination
OSAPE	API Exploration & Production Department Committee on Standardization of Offshore Safety and Anti-Pollution Equipment
QTC	Qualification Test Coupon

The definitions below are related specifically to surface safety valves and/or underwater safety valves and are presented to define the terminology used in this Specification.

Authorized Facility — A facility authorized under the applicable quality assurance program specified by the operator on the purchase order.

Authorized Quality Assurance Program — API or SPPE Quality Program.

Date of Manufacture — The date of manufacturer's final acceptance of finished equipment.

Chloride Stress Cracking — The stress corrosion cracking of ferrous based alloy steels, which may result when exposed to wellstreams containing water and chlorides under certain conditions of concentration and temperature. Other constituents present, such as oxygen, may contribute to chloride stress cracking.

Date of Repair/Remanufacture — The date of repairer's/remanufacturer's final acceptance of finished equipment.

Failure — Improper performance of a device or equipment item that prevents completion of its design function.

Heat Sensitive Lockopen Device — A device installed on an SSV actuator to maintain the SSV valve in a full open position until exposed to sufficient heat to cause the device to release and allow the SSV valve to close.

Manufacturer — The principal agent in the design, fabrication, and furnishing of SSV/USV actuator and or SSV/USV valve. The SSV/USV valve and SSV/USV actuator define functional entities and do not necessarily represent the units as supplied.

Metal Loss Corrosion — Loss of metal in areas exposed to well streams which contain water or brine and carbon dioxide (CO₂), hydrogen sulfide (H₂S), oxygen (O₂), or other corrosive agents.

Normally Closed Valve — A valve which will shift to the closed position upon loss of the power media.

Operating Manual — The publication issued by the manufacturer which contains detailed data and instructions related to the design, installation, operation, and maintenance of SSV/USV equipment.

Pressure Containing Parts — Those parts whose failure to function as intended would result in a release of pressurized fluid to the atmosphere. Includes only the SSV/USV valve body, bonnet, and stem; actuator piston, cylinder, and stem (shaft).

Pressure Controlling Parts — Those parts intended to control or regulate the movement of pressurized fluids. Includes only SSV/USV valve gate and seats.

Qualified Parts — A part manufactured under an authorized quality assurance program and, in the case of replacement, produced to meet or exceed the performance of the original part.

Rated Working Pressure — The maximum internal pressure that equipment is designed to contain and/or control. Working pressure is not to be confused with test pressure.

Remanufacture — An activity involving disassembly, reassembly, and testing of *API Spec 14D* equipment with or without the replacement of qualified parts where machining, welding, heat treating, or other manufacturing operations are employed. Remanufacture does not include the replacement of bodies.

Repair — An activity involving disassembly, reassembly, and testing of *API Spec 14D* equipment with or without the replacement of qualified parts. Repair does not include machining, welding, heat treating, other manufacturing operations or the replacement of bodies.

Repairer/Remanufacturer — A person or company who performs the repair/remanufacture in an authorized facility.

Manufacturing Operation — An activity involving, but not limited to, the machining, welding, heat treating, or other processes utilized to produce a finished product.

Stress Corrosion Cracking — The cracking which results from a combination of corrosion and stress.

Sulfide Stress Cracking — The stress corrosion cracking of susceptible materials which occurs when exposed to wellstreams containing hydrogen sulfide (H₂S) and water.

SECTION 200

ABBREVIATIONS AND DEFINITIONS (continued)

SECTION 200

Surface Safety Valve (SSV) — An automatic wellhead valve assembly which will close upon loss of power supply. When used in this Specification it includes SSV valve and SSV actuator.

SSV/USV Actuator — The device which causes the SSV/USV valve to open when power is supplied and to automatically close when power is lost or released.

SSV/USV Valve — The portion of the SSV/USV which contains the wellstream and shuts off flow when closed.

Test Agency — Any independent third party which provides a test facility and administers a testing program which meets the Class 2 SSV/USV valve verification test requirements of this Specification.

Traceability, Job Lot — The ability for parts to be identified as originating from a job lot which identifies the included heat(s).

Underwater Safety Valve (USV) — An automatic valve assembly (installed at an underwater wellhead location) which will close upon loss of power supply. When used in this Specification, this includes the USV valve and USV actuator.

Valve, Gate — A valve designed to function in either a full open or full closed position in which the closure member (gate) is moved in a direction perpendicular to the flow direction.



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SECTION 300 GENERAL

301. PERFORMANCE REQUIREMENTS.

301.1 GENERAL. Surface Safety Valves (SSV) and Underwater Safety Valves (USV) designed and manufactured in accordance with this Specification shall be constructed of materials in compliance with Section 400 of this Specification and shall perform satisfactorily in the tests required by Section 900 of this Specification. The SSV/USV shall be of a normally closed design. The SSV/USV shall be designed to operate, without damage to the SSV/USV valve or SSV/USV actuator, when SSV/USV actuator energy is instantaneously applied or lost under any condition of SSV/USV valve body pressure within its pressure rating. Design criteria for USVs shall also include the maximum water depth.

301.2 RELATED SPECIFICATIONS. In addition to the requirements of this section, a SSV/USV valve must comply with the applicable dimensional requirements of *API Spec 6A*.

301.3 SSV VALVE DESIGN. This Specification covers flanged valves, or valves with other industry accepted non-threaded end connections, and multiple completion or block type valves used as wellhead surface safety valves. A multiple completion or block type valve will qualify as a wellhead SSV for Class 2 service, without verification testing, if it is of the same internal design as an SSV valve within the manufacturer's product line, which has passed the verification test in Section 900 of this Specification. Such valves must be manufactured and supplied in accordance with all other requirements of this Specification.

301.4 USV VALVE DESIGN. USV valve designs must meet the requirements for SSV valve design with the following exceptions: (1) USV valves may use any standard or other industry accepted end connections. (2) USVs may be of nonstandard bores and/or end-to-end lengths. End connections which are not specified in *API Spec 6A* shall meet all other requirements of this Specification.

301.5 SSV/USV ACTUATOR DESIGN. The manufacturer shall provide an SSV/USV actuator design which has the following features:

301.5a Internal components shall be resistant to environmental corrosion, the operating media, and the wellstream fluid, if exposed under normal operating conditions.

301.5b SSV/USV actuator closing force must be sufficient to close the SSV/USV valve when the SSV/USV valve is at the most severe design closing condition as specified by the valve manufacturer.

301.5c In pneumatically operated SSV/USV actuators, a relief device will be provided to relieve at no higher than the rated working pressure of the SSV/USV actuator.

301.5d SSV/USV actuators must be designed to prevent pressure buildup in the SSV/USV actuator case due to leakage from the SSV/USV valve.

301.5e Permanently attached lockopen features are not permitted on SSV actuators.

301.6 HEAT SENSITIVE LOCKOPEN DEVICE DESIGN. The SSV actuator manufacturer shall make available, as an accessory, a heat sensitive lockopen device. Each type of heat sensitive lockopen device shall maintain the SSV valve in the fully open position, at atmospheric temperatures up to 150 degrees Fahrenheit (66° Celsius) with the SSV valve body pressurized to its rated working pressure and the SSV actuator cylinder bled to atmospheric conditions.

301.6a The following temperature actuation conditions must be met:

301.6a(1) The lockopen device shall allow the SSV valve to automatically close from SSV actuator forces alone (i.e., no pressure in the SSV valve body or energy supply to the SSV actuator cylinder) within six minutes after being subjected to, and maintained in, a controlled environmental temperature of 1,000 degrees Fahrenheit ± 25 degrees Fahrenheit (538° Celsius $\pm 14^\circ$). Tests to confirm this design feature shall be done in an air environment with air velocity past the SSV actuator due to natural air convection only.

301.6a(2) Eutectic materials used shall meet the manufacturer's design specifications for fusing within a degree Fahrenheit temperature range of $\pm 10\%$. The heat sensitive device shall be designed to actuate at maximum sustained temperature of 400 degrees Fahrenheit (204° Celsius).

301.6b The lockopen device shall be designed such that any component part released upon actuation of the device shall not present itself as a potential hazard to personnel.

302. SERVICE CONDITIONS.

302.1 PRESSURE RATINGS.

302.1a General. Valves shall be designed to operate in the following rated working pressures: 2,000 psi (13,8 MPa); 3,000 psi (20,7 MPa); 5,000 psi (34,5 MPa); 10,000 psi (69,0 MPa); 15,000 psi (103,4 MPa); 20,000 psi (138,0 MPa)

302.1b Design Considerations. The design shall take into account the effects of pressure containment and other pressure-induced loads.

302.1c SSV/USV Valve Pressure Considerations. The rated working pressure of SSV/USV valve shall be the lowest rated working pressure of any part.

302.2 TEMPERATURE RATINGS.

302.2a General. Equipment shall be designed to operate in one or more of the specified temperature ratings with minimum and maximum temperatures as shown in Table 302.2.

SECTION 302.2a

GENERAL (continued)

SECTION 303.3

Minimum temperature is the lowest ambient temperature to which the equipment may be subjected. Maximum temperature is the highest temperature of the fluid that will directly contact the equipment.

TABLE 302.2
TEMPERATURE RATINGS

Temperature Classification	Operating Range			
	Degree Fahrenheit		Degree Celsius	
	Min.	Max.	Min.	Max.
K	-75	to 180	-60	to 82
L	-50	to 180	-46	to 82
P	-20	to 180	-29	to 82
S	0	to 150	-18	to 65
T	0	to 180	-18	to 82
U	0	to 250	-18	to 121

302.3 SERVICE CLASSES. SSVs/USVs are classified as to the service to which they will be subjected, as outlined in Section 102: Class 1 — Standard Service; Class 2 — Sandy Service; Class 3 — Stress Corrosion Cracking Service; Class 4 — Metal Loss Corrosion. SSV/USV valves designed to meet the requirements for combinations of these classes of service may be furnished to this Specification. They must be identified as specified in Section 700.

302.3a Requirements for Service Class. The parts of an SSV/USV valve exposed to well fluids shall be resistant to the effects of the service for which the SSV/USV valve is classed (e.g., erosion, corrosion).

302.4 SSV/USV ACTUATOR.

302.4a Temperature Ratings. Equipment shall be designed to operate in one or more of the specified temperature ratings with minimum and maximum temperatures as shown in Table 302.2.

Minimum temperature is the lowest ambient temperature for which the equipment is designed to operate. Maximum temperature is the highest temperature of the fluid that the equipment is designed to contain.

302.4b Low Temperature. For temperature ratings at -20 degrees Fahrenheit (-6° Celsius) and below, metallic pressure containing parts shall be fabricated from materials which demonstrate material toughness. Refer to Tables 403.3 and 403.4.

302.4c Pressure Ratings. An SSV/USV actuator covered by this Specification shall be designed by the manufacturer for a pressure rating not greater than 20,000 psi (138.0 MPa). The pressure ratings shall be applicable to pressure containing parts at the rated temperature.

303. DESIGN METHODS.

303.1 FLANGES. API flanges have been designed in accordance with design criteria and methods developed by the API Committee on Standardization of Valves and Wellhead Equipment (Committee 6).

303.2 BODIES AND BONNETS. Bodies and bonnets shall be designed in accordance with one or more of the following methods:

NOTE: *In the event stress levels calculated by these methods exceed the allowable stresses, other methods identified by the manufacturer shall be used to justify these stresses. Fatigue analysis and localized bearing stress values are beyond the scope of this Specification.*

303.2a ASME. The design methodology as described in the *ASME Boiler and Pressure Vessel Code*, Section VIII, Division 2, Appendix 4, may be used for design calculations for pressure containing equipment. Design allowable stresses shall be limited by the following criteria:

$$S_T = 0.83S_Y \text{ and } S_M = \frac{2}{3} S_Y$$

where:

S_M = design stress intensity at rated working pressure, psi.

S_T = maximum allowable general primary membrane stress intensity at hydrostatic test pressure, psi.

S_Y = material minimum specified yield strength, psi.

303.2b Distortion Energy Theory. The distortion energy theory method may be used for design calculations for pressure containing equipment. The basic pressure vessel wall thickness may be sized by combining triaxial stresses based on hydrostatic test pressure and limited by the following criteria:

$$S_E = S_Y$$

where:

S_E = maximum allowable equivalent stress computed by the Distortion Energy Theory method, psi.

S_Y = material minimum specified yield strength, psi.

303.2c Experimental Stress Analysis. Experimental stress analysis as described in the *ASME Boiler and Pressure Vessel Code*, Section VIII, Division 2, Appendix 6.

303.2d Proof Test Analysis. Proof testing as described in the *ASME Boiler and Pressure Vessel Code*, Section VIII, Division 1, Part UG-101.

303.3 CLOSURE BOLTING. The maximum allowable tensile stress for closure bolting shall be determined, considering initial boltup, rated working pressure, and hydrostatic test pressure conditions. Bolting stresses, based on the root area of the thread, shall not exceed the following limits:

$$S_A = 0.83S_Y$$

where:

S_A = maximum allowable tensile stress, psi.

S_Y = bolting material specified minimum yield strength, psi.

Bolting stresses shall be determined considering all loading on the closure including pressure acting over the seal area, gasket loads, and any additive mechanical and thermal loads.

SECTION 303.4**GENERAL (continued)****SECTION 307.3**

303.4 OTHER PARTS. All other pressure containing parts shall be designed to satisfy the manufacturer's documented performance characteristics and the service conditions in this Specification. The manufacturer shall specify methods to be used in design which are consistent with accepted engineering practices.

304. MISCELLANEOUS DESIGN INFORMATION.

304.1 GENERAL. End and outlet connections shall be an integral part of the body or attached by welding which meets requirements of this Specification.

304.2 DIMENSIONAL REQUIREMENTS. Dimensional tolerance of components or subassemblies shall be such that additive tolerances will not preclude proper operation of the SSV/USV. All components must be dimensionally inspected to the extent necessary to assure proper operation and compliance with design specifications and drawings.

304.3 BOLTING.**304.3a End and Outlet Bolting.**

304.3a(1) Hole Alignment. End and outlet bolt holes shall be equally spaced and shall straddle common center lines.

304.2a(2) Stud Thread Engagement. Stud thread engagement length into the body shall be a minimum of one times the outside diameter of the stud.

304.3b Other Bolting. The stud thread anchoring means shall be designed to sustain a tensile load equivalent to the load which can be transferred to the stud through a fully engaged nut.

304.3c Bonnet Bolting. Bonnet bolting material for Class 4 valves shall meet the requirements of *API Spec 6A*.

304.4 TEST, VENT, INJECTION, AND GAGE CONNECTIONS. Test, vent, injection, and gage connections shall conform to all design and equipment requirements of *API Spec 6A*.

304.5 OPERATING ORIENTATION. The SSV/USV shall be designed to be fully operative in all possible positions of installation when installed and maintained in accordance with manufacturer's operating manual.

304.6 REDUCED OPENING SSV/USV VALVE PORTS. Reduced opening SSV/USV valves are customarily made in regular and venturi types, both of which can have ports of circular or substantially rectangular cross-section through the plug or gate.

These SSV/USV valves have no drift test requirement; however, the bore through the gate or plug shall align with the bore through the SSV/USV valve body to permit a smooth flow pattern when in the fully open position.

Reduced opening USV flow ports should be sized after consideration of Through Flow-Line (TFL) operations.

304.7 GREASE OR SEALANT FITTING. If grease or sealant is required in the SSV/USV valve body or stem area, provisions shall be made for injecting the grease or sealant without reducing the pressure in the SSV/USV valve.

305. DESIGN DOCUMENTATION. Documentation of designs shall include methods, assumptions, calculations, and, design requirements. Design requirements shall include, but not be limited to, those criteria for size, test, and operating pressures, material environmental and API Specification requirements, and other pertinent requirements upon which the design is to be based. Design documentation media shall be clear, legible, reproducible, and retrievable. Design documentation shall be retained for five (5) years after the last unit of that design is manufactured.

306. DESIGN REVIEW.

306.1 GENERAL. Design documentation shall be reviewed and verified by a qualified individual other than the individual who created the original design.

306.2 DESIGN CHANGES FROM FAILURE REPORTS — MANUFACTURER'S RESPONSIBILITY.

The manufacturer providing SSVs/USVs in accordance with this Specification shall make an analysis of failures submitted in accordance with Appendix C. In the event the Failure Reports show repetitive failure of any component part or subassembly, the manufacturer shall make necessary design changes on all future affected models, types, and sizes of SSVs/USVs. The manufacturer shall notify purchasers of equipment affected by such design changes.

307. DESIGN VERIFICATION.

307.1 GENERAL. The manufacturer shall conduct and document the verification test as described in Section 900.

307.2 MANUFACTURE. All SSVs/USVs conforming to this Specification shall be manufactured in accordance with drawings and written standards, specifications, and procedures prepared by the manufacturer. In addition, Class 2 SSV/USV valves shall be manufactured to drawings and written specifications that are neither less stringent nor significantly different from those of the Class 2 SSV or USV valve that qualified in the verification test. Qualification of an SSV qualifies a USV with the same SSV valve bore sealing mechanisms and vice versa.

307.3 DESIGN OR MATERIAL CHANGES OF CLASS 2 SSV/USV VALVES. Changes in design or material, which affect the valve bore sealing mechanism of the Class 2 SSV/USV valve, shall require requalification by verification test.

SECTION 400 MATERIAL REQUIREMENTS

401. GENERAL. This section describes the material performance, processing, and composition requirements for pressure containing and pressure controlling metallic and non-metallic parts.

402. WRITTEN SPECIFICATIONS. All metallic and non-metallic pressure containing or pressure controlling parts for SSV/USV valves shall require a written material specification.

402.1 METALLIC REQUIREMENTS. The manufacturer's written specified requirements for metallic materials shall define the following along with accept/reject criteria:

1. Mechanical property requirements.
2. Material qualification.
3. Allowable melting practice(s).
4. Forming practice(s) including hot working & cold working.
5. Heat treatment procedure including cycle time and temperature with tolerances, heat treating equipment, and cooling media.
6. Material composition with tolerance.
7. NDE requirements.

402.2 NON-METALLIC REQUIREMENTS. Non-metallic pressure containing seals shall have written material specifications. The manufacturer's written specified requirements for non-metallic materials shall define the following:

1. Generic base polymer(s).
2. Physical property requirements.
3. Service class material compatibility.
4. Storage and age control requirements.

403. CLASS 1 AND CLASS 2 — MATERIALS FOR STANDARD AND SANDY SERVICE.

SSV/USV materials for standard and sandy service in direct contact with retained fluids shall comply with the manufacturer's written specification and Section 403.1 through 403.5.

403.1 VALVE MATERIAL PERFORMANCE BASES FOR PRESSURE CONTAINING PARTS.

403.1a Property Requirements. All bodies, bonnets, and flanges shall be fabricated from materials which meet the applicable property requirements shown in Table 403.1 and Table 403.2.

403.1b Impact Requirements. Impact testing shall conform to the requirements of Table 403.3. When subsize specimens are used, the Charpy V-Notch impact requirements shall be equal to that of the 10mm X 10mm specimens multiplied by the appropriate adjustment factor listed in Table 403.4.

403.2 MATERIAL QUALIFICATION TESTING.

403.2a When minimum impact and/or tensile properties are required in order for a material to be qualified for service, the required tests shall be performed on specimens from an acceptable Qualification Test Coupon (QTC) as described in Section 411.

403.2b Tensile Testing.

403.2b(1) Test Specimens. Tensile test specimens shall be removed from a QTC as described in Section 410.4a. This QTC shall be used to qualify a heat and the bodies, bonnets, and flanges produced from that heat.

403.2b(2) Methods. Tensile tests shall be performed at room temperature in accordance with the procedures specified in *ASTM A370*. A minimum of one tensile test shall be performed. The results of the tensile test(s) shall satisfy the applicable requirements of Table 403.1. If the results of the tensile test(s) do not satisfy the applicable requirements, two additional tensile tests may be performed in an effort to qualify the material. The results of each of these tests shall satisfy the applicable requirements.

**TABLE 403.1
API MATERIAL PROPERTY REQUIREMENTS
BODIES, BONNETS, AND FLANGES**

API Material Designation	.2% Yield Strength, minimum (psi)	Tensile Strength, minimum (psi)	Elongation in 2 in. (50mm), minimum (%)	Reduction in Area, minimum (%)
36K	36,000 (248 MPa)	70,000 (483 MPa)	21	No requirement
45K	45,000 (310 MPa)	70,000 (483 MPa)	19	32
60K	60,000 (414 MPa)	85,000 (586 MPa)	18	35
75K	75,000 (483 MPa)	95,000 (655 MPa)	17	35

MATERIAL REQUIREMENTS (continued)

TABLE 403.2
API MATERIAL APPLICATIONS FOR BODIES, BONNETS, AND FLANGES

Part	Pressure Ratings (psi)					
	2000 (13,8 MPa)	3000 (20,7 MPa)	5000 (34,5 MPa)	10,000 (69,0 MPa)	15,000 (103,4 MPa)	20,000 (138,0 MPa)
Body, Bonnet	36K,45K 60K,75K	36K,45K 60K,75K	36K,45K 60K,75K	36K,45K 60K,75K	45K,60K 75K	60K,75K
Flanges	60K,75K	60K,75K	60K,75K	60K,75K	75K	75K

TABLE 403.3
CHARPY V NOTCH IMPACT REQUIREMENTS (10mm x 10mm)

Temperature Classification	Test Temperature (°F)	Minimum Average Impact Value (ft-lbs)
K	-75 (-60°C)	15 (20 Joules)
L	-50 (-46°C)	15 (20 Joules)
P	-20 (-29°C)	15 (20 Joules)
S	0 (-18°C)	--
T	0 (-18°C)	--
U	0 (-18°C)	--

TABLE 403.4
**ADJUSTMENT FACTORS FOR
SUB-SIZE SPECIMENS**

Specimen Dimension	Adjustment Factor
10mm x 7.5mm	0.838
10mm x 5.0mm	0.667
10mm x 2.5mm	0.333

TABLE 403.5
**STEEL COMPOSITION LIMITS FOR
BODY, BONNET, AND FLANGE
MATERIAL (wt%)**

Alloying Element	Carbon and Low Alloy Steels Composition Limits	Martensitic** Stainless Steels Composition Limits
Carbon	0.45 max	0.15 max
Manganese	1.80 max	1.00 max
Silicon	1.00 max	1.50 max
Phosphorus	0.040 max	0.040 max
Sulfur	0.040 max	0.040 max
Nickel	1.00 max	4.50 max
Chromium	2.75 max	11.0-14.0
Molybdenum	1.50 max	1.00 max
Vanadium	0.30 max	N/A

**Other alloy systems are not required to conform to this table.