Date of Issue: September 19, 1996
Affected Publication: API Specification 14A, *Specification for Subsurface Safety Value Equipment,* Ninth Edition, July 1, 1994

ERRATA

Preface

This errata corrects editorial errors in the Ninth Edition of API Specification 14A.

Page 2, Table 1, Referenced Standards. Make the following changes:

Delete references 32, 34, 36, 37 and 38.

Replace reference 25, MIL STD-105E, with ANSI Z1.4, 1993 Edition.

Replace reference 27, MIL STD-45662, with ANSI/NCSL Z540-1-1994

Delete reference 35, ISO/IEC Guide 25 (subject matter is covered in ANSI Z540)

Page 5, Par. 6.5.1. Change "accept-ance" to "acceptance".

Page 6, Par. 6.5.2. Change "accord-ance" to "accordance".

Page 8, Par. 7.1.2. Change "Figure 5.6" to "Figure 6".

Page 34, Par. 7.17.2a. Change "Table 5.1" to "Table 4".

Page 34, Par. 7.17.2b. Change "Table 1-1" to "Table 4".

Page 35, Par. 7.18.3a. Change "Table 5.1" to "Table 4".

Page 35, Par. 7.18.3b. Change "Table 1" to "Table 4".

Page 43, Par. 7.25.2a.2. Change "(189°C)" to "(260°C)".

Page 47, Appendix A. Make the following corrections:

Change all commas (,) to periods (.) in all SI unit conversion factors.

Under the "Quantity" column, correct the spelling of "Strength".

Under the "SI Units" column, change the pressure and strength conversion factors from "6,894757 Pa" to "6894.757 Pa".

Page 48, Appendix B. Delete all references to specific sections of Spec 14A and RP 14B.

[Example: change "Type System (See RP 14B, Section 4.1, 4.2 and 4.4)" to "Type System (See RP 14B)".]

Page 51, Appendix D. Revise the first paragraph of Section D.2 to read as follows (the second and third paragraphs are unchanged):

D.2

Laboratories desiring license under this Appendix shall have a functional quality program in accordance with the ISO/IEC Guide 25-1982, "General Requirements for the Technical Competence of Testing Laboratories," and the following sections of API Spec Q1: Scope and Field of Application, References, Definitions, Quality System Requirements except requirements related to design, manufacturing and field nonconformance. API shall maintain a list of licensed laboratories, which shall appear in the API Composite List of Manufacturers Licensed for use of the API Monogram. Laboratories desiring licensing under this Appendix shall make application and pay fees as follows:

Supplement 1
December 15, 1997
Effective Date: June 1, 1998

Specification for Subsurface Safety Valve Equipment

API SPECIFICATION 14A
NINTH EDITION, JULY 1, 1994

American Petroleum Institute

Supplement 1 to Specification for Subsurface Safety Valve Equipment

This supplement includes editorial corrections previously published in a September 19, 1996 Errata sheet, some additional editorial changes, and revisions approved by letter ballot of the API Subcommittee on Valves and Wellhead Equipment in 1996 and 1997. The revisions are marked by a vertical bar in the margin. These revisions shall be effective on the effective date shown on the cover, but may be used voluntarily from the date of publication.

Page 1, Par. 1.4, Class of Service

Insert the following note under Class 3, Stress Corrosion Cracking Service:

Note: Metallic materials for Class 3C service are dependent of specific well conditions. No national of international standards exist for the application of metallic materials for this class of service.

Insert the following note under Class 4, Weight Loss Corrosion Service:

Note: Metallic materials for Class 4 service are dependent of specific well conditions. No national of international standards exist for the application of metallic materials for this class of service.

Pages 1 -3, Section 3. Make the following changes:

Renumber current definitions as follows:

Change current 3.10 and 3.11 to 3.11 and 3.12

Change current 3.12 to 3.16

Change current 3.13 through 3.26 to 3.18 through 3.32.

Change current 3.27 through 3.33 to 3.34 through 3.40

Insert the following new definitions:

3.10 DESIGN ACCEPTANCE CRITERIA: Defined limits placed on characteristics of materials, products, or services established by the manufacturer to ensure conformance to the product design.

3.13 FIT: (1) The geometric relationship between parts. This would include the tolerance criteria used during the design of a part and its mating parts. (2) The state of being adjusted to or shaped for, this would include the tolerance criteria used during the design of a seal and its mating parts.

3.14 FORM: The essential shape of a product including all its component parts.

3.15 FUNCTION: The operation of a product during service.

3.17 HEAT TREATMENT (Heat Treating): Alternate steps of controlled heating and cooling of materials for the purpose of changing physical or chemical properties.

3.18 INTERCHANGEABLE: Conforms in every detail, within specified tolerances, to both fit and function of a safe design but not necessarily to the form.

3.33 STRESS RELIEF: Controlled heating of material to a predetermined temperature for the purpose of reducing any residual stresses.

Page 2, Table 1, Referenced Standards.
Make the following changes:

Delete references 32, 34, 36, 37 and 38.

Replace reference 25, MIL STD-105E, with ANSI Z1.4, 1993 Edition.

Replace reference 27, MIL STD-45662, with ANSI/ NCSL Z540-1-1994

Delete reference 35, ISO/IEC Guide 25 (subject matter is covered in ANSI Z540)

Page 3, Par. 4.1.4.

Revise to read as follows:

4.1.4 Changes to the design acceptance criteria which may affect Verification Test performance or interchangeability of SSSV Equipment shall require requalification, except seals that have passed the applicable Verification Testing requirements of Section 7 are considered interchangeable among the SSSV Equipment of any one Manufacturer for a particular class of service.

Page 4, Par. 5.2.2.

Revise to read as follows:

5.2.2 The mechanical properties specified in 5.2.1 for traceable metal components shall be verified by tests conducted on a material sample produced from the same heat of material. The material sample shall experience the same heat treatment process as the component it qualifies. Material subsequently heat treated from the same heat of material shall be hardness tested after processing to confirm compliance with the hardness requirements of the manufacturer's specifications. The hardness results shall verify through documented correlation that the mechanical properties of the material tested meet the properties specified in 5.2.1. The heat treat process parameters shall be defined in the heat treating procedure. Hardness testing is the only mechanical property test required after stress relieving. Material test reports provided by the material supplier or the manufacturer are acceptable documentation.

Page 4, Par. 5.2.3.

Delete

Page 5, Par. 5.2.4.

Change to 5.2.3.

Page 5, Par. 6.5.1.

Change "accept-ance" to "acceptance".

Page 6, Par. 6.5.2.

Change "accord-ance" to "accordance".

Page 8, Par. 7.1.2.

Change "Figure 5.6" to "Figure 6".

Page 8, Par. 7.2.2.

Change the first paragraph to read as follows (Subparagraphs a, b and c are not changed):

The Manufacturer shall submit a SSSV of most recent manufacture for Verification Testing. Such testing shall qualify SSSVs of the same size, type and model as the tested SSSV. Substantive changes to the Verification Test (specified herein) shall require requalification of a previously qualified SSSV within three years of the effective date of the change.

Page 34, Par. 7.17.2a.

Change "Table 5.1" to "Table 4".

Page 34, Par. 7.17.2b.

Change "Table 1-1" to "Table 4".

Page 35, Par. 7.18.3a.

Change "Table 5.1" to "Table 4".

Page 35, Par. 7.18.3b.

Change "Table 1" to "Table 4".

Page 43, Par. 7.25.2a.2.

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Order No. G14A05

Specification for Subsurface Safety Valve Equipment

API SPECIFICATION 14A (SPEC 14A)
NINTH EDITION, JULY 1, 1994

Contains ISO 10432:1993

Petroleum and natural gas industries—Subsurface safety valve equipment

STEP
Strategies for Today's Environmental Partnership

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005

STEP

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- To work with others to resolve problems created by handling and disposal of hazardous substances from our operations.
- 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.

Specification for Subsurface Safety Valve Equipment

Exploration and Production Department

API SPECIFICATION 14A (SPEC 14A)
NINTH EDITION, JULY 1, 1994

American
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SPECIAL NOTES

Note: This section is not part of ISO 10432:1993

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CONTENTS

FOREWORD

Note: This section is not part of ISO 10432:1993.

API 14A serves as the basis for ISO 10432:1993. The complete text of both the API and ISO standards is contained in this document. Some differences exist between the API version and the ISO version of this standard; for example:

- The Special Notes and Foreword are not part of ISO 10432.
- Appendix D is not part of ISO 10432.

Language that is unique to the ISO version is shown in ***bold oblique type*** in the text or, where extensive, is identified by a note under the title of the section. Language that is unique to the API version is identified by a note under the title of the section or by a bar in the margin. The bar notations identify parts of this publication that have been changed from the previous API edition; these changes have not yet been adopted by ISO.

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Suggested revisions are invited and should be submitted to the director of the Exploration and Production Department, American Petroleum Institute, 700 North Pearl, Suite 1840, Dallas, Texas 75201.

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:

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.*

Spec. 14D, *Specification for Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service.*

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.*

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

Specification for Subsurface Safety Valve Equipment

1 Scope

1.1 This specification was formulated to provide the minimum acceptable requirements for Subsurface Safety Valve (SSSV) Equipment.

1.2 To be qualified in accordance with this specification, SSSV Equipment shall meet all the applicable requirements of this specification.

1.3 COVERAGE

This specification covers Subsurface Safety Valves, Safety Valve Locks, Safety Valve Landing Nipples, and all components that establish tolerances and/or clearances which may affect performance or interchangeability of the SSSV Equipment. Safety Valve Locks, Safety Valve Landing Nipples and SSSVs manufactured by different facilities or Manufacturers may be supplied as separate items.

1.4 CLASS OF SERVICE

SSSV Equipment manufactured in accordance with this specification shall conform to one or more of the following classes of service:

Class 1. Standard Service. This class of SSSV Equipment is intended for use in wells which do not exhibit the detrimental effects caused by sand or corrosive agents.

Class 2. Sandy Service. This class of SSSV Equipment is intended for use in wells where a substance such as sand could be expected to cause SSSV Equipment failure. Class 2 SSSV Equipment must also meet the requirements for Class 1 service.

Class 3. Stress Corrosion Cracking Service. This class of SSSV Equipment is intended for use in wells where corrosive agents could be expected to cause stress corrosion cracking. Class 3 equipment must meet the requirements for Class 1 or Class 2 and be manufactured from materials which are resistant to stress corrosion cracking. Within this service class there are two divisions, 3S for sulfide stress cracking service and 3C for chloride stress cracking service. Metallic materials, suitable for a 3S environment, shall be in accordance with NACE MR0175.

Class 4. Weight Loss Corrosion Service. This class of SSSV Equipment is intended for use in wells where corrosive agents could be expected to cause weight loss corrosion. Class 4 equipment must meet the requirements for Class 1 or Class 2 and be manufactured from materials which are resistant to weight loss corrosion.

1.5 APPENDICES

Appendices are for information only.

2 Referenced Standards

This specification includes by reference, either in total or in part, other API, industry and government standards listed in Table 1. Where cited these requirements are mandatory. Referenced standards used by the Manufacturer may be either the applicable revision shown in Table 1 or the latest revision.

3 Definitions

The following abbreviations and definitions are used in this specification:

3.1 AISI: American Iron & Steel Institute

3.2 ANSI: American National Standards Institute

3.3 API: American Petroleum Institute

3.4 AQL: Acceptance Quality Level

3.5 ASME: American Society of Mechanical Engineers

3.6 ASTM: American Society for Testing and Materials

3.7 BEAN: The orifice or designed restriction causing the pressure drop in velocity type SSCSVs.

3.8 BS: British Standards

3.9 CHLORIDE STRESS CORROSION CRACKING: Cracking under the combined action of tensile stress and corrosion in the presence of chlorides and water.

3.10 END CONNECTION: SSSV Equipment/Tubular connecting interface.

3.11 FAILURE: Any condition of SSSV Equipment that prevents it from performing the design function.

3.12 FUNCTIONAL TEST: Testing performed to confirm proper operation of SSSV Equipment.

3.13 MANUFACTURER: The principal agent in the design, fabrication and furnishing of SSSV Equipment who chooses to comply with this specification.

3.14 MIL-STD: Military Standard

3.15 MODEL: SSSV Equipment with unique internal part(s) and operating characteristics which differentiate it from other SSSV Equipment of the same type. It may have any of a variety of end connections.

3.16 NACE: National Association of Corrosion Engineers

Table 1—Referenced Standards

		Applicable Revision At Publication*
1.	ASME SPPE-2	'91
2.	API RP 13B1	'90
3.	API RP 14B, 3rd ed **[ISO 10417]**	1/1/90
4.	API SPEC 5CT, 3rd ed **[ISO 11960, at present under study]**	12/1/90
5.	API Std 5B, 13th (6/1/90 Supplement) **[ISO 10422]**	5/31/88
6.	ASME, B & PV, Sect. V (12/31/89 and 12/31/90 Supplements)	'89
7.	ASME, B & PV, Sect. VIII (12/31/89 and 12/31/90 Supplements)	'89
8.	ASME, B & PV, Sect. IX (12/31/89 and 12/31/90 Supplements)	'89
9.	ASTM A 370-90	'90
10.	ASTM A 388/A 388M-86	'86
11.	ASTM A 609/A 609M-86a	'86
12.	ASTM D 395-89	'89
13.	ASTM D 412-87	'87
14.	ASTM D 1414-78	Reapproved '87
15.	ASTM D 1415-88	'88
16.	ASTM D 2240-86	'86
17.	ASTM E 94	'84
18.	ASTM E 165-80	Reapproved '83
19.	ASTM E 186-84	Reapproved '89
20.	ASTM E 280-84	Reapproved '89
21.	ASTM E 428-71	Reapproved '85
22.	ASTM E 446-84	Reapproved '89
23.	ASTM E 709-80	Reapproved '85
24.	MIL-H-6875H	3/1/89
25.	MIL-STD-105E	'86
26.	MIL-STD-413C	'87
27.	MIL-STD-45662	'88
28.	NACE MR0175-92	'92
29.	SAE-AS-568A	'84
30.	SNT-TC-1A	'88
31.	API Manual of Petroleum Measurement Standards, Chapter 10.4	May '88
32.	MIL-HANDBOOK 5E CHANGE NOTICE 2 5/1/89	'87
33.	BS-M54:1982	'82
34.	API Manual Of Petroleum Measurement Standards, Chapter 15	Reapproved Aug. '87
35.	ISO/IEC Guide 25-1982	'82
36.	API SPEC Q1, 4TH ED.	'92
37.	API BUL S1, 17TH ED.	'92
38.	API Composite List Of Manufacturers Licensed For Use Of The API Monogram, 7TH ED.	'92

*Latest revision may be used.

3.17 NDE: Nondestructive Examination

3.18 OPERATING MANUAL: The publication issued by the Manufacturer which contains detailed data and instructions related to the design, installation, operation and maintenance of SSSV Equipment.

3.19 OPERATOR: The user of SSSV Equipment.

3.20 SAE-AS: Society of Automotive Engineers, Inc. - Aerospace Standard

3.21 SCSSV: A Surface Controlled Subsurface Safety Valve is an SSSV controlled from the surface.

3.22 SNT: Society for Nondestructive Testing

3.23 SSCSV: A Subsurface Controlled Subsurface Safety Valve is an SSSV actuated by the characteristics of the well.

3.34 SSSV: A Subsurface Safety Valve is a device whose design function is to prevent uncontrolled well flow when closed. These devices may be installed and retrieved by wireline or pump down methods (Wireline Retrievable) or be an integral part of the tubing string (Tubing Retrievable).

3.25 SSSV EQUIPMENT: The Subsurface Safety Valve, Safety Valve Lock, Safety Valve Landing Nipple, and all components that establish tolerances and/or clearances which may affect performance or interchangeability of the SSSV Equipment.

3.26 STRESS CORROSION CRACKING: Cracking which results from a combination of corrosion and stress when susceptible materials are exposed to specific corrosive media.

3.27 SULFIDE STRESS CRACKING: Cracking under the combined action of tensile stress and corrosion in the presence of water and hydrogen sulfide.

3.28 SV LOCK: A Safety Valve Lock is a device attached to or a part of the SSSV that holds the SSSV in place.

3.29 SVLN: A Safety Valve Landing Nipple is a receptacle with internal sealing surfaces in which an SSSV may be installed. It may include recesses for locking devices to hold the SSSV in place and may be ported for communication to an outside source for SSSV operation.

3.30 TEST AGENCY: Any independent third party which provides a test facility and administers a testing program that meets the Verification Test requirements of this specification.

3.31 TYPE: SSSV Equipment with unique characteristics which differen-tiate it from other SSSV Equipment. The SCSSV, the Velocity Type SSCSV and the Low Tubing Pressure Type SSCSV are examples of SSSV types.

3.32 VERIFICATION TEST: Testing performed to qualify a particular size, type and model of SSSV Equipment for a specific Class of Service.

3.33 WEIGHT LOSS CORROSION: Loss of metal in areas exposed to fluids which contain water or brine and carbon dioxide (CO_2), or hydrogen sulfide (H_2S), oxygen (O_2) or other corrosive agents.

4 Requirements

4.1 DESIGN REQUIREMENTS

4.1.1 Drawings, manufacturing specifications and the Verification Test results shall be retained by the Manufacturer for a period of ten years after SSSV's of that size, model and type are discontinued from the Manufacturer's product line. SSSV Equipment conforming to this specification shall be manufactured to drawings and specifications that are substantially the same as those of the SSSV Equipment that has passed the Verification Test.

4.1.2 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, API and other pertinent requirements upon which the design is based. Design documentation shall be clear, legible, reproducible, and retrievable.

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

4.1.4 Changes to the SSSV Equipment which may affect performance or interchangeability shall require requalification, except seals that have passed the applicable Verification Testing requirements of Section 7 are considered interchangeable among the SSSV Equipment of any one Manufacturer for a particular class of service.

4.2 FUNCTIONAL CONSIDERATIONS

SSSV design shall permit prediction and repeatability of rates, pressures, or other conditions required for closure.

4.3 DESIGN CONSIDERATIONS

4.3.1 Measurement Units shall be English units and SI units. Appendix A contains the formulas used for English to SI conversion in this document.

4.3.2 The Manufacturer shall establish rated working pressures of SSSV Equipment within the requirements of this specification. These rated working pressures are commonly: 3,000, 5,000, 6,000, 10,000 and 15,000 psi. (207, 345, 414, 690 and 1035 Bar). Temperature effects on all the materials used in the manufacture of SSSV Equipment shall be considered in establishing the rated working pressure. The design shall take into account the effects of pressure containment and pressure induced loads. Specialized conditions shall also be considered such as pressure testing with temporary test plugs.

4.3.3 The Manufacturer shall establish internal yield pressure, collapse pressure and minimum tensile strength ratings, excluding end connections.

4.3.4 SSSV Equipment design shall take into consideration the effects of temperature gradients and thermal cycles on all components. The upper temperature limit shall be the lowest high temperature rating of any component of the SSSV. The lower temperature limit shall be the highest low temperature rating of any component of the SSSV. Derating of metal physical properties shall be in accordance with ASME Boiler and Pressure Vessel Code Section VIII or Military Handbook 5E.

4.3.5 SSSV Equipment design shall take into account the effects of retained fluid(s) on all components. SSSV Equipment design shall consider the effects of sand, chlorides, corrosion inhibitors, and other chemicals routinely encountered with oil and gas production.

Table 2—Standard Safety Valve Landing Nipples

Nominal Nipple Size[1] Inches(mm)	Tubing or Casing Size[2] Inches(mm)	Sealing Surface ID Inches(mm)	Tolerance[3] Inches(mm)
1 1/4 (31.8)	1.66 (42.2)	1.250 (31.75)	+.010 (+0.25) -.000 (-0.00)
1 1/2 (38.1)	1.90 (48.3)	1.500 (38.10)	+.010 (+0.25) -.000 (-0.00)
1 3/4 (44.5)	2.063(52.4)	1.625 (41.28)	+.010 (+0.25) -.000 (-0.00)
2 (50.8)	2 3/8 (60.3)	1.875 (47.63)	+.010 (+0.25) -.000 (-0.00)
2 1/2 (63.5)	2 7/8 (73.0)	2.312 (58.72)	+.010 (+0.25) -.000 (-0.00)
3 (76.2)	3 1/2 (88.9)	2.812 (71.42)	+.010 (+0.25) -.000 (-0.00)
3 1/2 (88.9)	4 (101.6)	3.313 (84.15)	+.010 (+0.25) -.000 (-0.00)
4 (101.6)	4 1/2 (114.3)	3.812 (96.82)	+.010 (+0.25) -.000 (-0.00)
4 1/2 (114.3)	5 (127.0)	4.125 (104.78)	+.010 (+0.25) -.000 (-0.00)
5 (127.0)	5 1/2 (139.7)	4.562 (115.87)	+.010 (+0.25) -.000 (-0.00)
6 (152.4)	7 (177.8)	5.963 (151.46)	+.010 (+0.25) -.000 (-0.00)

[1]Only sealing surface ID is specified in this table, and only standard size landing nipple dimensions are shown.
[2]API Spec 5CT tubing or casing outside diameters on which the nipples are to be run.
[3]O-ring applications require reduced tolerance to +.005/-.000(+0.13/-0.00 mm).

4.3.6 Component and subassembly interchangeability shall be required, within each Manufacturer's service class, size, type, and model including pressure rating of SSSV Equipment. This shall extend to all facilities of the Manufacturer. Components shall be designed or identified to avoid improper interchangeability.

4.3.7 Additive dimensional tolerance shall be such that proper operation of the SSSV Equipment is assured. This requirement applies to factory assembled equipment and to replacement components.

4.3.8 Internal diameters and tolerances for standard size SVLN's are listed in Table 2. External diameters and tolerances for standard size Wireline Retrievable SSSV's are listed in Table 3. The Manufacturer may establish other dimensions and tolerances.

4.4 VERIFICATION TEST

SSSVs, SV Locks, SVLNs and seals shall pass the applicable Verification Test specified in Section 7.

Table 3—Standard Outside Diameters Wireline Retrievable Subsurface Safety Valves

Nominal SSSV Size Inches	(mm)	Standard Valve OD[1] Inches	(mm)
1 1/4	(31.8)	1.240	(31.50)
1 1/2	(38.1)	1.490	(37.85)
1 3/4	(44.5)	1.615	(41.02)
2	(50.8)	1.865	(47.37)
2 1/2	(63.5)	2.302	(58.47)
3	(76.2)	2.802	(71.17)
3 1/2	(88.9)	3.303	(76.96)
4	(101.6)	3.802	(96.57)
4 1/2	(114.3)	4.115	(104.52)
5	(127.0)	4.552	(115.62)
6	(152.4)	5.953	(151.21)

[1]OD tolerances shall be +.000/-.100(+0.00/-2.54 mm).

5 Materials

5.1 GENERAL

The manufacturer shall have written specifications for all material used in SSSV Equipment. The manufacturer shall select all material to be suitable for Class of Service designation and shall document the selection criteria. All materials shall comply with the Manufacturer's written specifications.

Material substitutions, except seals, in qualified SSSV Equipment are allowed without Verification Testing provided that the Manufacturer's selection criteria are documented and meet all other requirements of this specification.

Seals that have passed the applicable Verification Test requirements of Section 7 are considered interchangeable among the SSSV Equipment of any one Manufacturer for a particular Class of Service.

5.2 METALS

5.2.1 The Manufacturer specifications shall define:

a. Chemical composition limits
b. Heat treatment conditions
c. Mechanical property limits:
   1. Tensile strength
   2. Yield strength
   3. Elongation
   4. Hardness

5.2.2 The mechanical properties shall be verified by tests conducted on material samples from a heat treat or other appropriate heat treat batch lot basis for traceable metal components of SSSV Equipment. Material test reports provided by the material supplier or Manufacturer are acceptable.

5.2.3 Each traceable component subjected to processing that may change the properties subsequent to the lot test

described in Section 5.2.2 shall be hardness tested after processing.

5.2.4 Each welded component shall be stress relieved per the Manufacturer's written specifications and, where applicable, in accordance with Paragraphs UCS-56 and UHA-32, Section VIII, Division 1, Subsection C, ASME Boiler and Pressure Vessel Code. In addition, carbon and low alloy steel weldments on Class 3 SSSV Equipment shall be stress relieved in accordance with NACE MR0175.

5.3 NON-METALS

5.3.1 The Manufacturer shall have written procedures and documentation of testing for sealing materials to the limits for which SSSV Equipment is rated.

5.3.2 The Manufacturer's written specifications for elastomeric compounds shall define:

a. Compound type
b. Physical properties as a minimum;
   - Tensile strength
   - Elongation
   - Modulus
c. Compression set
d. Durometer

5.3.3 Manufacturer's written specifications shall include handling, storage, and labeling requirements including cure date, batch number, compound identification and shelf life appropriate for each compound.

5.4 TRACEABILITY

5.4.1 All components, weldments, subassemblies and assemblies of SSSV Equipment shall be traceable except:

a. Springs for SSCSV
b. Beans for SSCSV
c. Common hardware items such as nuts, bolts, set screws, shear pins, spacers, tube fittings, tubing and shear screws.

5.4.2 Component traceability is considered sufficient when it can be traced to a job lot, which identifies the included heat or batch lot(s) and a material test report. All components in a multiheat job lot are rejectable if any heat lot does not comply with the Manufacturer's written specification.

5.4.3 Traceability for SSSV Equipment, except SSSV's, is considered sufficient if it meets the requirements of this specification when it leaves the original Manufacturer's inventory.

5.4.4 Traceability identification shall be sufficient to identify significant problems and permit proper corrective action and shall include assembly, subassembly and component traceability to a heat or other appropriate batch lot.

6 Quality Control Requirements

6.1 This section provides minimum quality control requirements to meet this specification. All quality control work shall be controlled by documented instruction which includes acceptance criteria.

6.2 DOCUMENTATION RETENTION

Required documentation for Quality Control work shall be retained for a minimum of five years from the date of origination.

6.3 PERSONNEL QUALIFICATIONS

6.3.1 Personnel performing NDE shall be qualified in accordance with ASNT: Recommended Practice SNT TC-1A, Level II minimum for evaluation and interpretation.

6.3.2 Personnel performing visual examinations shall have an annual eye examination in accordance with ASNT: Recommended Practice SNT-TC-1A, as applicable to the discipline to be performed.

6.3.3 All other personnel performing inspection for acceptance shall be qualified in accordance with documented requirements.

6.4 CALIBRATION SYSTEMS

6.4.1 Measuring and testing equipment used for acceptance shall be identified, controlled, calibrated and adjusted at specified intervals in accordance with written specifications, MIL-STD 45662 and this specification.

6.4.2 Pressure Measuring Devices shall:

a. Be readable to at least +/- 0.5% of full scale range.
b. Be calibrated to maintain +/- 2% accuracy of full scale range.

6.4.3 If a pressure gage is utilized, pressure measurements shall be made at not less than 25% nor more than 75% of the full span of the pressure gage.

6.4.4 Pressure measuring devices shall be periodically calibrated with a master pressure measuring device or a dead weight tester at 25%, 50% and 75% of full scale.

6.4.5 Calibration intervals for pressure measuring devices shall be a maximum of three months until documented calibration history can be established. Calibration intervals shall then be established based on repeatability, degree of usage and documented calibration history.

6.5 ELASTOMERIC MATERIALS INSPECTION

6.5.1 Sampling procedures, and the basis for accept-ance or rejection of a batch lot, shall be in accordance with MIL STD 105E, General Inspection Level II at a 2.5 AQL for O-

Rings and a 1.5 AQL for other packing elements until a documented variation history can be established. Sampling procedures shall then be established based on the documented variation history.

6.5.2 Visual Inspection of O-Rings shall be in accordance with MIL STD 413C. Other packing elements shall be visually inspected in accord-ance with the Manufacturer's documented specifications.

6.5.3 Dimensional tolerances of O-Rings shall be in accordance with SAE -AS-568A or equivalent. Other packing elements shall meet dimensional tolerances of the Manufacturer's written specifications.

6.5.4 The durometer hardness of O-Rings or other elastomeric packing elements shall be determined in accordance with ASTM D-2240 or D-1415. A test specimen manufactured from each batch may be used.

6.6 DIMENSIONAL INSPECTION

All Traceable Components, except elastomeric seals must be dimensionally inspected to assure proper function and compliance with design specifications and drawings.

6.7 THREAD INSPECTION

6.7.1 All API tapered thread tolerances, inspection requirements, gaging, gaging practice, gage calibration and gage certification shall be in accordance with API STD 5B.

6.7.2 All other thread tolerances, inspection requirements, gage, gage practice, gage calibration and gage certification shall conform to written specifications.

6.8 WELDING AND BRAZING

6.8.1 Welding and Brazing Procedure and Personnel Qualification shall be in accordance with ASME Boiler and Pressure Vessel Code Section IX.

6.8.2 Material and practices not listed in the ASME Boiler and Pressure Vessel Code Section IX shall be welded using weld procedures qualified in accordance with the methods of ASME Boiler and Pressure Vessel Code Section IX.

6.9 HEAT TREATING EQUIPMENT QUALIFICATION

6.9.1 Furnace Calibration

a. Heat Treating of production parts shall be performed with heat treating equipment that has been calibrated and surveyed.
b. Each furnace shall be surveyed within one year prior to heat treating operations. When a furnace is repaired or rebuilt, a new survey shall be required before heat treating.
c. Batch type and continuous type heat treating furnaces shall be calibrated in accordance with one of the following procedures:

1. Procedures specified in MIL-H-6875H, Process for Heat Treatment of Steel, Section 5.
2. Procedures specified in British Standard M54:1982, Specification for Temperature Control in the Heat Treatment of Metals, Section 7.
3. Manufacturer's written specifications including acceptance criteria which are not less stringent than the procedures identified above.

6.9.2 Instruments

a. Automatic controlling and recording instruments shall be used.
b. Thermocouples shall be located in the furnace working zone(s) and protected from furnace atmospheres.
c. The controlling and recording instruments used for the heat treatment processes shall possess an accuracy of +\- 1% of their full scale range.
d. Temperature controlling and recording instruments shall be calibrated at least once every three (3) months until a documented calibration history can be established. Calibration intervals shall then be established based on repeatability, degree of usage and documented calibration history.
e. Equipment used to calibrate the production equipment shall possess an accuracy of +/- 0.25% of full scale range.

6.10 COATINGS AND OVERLAYS

Coatings and Overlays shall be controlled by documented instructions which include acceptance criteria.

6.11 MECHANICAL AND PHYSICAL PROPERTIES (Where required by this Specification)

6.11.1 Mechanical property and hardness test procedures and practices shall be in accordance with ASTM A370 for the metallic materials used for traceable components.

6.11.2 Physical Property and Hardness test procedures for Elastomeric compound types shall be in accordance with:

a. Tensile, Elongation, Modulus.
   1. O-Rings—ASTM D1414
   2. All others—ASTM D412
b. Compression Set
   1. O-Rings—ASTM D1414
   2. All others—ASTM D395
c. Durometer Hardness
   1. O-Rings—ASTM D1415
   2. All others—ASTM D2240

6.12 NDE REQUIREMENTS

6.12.1 All NDE instructions shall be approved by a Level III Examiner.

6.12.2 All Power Springs shall be Magnetic Particle or Liquid Penetrant inspected to verify conformance with the Manufacturers' written specifications.

6.12.3 All weldments shall be Magnetic Particle, Liquid Penetrant, Radiographic or Ultrasonic Inspected, to verify conformance with the Manufacturers' written specifications.

6.12.4 Castings and Forgings shall be Magnetic Particle, Liquid Penetrant, Radiographic or Ultrasonic Inspected to verify conformance with the Manufacturers' documented specifications. The Manufacturer may develop AQL Inspection Levels based on documented variation history.

6.12.5 NDE Methods and Acceptance Criteria.

a. Liquid penetrant
   1. Method—ASTM E165
   2. Acceptance Criteria—ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels, Division 1, Appendix 8.
b. Wet magnetic particle examination
   1. Method—ASTM E709
   2. Definitions:
      a. Relevant Indication—Only those indications with major dimensions greater than $^1/_{16}$ in.(1.6 mm) shall be considered relevant. Inherent indications not associated with a surface rupture (i.e., magnetic permeability variations, non-metallic stringers...) are considered non-relevant.
      b. Linear Indication—Any indication in which the length is equal to or greater than three times its width.
      c. Rounded Indication—Any indication which is circular or elliptical with its length less than 3 times the width.
   3. Acceptance Criteria—
      a. Any relevant indication $^3/_{16}$ in. (4.8 mm) or greater is unacceptable. No relevant linear indications are allowed for weldment.
      b. No more than 10 relevant indications in any 6 sq. in. (3,870 mm^2) area.
      c. Four (4) or more rounded relevant indications in a line separated by less than $^1/_{16}$ in. (1.6 mm) are unacceptable.
c. Ultrasonic Inspection—Weldments
   1. Method—ASME Boiler and Pressure Vessel Code, Section V, Nondestructive Examination, Article 5.
   2. Acceptance Criteria—ASME Boiler and Pressure Code, Section VIII, Pressure Vessel, Division 1, Appendix 12.
d. Ultrasonic Inspection—Castings
   1. Method—ASTM E428: Standard Recommended Practice for Fabrication and Control of Steel Reference Blocks used in Ultrasonic Inspection.
   ASTM A609: Standard Specification for Longitudinal-Beam Ultrasonic Inspection of Carbon and Low-Alloy Steel Castings.
   2. Acceptance Criteria—ASTM A609: Standard Specification for Longitudinal-Beam Ultrasonic Inspection of Carbon and Low-Alloy Steel Castings. Ultrasonic Testing Quality Level 1, minimum.
e. Ultrasonic Inspection—Forgings and Wrought Products
   1. Method—ASTM E428: Standard Recommended Practice for Fabrication and Control of Steel Reference Blocks used in Ultrasonic Inspection.
   ASTM A388: Standard Recommended Practice for Ultrasonic Examination of Heavy Steel Forgings.
   2. Calibration:
      (a.) Back reflection technique—The instrument shall be set so that the first back reflection is 75% +/- 5% of screen height when the transducer is placed on an indication-free area of the forging or wrought product.
      (b.) Flat Bottom Hole Technique—Distance Amplitude Curve (DAC) based on $^1/_8$ in. (3.2 mm) flat bottom hole through 4 in. (101.6 mm) of metal and $^1/_4$ in. (6.4 mm) flat bottom hole for metal distances exceeding 4 in. (101.6 mm).
      (c.) Angle Beam Technique—Distance Amplitude Curve (DAC) shall be based on a notch of a depth equal to the lesser of $^3/_8$ in. (9.5 mm) or 3% of the normal section thickness $^3/_8$ in. maximum (9.5 mm), a length of approximately 1 in. (25.4 mm) and a width not greater than twice its depth.
   3. Acceptance Criteria—The following forging or wrought product defects are rejectable.
      (a.) Back Reflection Technique—Indications greater than 50% of the referenced back reflection accompanied by a complete loss of back reflection.
      (b.) Flat Bottom Hole Technique—Indications equal to or larger than the indications observed from the calibration Flat Bottom Hole.
      (c.) Angle Beam Technique—Amplitude of the discontinuities exceeding those of the reference notch.
f. Radiographic Inspection—Weldments
   1. Method—ASTM E94: Standard Recommended Practice for Radiographic Testing.
   2. Acceptance Criteria—ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Pressure Vessel, UW-51.
g. Radiographic Inspection—Castings
   1. Method—ASTM E94: Standard Recommended Practice for Radiographic Testing.
   2. Acceptance Criteria—

(a.) ASTM E186: Standard Reference Radiographs for Heavy-Walled (2-4 1/2 in.) (51 mm to 114 mm) Steel Casting.
(b.) ASTM E280: Standard Reference Radiographs for Heavy-Walled (4 1/2 to 12 in.) (114 mm to 305 mm) Steel Castings.
(c.) ASTM E446: Standard Reference Radiographs for Steel Casting up to 2 in. (51 mm) thickness. Maximum defect classification as follows:

TYPE DEFECT	MAXIMUM DEFECT CLASS
A	3
B	2
C	2 (All Types)
D	None Acceptable
E	None Acceptable
F	None Acceptable
G	None Acceptable

h. Radiographic Inspection—Forgings
1. Method—ASTM E94: Standard Recommended Practice for Radiographic Testing.
2. Acceptance Criteria—The following defects are rejectable.
(a.) Any type of crack or lap
(b.) Any other elongated indication with length greater than:
1/4 inch (6.4 mm) for t up to 3/4 inch (19 mm) inclusive.
1/3 t from 3/4 inch (19 mm) up to 2 1/4 inch (57.2 mm).
3/4 inch (19 mm) for t over 2 1/4 inch (57.2 mm).
Where 't' is the pressure vessel wall thickness.
(c.) Any group of indications in a line that have an aggregate length greater than 't' in a length of 12t.

7 Testing

7.1 GENERAL

The SSSVs, SV Locks and SVLNs produced in accordance with this specification shall be constructed of materials in compliance with this specification and pass the Verification and Functional Tests required by this section.

7.1.1 The API testing requirements are not represented as well conditions.

7.1.2 During Verification Testing of hydraulically operated SSSV's, control line fluid metering shall be used to provide a readable hydraulic control line pressure trace, unless otherwise specified. Refer to Figure 5.6 for a characteristic pressure versus time plot for opening and closing hydraulic control pressures with hydraulic fluid being applied at a metered rate.

7.1.3 All pressures are defined as gage unless otherwise specified.

7.1.4 All test conditions without a specified tolerance shall be considered minimum values. The maximum values shall not exceed 10% above the minimum value.

7.1.5 The drift bar used in the Verification Test shall be provided by the Manufacturer. Drift bar dimensions and a unique identifier for the bar shall be provided by the Manufacturer.

7.1.6 With mutual consent between the Test Agency and the Manufacturer, higher flow rates may be applied and used for all flow tests.

7.1.7 The objectives of the testing requirements of this section are to qualify SSSV Equipment for specific classes of service and to verify proper operation of SSSV Equipment. Testing required for SSSV Equipment furnished to this specification is:

a. Verification Testing to qualify each size, type and model of SSSV for a specific class of service, either Class 1 or combined Class 1 and Class 2.
b. Functional Testing for each SSSV.
c. Functional and Verification Testing for SVLN(s).
d. Functional and Verification Testing for SV Lock(s).

7.2 VERIFICATION TESTING

7.2.1 General

a. Verification Testing to qualify an SSSV for Class 1 or combined Class 1 and Class 2 service must be performed by a Test Agency.
b. Verification Testing for SV Locks, SVLNs and all seals shall be performed by the Manufacturer or a Test Agency.

7.2.2 Manufacturer Requirements

The Manufacturer shall submit a SSSV of most recent manufacture for Verification Testing. Such testing shall qualify SSSVs of the same size, type and model as the tested SSSV which are manufactured during the three year period subsequent to the date the Verification Test form is approved by the Test Agency.

a. The test section shall completely enclose the wireline retrievable SSSV. Tubing retrievable SSSV's shall be an integral part of the test section. The test section shall be rated to at least the rated working pressure of the SSSV.
b. The test section ends, length, and hydraulic control connections shall be compatible with the Test Agency's facility.
c. The Manufacturer shall furnish any equipment not normally furnished by the Test Agency to accommodate installation of a particular SSSV in the test facility or to accomplish the Verification Test.

7.2.3 Verification Testing Requirements

a. The Manufacturer must declare that a SSSV is being submitted for the class of service and working pressure desired in the Verification Test by submitting an application to the Test Agency. The application form shall contain the minimum information shown in Table 4.

1. A Manufacturer may submit a SSSV for Class 1 or Class 1 and 2 testing. For combined testing, a SSSV passing both portions of the test will be qualified for both Class 1 and Class 2 service. A SSSV passing the Class 1 portion, but failing the Class 2 portion of the combined test, will be qualified for Class 1 service only.
2. In the event that a particular SSSV has design or operational features which are incompatible with the test facility and test procedures required by this specification, the Manufacturer shall advise the Test Agency as to the nature of the incompatibility and shall request and fully describe on the test application, or attachments thereto, any equipment or procedures required to test the SSSV. Responsibility for furnishing, installing and testing this equipment shall be by agreement between the Test Agency and the Manufacturer. The Manufacturer shall be responsible for assuring that such equipment or procedures are not less stringent than this specification.
3. The Test Agency shall conduct the test as specified on the Manufacturer's test application. Any variation from the Verification Test requirements of this specification shall be recorded on the Verification Test Data Summary Form (Table 19) by the Test Agency.

b. The Manufacturer shall provide the Test Agency with a functionally tested SSSV, one Operating Manual and associated documentation, for each size, type and model to be tested.

c. If a particular size, type and model, of SSSV fails the Verification Test, that SSSV and any other SSSV of the same basic design and materials of construction shall not be submitted for retest until the Manufacturer has determined and documented the justification for retest. The Manufacturer shall conduct this analysis and document the results, including any corrective action taken. Such information need not be submitted to the Test Agency, but must be placed in the Manufacturer's test file for that SSSV before the SSSV is submitted for retest.

d. The Test Agency shall record the results of the Verification Test on documentation which contain the data specified in the applicable example tables shown in this section. This documentation shall be retained by the Manufacturer, and by the Test Agency and shall be available to the Operator upon request to the Manufacturer.

e. To pass the Verification Test, the SSSV must successfully complete all steps of the Verification Testing procedure within the limits specified and in the order shown. The basis for discontinuing the test, and any unusual conditions observed at or prior to the time of discontinuance shall be noted on the test data form by the Test Agency. Verification Testing shall be discontinued if the valve fails to perform within specified limits of any step except when such failures are determined to be a result of actions by the Test Agency or a failure within the test facility. The Manufacturer, not the Test Agency, shall be responsible for determining the cause of failure of the valve.

f. Pre and post-test dimensional verification shall be conducted and documented by the Manufacturer.

g. The Manufacturer shall maintain a Verification Test File on each Verification Test including any retests that may have been required to qualify SSSV Equipment and seals. This file shall be retained by the Manufacturer for a period of ten years after such SSSV Equipment and seals are discontinued from the Manufacturer's product line. As a minimum this file shall contain sufficient documentation to identify and permit retrieval of:

1. All drawings and specifications applicable at the time of manufacture.
2. All applications for Verification Tests or Retests.
3. All design and/or material modifications, or other justification for retest of SSSV Equipment and seals which did not pass any Verification Test.
4. All test data specified in this section.
5. Documentation required in Section 8 Identification, Documentation and Shipping.

7.2.4 Test Agency Requirements

a. The Agency must meet the criteria of API Spec 14A, Appendix D or 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 in ASME SPPE-2 in order to test SSSV equipment which is intended to be marked with the API Monogram or other Registered Mark, including the ASME SPPE OCS Symbol.

b. The Test Agency shall conform with the applicable portions of Section 6—Quality Control Requirements.

c. The Test Agency shall conduct Verification Tests in accordance with this section.

d. The Test Agency shall be responsible for assuring itself, the Manufacturers and the Operators that the Test Facility, procedures and forms comply with this specification.

7.2.5 The Test Agency shall publish literature which includes as a minimum:

a. A description of the facility, including any limitation on the size, length, weight, type, pressure rating, temperature rating, and service class of SSSV that may be tested.

b. The test procedures and forms actually used at the facility for each type and service class of SSSV.

c. The procedures for maintenance and calibration of measuring equipment.

Table 4—Example Application For Verification Test

Test Agency _____ Manufacturer _____

Address _____ Representative _____

_____ Address _____

_____ Telephone _____

_____ Date _____

Official Qualification Test _____ Retest _____ 3-Year Requalification _____

Requalification Date _____

Valve to be tested

Type SCSSV_____ SSCSV_____ Model _____ Serial Number_____

Rated Working Pressure _____ Nominal Tubing Size _____

Test Section Length _____ inches

For SCSSV:

Minimum specified ID _____ inches

Maximum hydraulic control line pressure _____ psi greater than valve bore pressure

Maximum unequalized opening pressure _____ psi

For SSCSV:

Velocity:

Design Closing Rate _____ B/D _____ psi

Tubing Pressure: Design Closing Pressure _____ psi

Procedure Required:

API Spec 14A Procedure Section _____ Class 1 _____ Class 2 _____

Non-specified equipment or procedures required for testing _____

_____

_____

_____

TEST AGENCY USE ONLY

Testing Schedule_____ _____ _____
Month Day Year

Location _____

_____

_____

Applicant notified _____ _____ _____
Month Day Year

d. The basis for determining test scheduling priorities.
e. The fees for testing each type and service class of SSSV.
f. The procedures for making application for tests, delivery of SSSVs, initial installation and checkout of SSSVs and other pertinent information.
g. Any limitations on accessibility of the facility. Such limitations shall not preclude reasonable access to the facility for inspection by Manufacturers or Operators.
h. Any limitation on receipt of proprietary information.
i. Any other information considered pertinent by the Test Agency.
j. The above literature shall be kept current and shall be furnished to Manufacturers or Operators upon written request.

7.3 FUNCTIONAL TESTING

7.3.1 SSSV Functional Testing shall be performed by the Manufacturer on each new SSSV manufactured in accordance with this Specification. The Manufacturer's test facility shall be equipped with instrumentation to display and record information required by the test procedure.

7.3.2 Each SSSV shall be serialized and results of Functional Tests delivered with the SSSV.

7.3.3 Results of Functional Tests shall be retained by the Manufacturer for a period of five years after the date of sale of a specific SSSV.

7.3.4 Functional Test data shall be recorded, dated and signed by the personnel performing the tests. The required data is indicated in Table 27.

7.4 GENERAL REQUIREMENTS FOR SSSV VERIFICATION TEST FACILITY

7.4.1 The components of the Test Facility systems shall have a capacity and working pressure as required by the size and/or working pressure of the SSSV to be verification tested. Typical Test Facility Schematics, the SSSV Gas Flow Facility, Liquid Test Facility, and Controlled Temperature Test Facility are shown in Figures 1, 2, and 4, respectively.

7.4.2 The control pressure system components shall, as a minimum, consist of the items listed below:

a. A hydraulic fluid reservoir with a filtered vent.
b. An accumulator.
c. A hydraulic pump.
d. A control system to operate the pump.
e. A method for pressure relief to protect the system.

7.4.3 Nitrogen gas to conduct the required nitrogen leak test and a gas flow meter to indicate leakage rate.

7.4.4 A gas reservoir with a gas release device and instrumentation to measure test parameters.

7.4.5 The Liquid Test facility, as a minimum, shall consist of the items listed below:

a. The test facility piping shall be at least 2" (50.8 mm) nominal diameter.
b. Fresh water tank.
c. Sand slurry tank.
d. A Marsh Funnel Viscometer in accordance with API RP 13B1 with required timer and graduated beaker.
e. A centrifuge with BS&W (Basic Sediment & Water) sample flasks in accordance with API Manual of Petroleum Measurement Chapter 10.4.
f. Circulation pumps.
g. Flow rate measurement device.
h. Pressure measurement systems.
i. A time based recorder to simultaneously record the required pressure and flow data.
j. Back pressure regulator.
k. Propane system as shown in Figure 5.
l. A high pressure water pump and accumulator system.

7.5 SCSSV VERIFICATION TEST PROCEDURE

7.5.1 Verify that the model and serial numbers appearing on the test valve are in agreement with the Manufacturer's application before leaving the Test Agency.

7.5.2 Perform the SCSSV Gas Flow Test (Section 7.6).

7.5.3 Perform the Drift Test (Section 7.7).

7.5.4 Open the test valve. Record the full-open hydraulic control pressure on Table 5.

7.5.5 Fill the test valve with water and circulate water to displace gas out of the test section. Once gas has been displaced from the test section, discontinue water circulation.

7.5.6 Close the test valve. Record the full-closed hydraulic control pressure on Table 5.

7.5.7 Perform the Liquid Leakage Test (Section 7.8).

7.5.8 Perform the Unequalized Opening Test (Section 7.9).

7.5.9 Perform the Operating Pressure Test (Section 7.10).

7.5.10 Perform the Propane Test (Section 7.11).

7.5.11 Perform the Nitrogen Leakage Test (Section 7.12).

7.5.12 Perform the Operating Pressure Test (Section 7.10).

7.5.13 Perform the SCSSV Class 1 Flow Test (Section 7.13).

7.5.14 Repeat 7.5.11 through 7.5.13 four additional times.

7.5.15 Perform the Liquid Leakage Test (Section 7.8).

7.5.16 Perform the Controlled Temperature Test (Section 7.14).

7.5.17 Cycle the test valve five times. Record the full-open and full-closed hydraulic control line pressures on Table 17. If the test valve is being qualified for Class 1 service only, proceed to 7.5.24.

Note: The full-open pressure and full-closed pressure shall be monitored for possible refinements of this specification but will not be a cause for failure of the Verification Test.

7.5.18 Perform the Nitrogen Leakage Test (Section 7.12).

7.5.19 Perform the Operating Pressure Test (Section 7.10).

7.5.20 Perform the Class 2 Flow Test (Section 7.15).

7.5.21 Repeat 7.5.18 through 7.5.20 six additional times. The slurry may be allowed to stagnate in the test section overnight with the test valve in the open position.

7.5.22 Perform the Liquid Leakage Test (Section 7.8).

7.5.23 Perform the Drift Test (Section 7.7).

7.5.24 If the test valve has performed within the limits specified, it has passed the Verification Test requirements.

7.5.25 Summarize the Verification Test data on Table 19 and attach the completed data forms. Calibration records shall be included with the Verification Test Report. Each data form must be signed and dated by the person(s) conducting the test. Table 19 must be signed and dated by the Test Agency's designated approval authority.

7.6 SCSSV GAS FLOW TEST (Enter results on Table 5)

7.6.1 Install the test valve in the gas flow test stand.

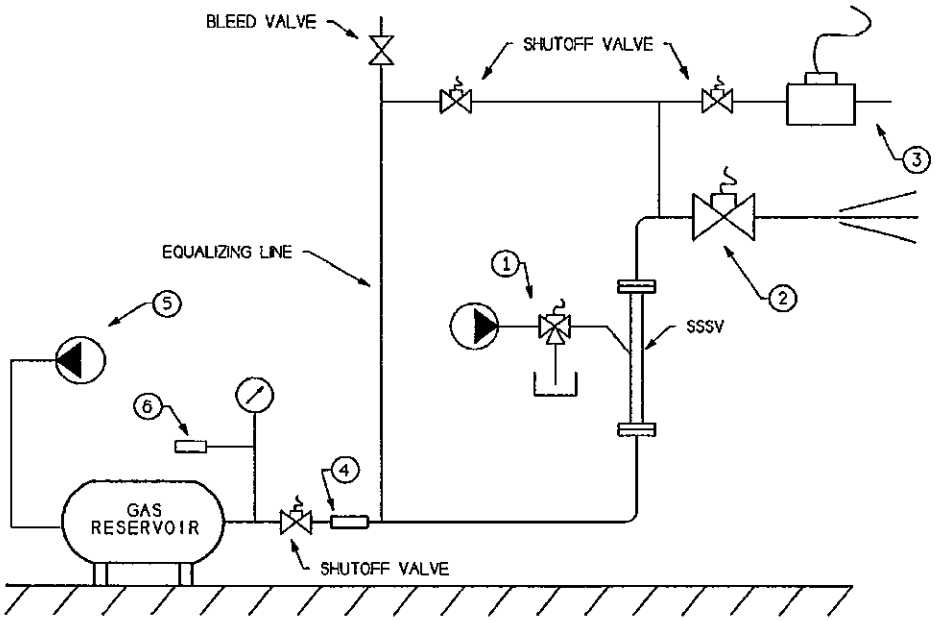
7.6.2 Set the control line resistance to the appropriate setting shown in Table 6.

7.6.3 Open and close the test valve. Record the full-open and full-closed control pressures.

7.6.4 Close the gas release valve and bleed line valve (see Figure 1). Set the flow control device to provide gas flow at a test rate in accordance with Table 6.

7.6.5 Increase gas pressure in the system to between 2,000 (138 Bar) and 2,500 psi (173 Bar).

7.6.6 Open the test valve. Record the full-open control pressure.



Equipment List

1. Hydraulic Pressure Source (For SCSSV Only)
2. Flow Control Valve
3. Leakage Flowmeter
4. Flow Measurement Device
5. Gas • Supply
6. Pressure Measurement Device

• Nitrogen or other suitable gas

Figure 1—Example Schematic of Gas Flow Facility

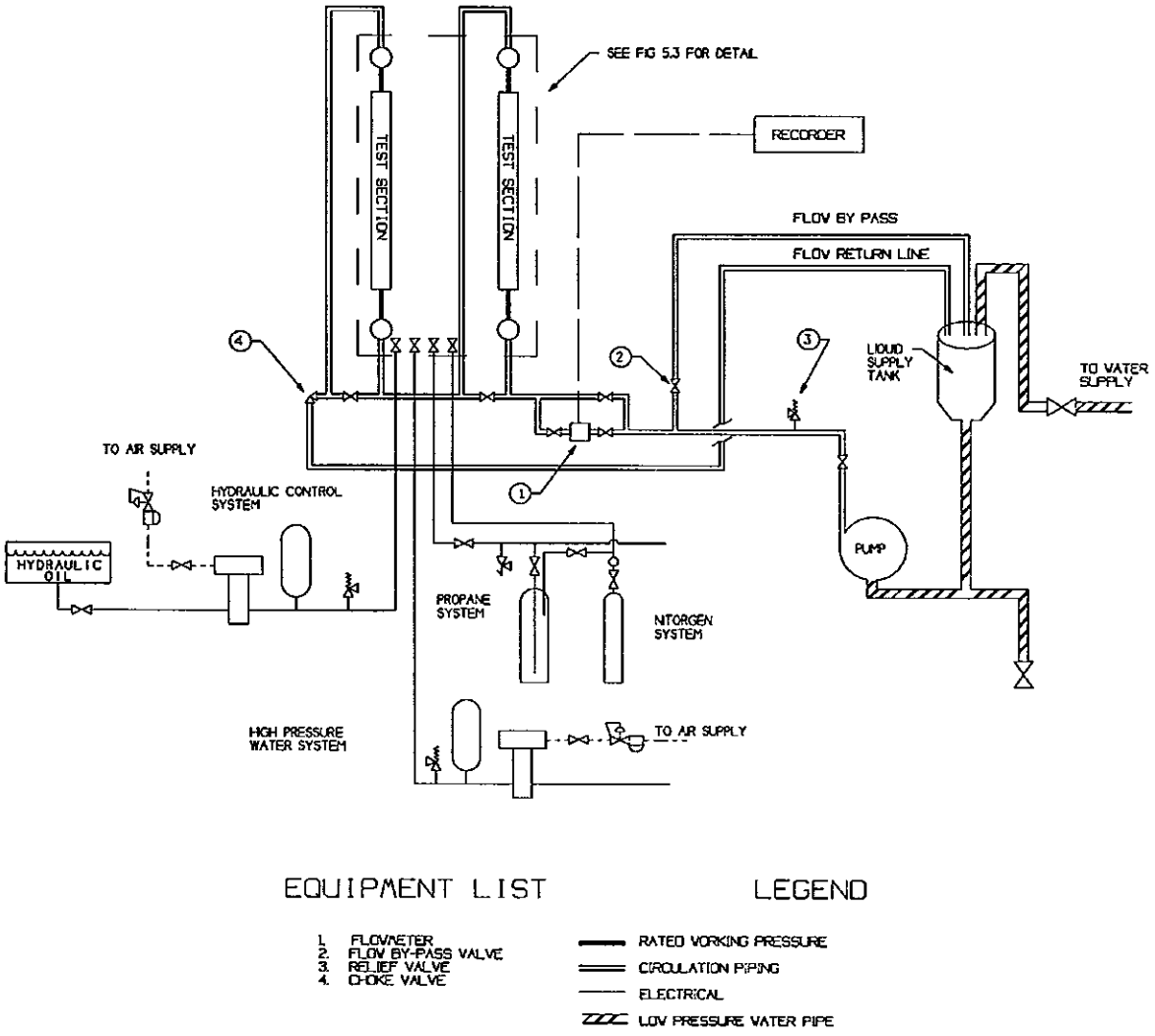


Figure 2—Example Schematic of Liquid Test Facility
(Number of Test Sections is Optional)

Table 5—SCSSV Gas Flow Test
(Reference Section 7.6)

Test Report No._____

Test Start Date/Time: _____ Test Stop Date/Time: _____

Measurement	Test No. 1	Test No. 2	Test No. 3	Test No. 4
Hydraulic Opening Pressure at Zero Bore Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Hydraulic Closing Pressure at Zero Bore Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Hydraulic Opening Pressure at 2,000-2,500 PSI Bore Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Closure Data:				
Gas Flow Rate	_____ SCFD	_____ SCFD	_____ SCFD	_____ SCFD
Full-Closed Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time To Close	_____ S	_____ S	_____ S	_____ S
Nitrogen Leakage Data:				
Test Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Leakage Rate	_____ SCFM	_____ SCFM	_____ SCFM	_____ SCFM
Body Joint Leakage Detected (Tubing Retrievable Only)	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__
Test Passed?	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__

Conducted By:_____

Signature:_____ Date: _____

Table 6—SCSSV Gas Flow Rates[1]
(Reference Section 7.6)

Nominal Tubing or Casing Size inches (mm)	Gas Flow Rate and Control Line Resistances for Each Valve Closure Test							
	Low Resistance				High Resistance			
	Test No. 1 Flow Rate SCFD X 10^6 (M^3/d x 10^6)		Test No. 2 Flow Rate SCFD X 10^6 (M^3/d x 10^6)		Test No. 3 Flow Rate SCFD X 10^6 (M^3/d x 10^6)		Test No. 4 Flow Rate SCFD X 10^6 (M^3/d x 10^6)	
$2^3/_8$	(60.3)	5.1	(.14)	7.7	(.22)	2.6	(.07)	5.1	(.14)
$2^7/_8$	(73.0)	8.0	(.23)	12.0	(.34)	4.0	(.11)	8.0	(.23)
$3^1/_2$	(88.9)	11.5	(.33)	17.3	(.49)	5.8	(.16)	11.5	(.33)
4	(101.6)	15.7	(.44)	23.6	(.67)	7.9	(.22)	15.7	(.44)
$4^1/_2$	(114.3)	20.5	(.58)	30.8	(.87)	10.3	(.29)	20.5	(.58)
5	(127.0)	25.9	(.73)	38.9	(1.10)	13.0	(.37)	25.9	(.73)
$5^1/_2$	(139.7)	32.0	(.91)	48.0	(1.36)	16.0	(.45)	32.0	(.91)
$6^1/_2$	(165.1)	46.1	(1.30)	69.2	(1.96)	23.1	(.65)	46.1	(1.30)
7	(177.8)	63.1	(1.79)	94.7	(2.68)	31.6	(.89)	63.1	(1.79)

[1]Based on a pressure of 2000 PSI (138 Bar) and a velocity of 20 feet (6.10 m) per second in the tubing for valve closure tests 1 and 4, a velocity of 30 feet (9.15 m) per second for test 2, and a velocity of 10 feet (3.05 m) per second for test 3.

NOTES:

A: The test medium shall be air, nitrogen or any other suitable gas.

B: Test flow rates shall be maintained within -5% and +15% of the nominal value given in Table 7.3 or -0.5 $(10)^6$ and +1.5$(10)^6$ standard cubic feet of gas per day (-.01 x 10^6 and + .04 x 10^6 m^3/d), whichever is greater.

C: The low control line resistance test shall consist of a hydraulic control line having an inside diameter of at least 0.38 inches (9.6 mm) and a maximum total length of 25 feet (7.6 m). The configuration for the high control line resistance test shall consist of the control line used for the low resistance configuration plus a square-edge orifice having an inside diameter of 0.020" +/-0.002" (.5 mm +/- .05 mm) and a length of 1.0" +/-0.1" (25.4 mm +/-2.5 mm).

The manufacturer establishing sizes not covered by this specification may interpolate or extrapolate by a ratio of the square of the diameter versus the parameter involved.

Table 7—Drift Test
(Reference Section 7.7)

Test Report No.________

Internal Drift Information:

Minimum Inside Diameter of the Test Valve:_______ inches
Drift Outside Diameter:_______ inches
Drift Length:_______ inches
Drift Bar Unique Identifier:______________

	Step 7.5.3 (Class 1 Drift Test)	Step 7.5.23 (Class 2 Drift Test)
Date of Test	________	________
Full-Open Hydraulic Control Pressure	________ PSI	________ PSI
Full-Closed Hydraulic Control Pressure	________ PSI	________ PSI
Full-Open Hydraulic Control Pressure	________ PSI	________ PSI
Full-Closed Hydraulic Control Pressure	________ PSI	________ PSI
Full-Open Hydraulic Control Pressure	________ PSI	________ PSI
Full-Closed Hydraulic Control Pressure	________ PSI	________ PSI
Full-Open Hydraulic Control Pressure	________ PSI	________ PSI
Full-Closed Hydraulic Control Pressure	________ PSI	________ PSI
Full-Open Hydraulic Control Pressure	________ PSI	________ PSI
Full-Closed Hydraulic Control Pressure	________ PSI	________ PSI
Drift Pass?	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:	________	________

Table 8—Initial Opening and Closing Test
(Reference Test Steps 7.5.4 and 7.5.6)

Test Report No. _____ Test Stand # _____

Date:_____ Test Start Time:_____ Test Stop Time:_____

Open and Close at Zero Valve Bore Pressure:

Full-Open Hydraulic Control Pressure:_____ PSI
Full-Closed Hydraulic Control Pressure:_____ PSI

Conducted By:

Signature:_____ Date: _____

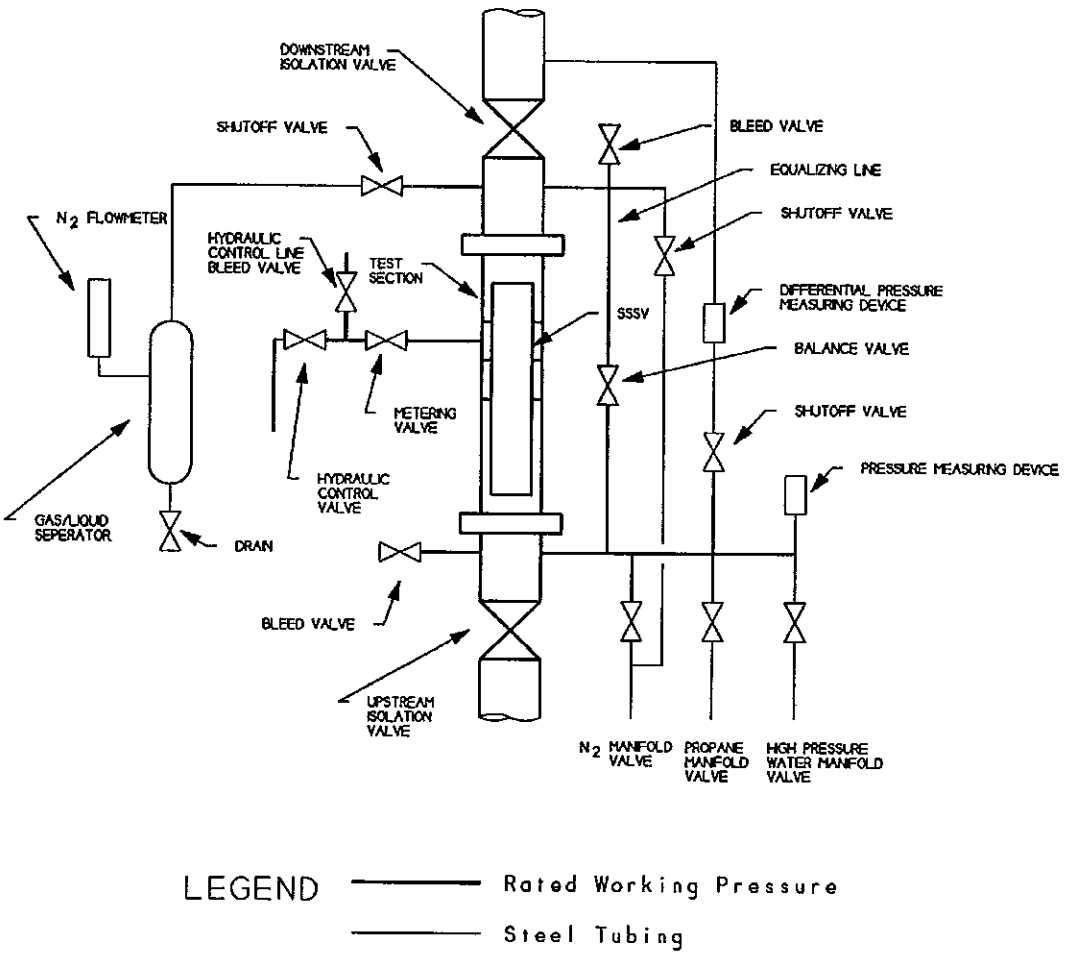
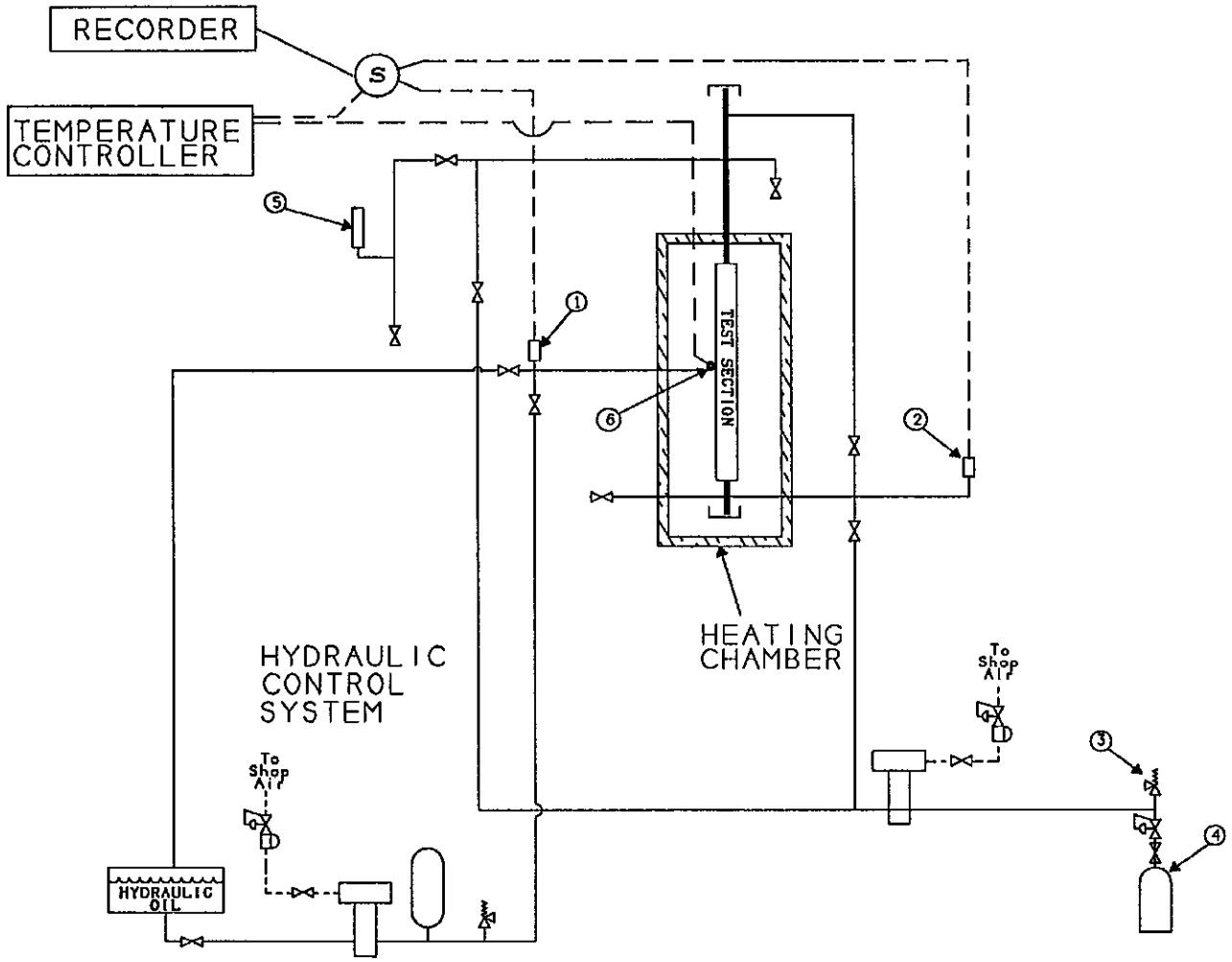


Figure 3—Example Liquid Test Section Detail



EQUIPMENT LIST

1. Hydraulic Control Line Pressure Measuring Device
2. Static Pressure Measuring Device
3. Relief Valve
4. Nitrogen Pressure System
5. Nitrogen Leakage Flow Meter
6. Thermocouple

LEGEND

- Rated Working Pressure
- Steel Tubing
- Pneumatic
- Electrical

Figure 4—Example Controlled Temperature Test Section Detail

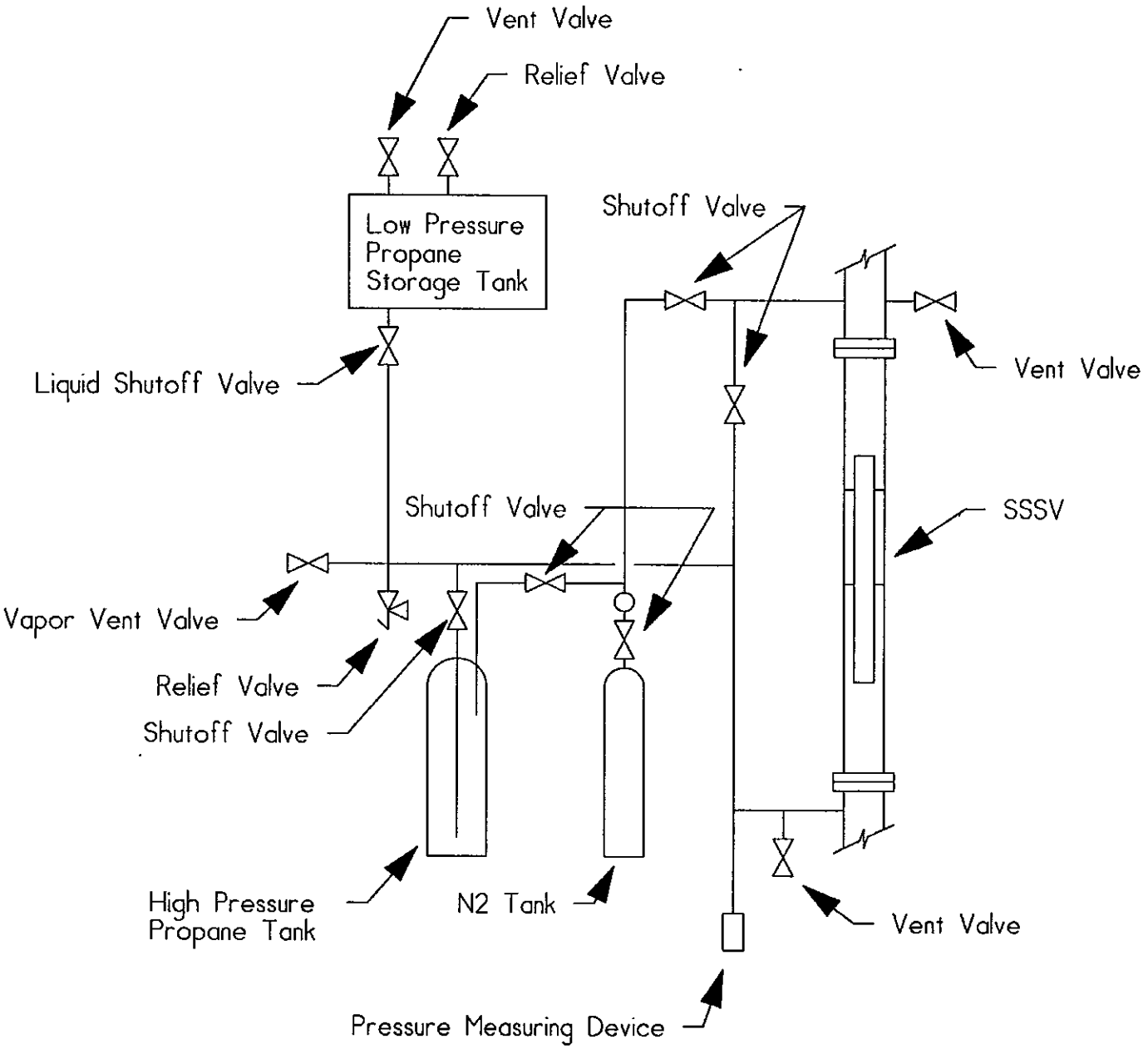


Figure 5—Example Propane System Schematic

7.6.7 Establish and maintain the gas flow rate indicated in Table 6 and close the test valve, while recording control line pressure and gas flow rate.

7.6.8 The test valve must shut off a minimum of 95% of the specified flow in 5.0 seconds or less after the hydraulic control pressure reaches zero or the test valve fails the test. Record the time required by the test valve to shut off the specified flow. If the test valve fails, discontinue testing.

7.6.9 Bleed the valve bore downstream pressure to zero. Adjust the test valve upstream bore pressure to 1,200 psi +/- 60 psi (83 Bar +/- 4 Bar). Record the test valve bore upstream pressure and gas leakage rate. If leakage exceeds 5 standard cubic feet (.14m^3) of gas per minute, the test valve fails. If the test valve fails, discontinue testing.

7.6.10 Bleed all pressure to zero. Repeat Steps 7.6.2 through 7.6.9 until tests 1 through 4 specified in Table 6 are successfully completed or until the test valve fails.

7.7 DRIFT TEST (Enter results on Table 7)

7.7.1 If necessary, remove the end connections (hammer unions, etc.) from the test valve to allow the Drift Test to be completed.

7.7.2 Open and close the test valve, record the full-open hydraulic control line pressure.

7.7.3 Position the test valve so that the valve is vertical, upside down and open before drifting the valve. The test valve may be opened prior to repositioning.

7.7.4 Record the Drift Bar dimensions and the unique identifier as supplied by the Manufacturer. Record the minimum specified inside diameter of the test valve.

7.7.5 Pass the Drift Bar completely through the test valve in a manner that does not cause the test valve's closure mechanism to be opened. The Drift Bar shall be aided only

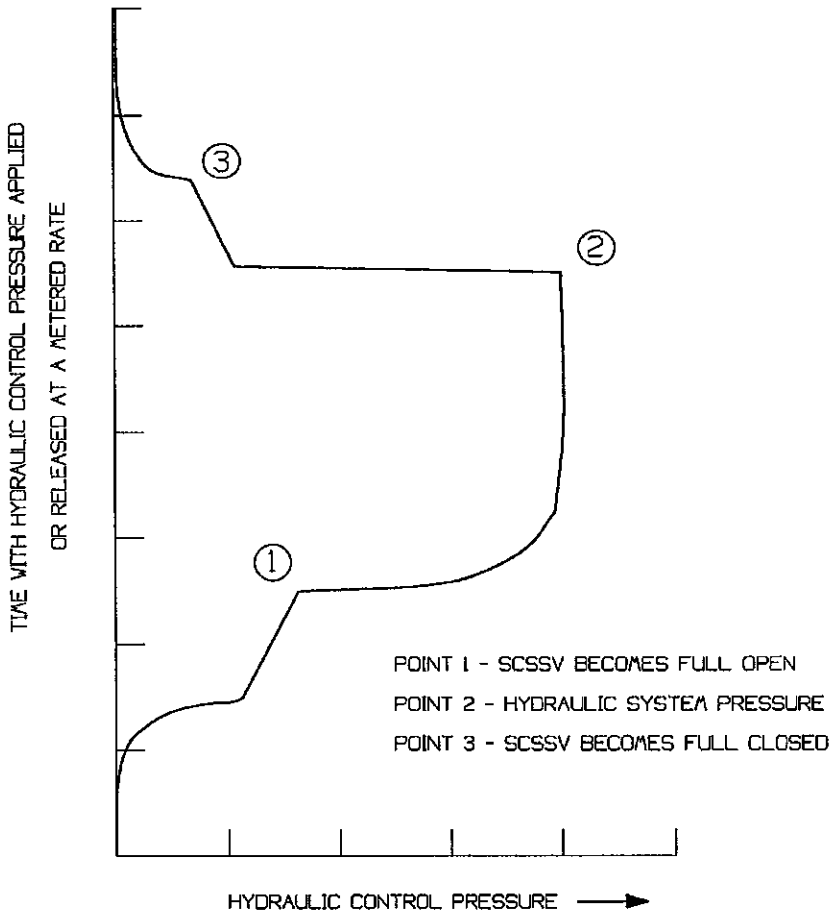


Figure 6—Hydraulic Control Pressure Characteristics for SCSSV
(For illustration)

by the force of gravity while being passed through the test valve. If the Drift Bar does not pass completely through the test valve, the test valve fails. If the test valve fails, discontinue testing.

7.7.6 Release hydraulic control pressure to close the test valve and reposition the test valve. Open and close the test valve four additional times. Record the full-open and full-closed hydraulic control line pressures.

7.8 LIQUID LEAKAGE TEST (Enter results on Table 9)

7.8.1 Make certain that the test valve is in the closed position with only liquid above and below the test valve.

7.8.2 Apply water pressure upstream of the test valve closure mechanism at 100% +0/-5% of the rated working pressure of the test valve. Record the test valve bore pressure and the time at which pressure is applied to the test valve.

7.8.3 Wait for a minimum of 3 minutes after applying water pressure upstream of the test valve closure mechanism before beginning collection of water leakage from the downstream bleed valve.

Continuously collect water leakage for a minimum of 5 minutes. Record the times at which water leakage collection begins and ends and the amount of water collected during the collection period. Calculate and record the average leakage rate. If the average leakage rate exceeds 10 cubic centimeters of water per minute, or if external body leakage is detected (tubing retrievable only), the test valve fails. If the test valve fails, discontinue testing.

7.9 UNEQUALIZED OPENING TEST (Enter results on Table 10)

7.9.1 Establish water pressure upstream of the test valve closure mechanism at the maximum Manufacturer-specified opening pressure differential.

7.9.2 Open the test valve closure mechanism against pressure as recommended in the test valve Operating Manual. Record the equalizing pressure and full-open hydraulic control pressure.

7.10 OPERATING PRESSURE TEST (Enter results on Table 11)

7.10.1 Apply 25% +/-5% of the rated working pressure of the test valve to the entire test section. Record the test valve bore pressure.

7.10.2 Close and open the test valve five times while recording the full-closed and full-open hydraulic control pressures. If the hydraulic control pressures do not repeat within +/- 10% of their averages or +/- 100 psi (7 Bar), whichever is greater, or if any body joint leakage (tubing retrievable only) is detected, the test valve fails. If the test valve fails, discontinue testing.

Table 9—Liquid Leakage Test
(Reference Section 7.8)

Test Report No._____ Test Stand # _____

	Step 7.5.7 (Class 1)	Step 7.5.15 (Class 1)	Step 7.5.22 (Class 2)
Date of Test	_____	_____	_____
Valve Bore Test Pressure (Nominal 100% Rated Working Pressure)	_____ PSI	_____ PSI	_____ PSI
Time at Which Test Pressure Applied	_____	_____	_____
Time at Start of Leakage Test	_____	_____	_____
Time at End of Leakage Test	_____	_____	_____
Average Leakage Rate at Test Pressure (100% Rated Working Pressure)	_____ CC/M	_____ CC/M	_____ CC/M
Body Joint Leakage Detected? (Tubing Retrievable Only)	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:	_____	_____	_____

Table 10—Unequalized Opening Test
(Reference Section 7.9)

Test Report No._____ Test Stand #_____

Date:_____ Test Start Time:_____ Test Completion Time:_____

Rated Working Pressure of Test Valve:_____ PSI
Valve Bore Upstream Test Pressure (Manufacturer's Maximum Recommended Unequalized Opening Pressure):_____ PSI
Equalizing Test Pressure:_____ PSI
Full-Open Hydraulic Control Pressure:_____ PSI

Conducted By:

Signature:_____ Date: _____

7.10.3 Repeat 7.10.1 and 7.10.2 at 75% +/-5% of the test valve rated working pressure.

7.11 PROPANE TEST (Enter results on Table 12)

7.11.1 Open test valve. Displace liquid out of the test section with nitrogen at a downstream location and bleed the nitrogen pressure to zero.

7.11.2 Cycle the test valve closed and open three times. Leave the test valve open. Record the full-closed and full-open hydraulic control pressures. If the hydraulic control pressures do not repeat within +/- 10% of their averages or +/- 100 psi (7 Bar), whichever is greater, the test valve fails. If the test valve fails, discontinue testing.

7.11.3 Transfer propane to the test section until the test section pressure reaches 400 psi +/- 20 psi (28 Bar +/- 1.4 Bar).

7.11.4 Open the downstream vent valve until liquid propane is expelled, close the propane vent valve, and adjust the pressure to 400 psi +/-20 psi (28 Bar +/- 1.4 Bar). Record the test valve bore pressure.

7.11.5 Close and open the test valve three times, leaving the test valve in each position (opened or closed) for a minimum of 15 minutes. Record the full-open and full-closed hydraulic control pressures. If the hydraulic control pressures do not repeat within +/- 10% or +/- 100 psi (7 Bar) of the averages, whichever is greater, or if any body joint leakage (tubing retrievable only) is detected, the test valve fails. If the test valve fails, discontinue testing.

7.11.6 Leave the test valve in the open position in propane for an additional 2 hours, minimum. Record the start and completion times and the valve bore pressure at the end of the 2 hour interval.

7.11.7 Bleed the section pressure to zero.

7.11.8 Purge the test section with nitrogen.

7.11.9 Close the test valve and record the full-closed hydraulic control pressure.

7.12 NITROGEN LEAKAGE TEST (Enter results on Table 13)

7.12.1 Apply 200 psi +/- 10 psi (14 Bar +/- .7 Bar) nitrogen pressure upstream of the test valve. Wait a minimum of 1 minute; then measure any nitrogen leakage through the closure mechanism. Record the test valve bore pressure, the leakage rate and start and completion times of the waiting period. If the leakage rate is greater than 5 standard cubic feet (.14m^3) per minute, or if any body joint leakage (tubing retrievable only) is detected, the test valve fails. If the test valve fails, discontinue testing.

7.12.2 Repeat 7.12.1 at 25% +/- 5% of the rated working pressure of the test valve.

7.12.3 Bleed the pressure upstream of the test valve to zero.

7.12.4 Open the test valve. Record the full-open hydraulic control pressure.

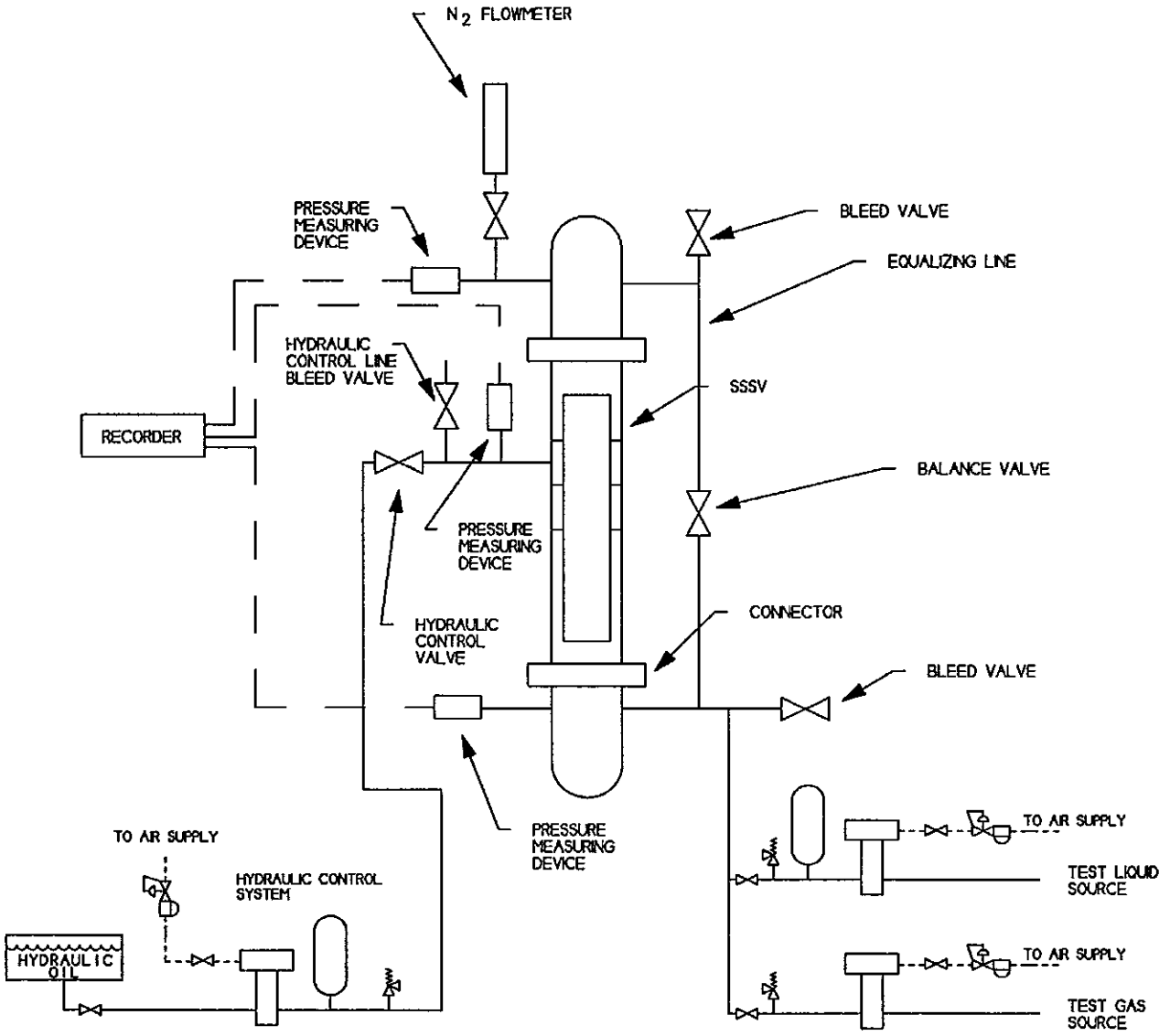


Figure 7—Example Functional Test Facility for Hydraulic Actuated SSSV

Table 11—Operating Pressure Test
(Reference Section 7.10)

Test Report No._____ Test Stand # _____

CHECK THE APPROPRIATE TEST CONDITION: ____ 20-30% of the Rated Working Pressure (RWP):_____ to _____ PSI
____ 70-80% of the Rated Working Pressure (RWP):_____ to _____ PSI

	Class 1						Class 2						
	Step 7.5.9 Cycle 1	Step 7.5.12 Cycle 2	Step 7.5.14 Cycle 3	Step 7.5.14 Cycle 4	Step 7.5.14 Cycle 5	Step 7.5.14 Cycle 6	Step 7.5.19 Cycle 1	Step 7.5.21 Cycle 2	Step 7.5.21 Cycle 3	Step 7.5.21 Cycle 4	Step 7.5.21 Cycle 5	Step 7.5.21 Cycle 6	Step 7.5.21 Cycle 7
Date of Test													
Hyd. Ctrl. System Pressure	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Repetition 1													
Full-Closed Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Full-Open Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Repetition 2													
Full-Closed Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Full-Open Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Repetition 3													
Full-Closed Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Full-Open Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Repetition 4													
Full-Closed Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Full-Open Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Repetition 5													
Full-Closed Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Full-Open Hyd. Ctrl. Pres.:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Average* Hyd. Ctrl. Pressure													
Full-Closed:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__
	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__
Full-Open:	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___ PSI	___PSI	___PSI	___PSI	___PSI	___PSI
	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__	+10%:__
	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__	-10%:__
Body Joint Leakage? (Tubing Retrievable Only)	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__

* The 5 individual closing and opening pressures must each repeat within +/-10% or +/-100 PSI of the average, whichever is greater.

Test Passed	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__	Yes:__ No:__
Conducted By: Signature, Date:													

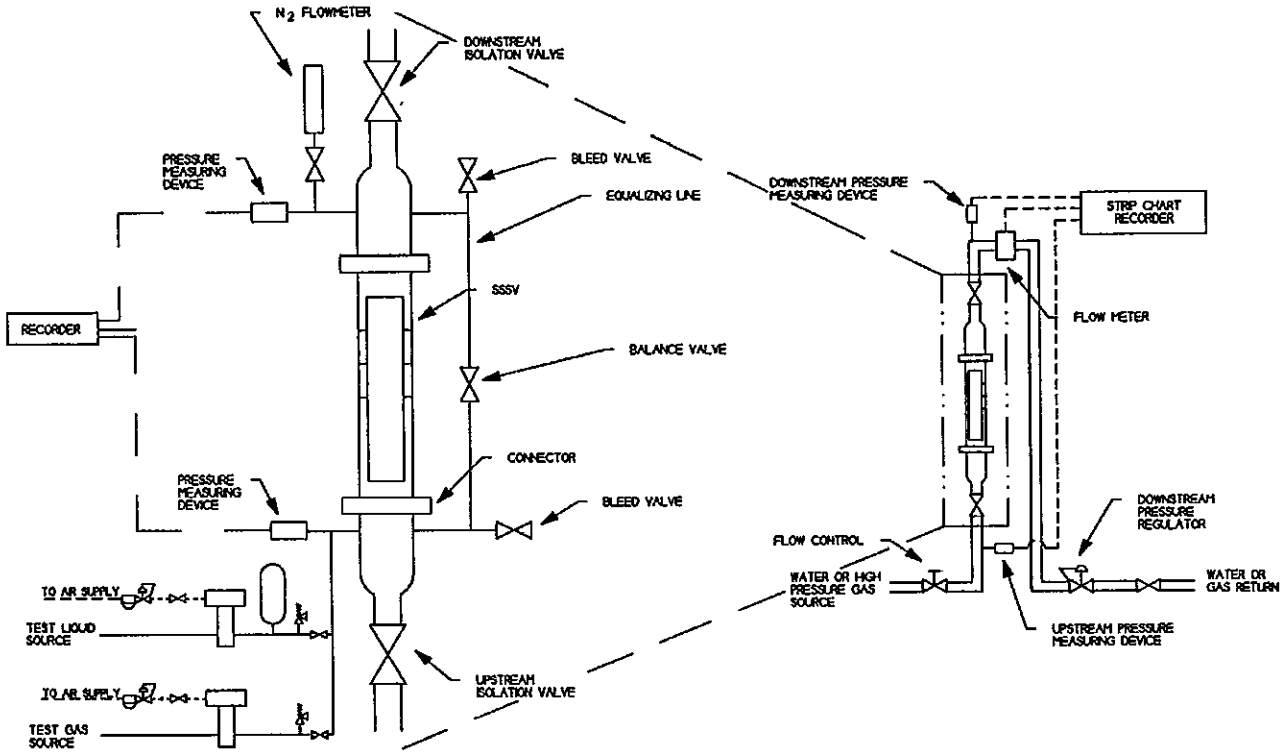


Figure 8—Example Functional Test Facility for Velocity and Tubing Pressure SSSV

Table 12—Propane Test
(Reference Section 7.11)

Test Report No._____ Date: _____ Test Stand # _____

Open/Close Cycles at Zero psi Test Valve Bore Pressure:

Measurement	#	#	#
Full-Closed Hydraulic Control Pressure:	____ PSI	____ PSI	____ PSI
Full-Open Hydraulic Control Pressure:	____ PSI	____ PSI	____ PSI

Average Full-Closed Control Pressure for 3 Closures Just Completed:
_____ PSI +10% _____ PSI -10% _____ PSI

Open/Close Cycles at 400 psi Test Valve Nominal Bore Pressure:

Valve Bore Pressure at Start of Open/Close Cycling: _____ PSI

Measurement	#	#	#
Time at Valve Closure:	_____	_____	_____
Full-Closed Hydraulic Control Pressure:	____ PSI	____ PSI	____ PSI
Time at Valve Opening:	_____	_____	_____
Full-Open Hydraulic Control Pressure:	____ PSI	____ PSI	____ PSI

Average Full-Closed Control Pressure for 3 Closures Just Completed:
_____ PSI +10% _____ PSI -10% _____ PSI

Average Full-Open Control Pressure for 3 Openings Just Completed:
_____ PSI +10% _____ PSI -10% _____ PSI

Propane Soak Period:

Time at Start of 2 Hour Soak Period: _____
Time at End of 2 Hour Soak Period: _____
Valve Bore Pressure at End of 2 Hour Soak Period: ____ PSI

Final Valve Closure During Propane Test:

Full-Closed Hydraulic Control Pressure After Last Closure: _____ PSI

Test Passed? Yes:____ No:____

*The 3 closings and openings must repeat within +/-10% or +/-100 PSI of the average, whichever is greater.

Conducted by:

Signature:_____ Date: _____

Table 13—SCSSV Nitrogen Leakage Test
(Reference Section 7.12)

Test Report No._____ Test Stand # _____

Enter the Following Test Valve Parameter: 20-30% of the Rated Working Pressure (RWP): _____ to _____ PSI

	Class 1					Class 2						
	Step 7.5.11 Cycle 1	Step 7.5.14 Cycle 2	Step 7.5.14 Cycle 3	Step 7.5.14 Cycle 4	Step 7.5.14 Cycle 5	Step 7.5.18 Cycle 1	Step 7.5.21 Cycle 2	Step 7.5.21 Cycle 3	Step 7.5.21 Cycle 4	Step 7.5.21 Cycle 5	Step 7.5.21 Cycle 6	Step 7.5.21 Cycle 7
Date of Test												
Valve Bore Test Pressure (190-210 PSI)	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Time at Start of Waiting Period												
Time at Completion of Waiting Period												
Measured Gas Leakage Rate (5 SCFM Max. Allowable)	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM
Body Joint Leakage? (Tubing Retrievable Only)	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Valve Bore Test Pressure (20-30% RWP)	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI	___PSI
Time at Start of Waiting Period												
Time at Completion of Waiting Period												
Measured Gas Leakage Rate (5 SCFM Max. Allowable)	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM	__SCFM
Body Joint Leakage? (Tubing Retrievable Only)	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:												

Table 14—SCSSV Class 1 Flow Test
(Reference Section 7.13)

Test Report No._____ Test Stand # _____

	Step 7.5.13 Cycle 1	Step 7.5.14 Cycle 2	Step 7.5.14 Cycle 3	Step 7.5.14 Cycle 4	Step 7.5.14 Cycle 5
Date of Test	_____	_____	_____	_____	_____
Time at Start of Circulation of Test Rate No. 1 Through the Valve	_____	_____	_____	_____	_____
Time at Valve Closure (Against Test Rate No. 1)	_____	_____	_____	_____	_____
Closure Data for Test Rate No. 1:					
Water Flow Rate	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D
Full-Closed Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time To Close	_____ S	_____ S	_____ S	_____ S	_____ S
Full-Open Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time at Start of Circulation of Test Rate No. 2 Through the Valve	_____	_____	_____	_____	_____
Time at Valve Closure (Against Test Rate No. 2)	_____	_____	_____	_____	_____
Closure Data for Test Rate No. 2:					
Water Flow Rate	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D
Full-Closed Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time To Close	_____ S	_____ S	_____ S	_____ S	_____ S
Full-Open Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time at Start of Circulation of Test Rate No. 3 Through the Valve	_____	_____	_____	_____	_____
Time at Valve Closure (Against Test Rate No. 3)	_____	_____	_____	_____	_____
Closure Data for Test Rate No. 3:					
Water Flow Rate	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D
Full-Closed Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time To Close	_____ S	_____ S	_____ S	_____ S	_____ S
Full-Open Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:	_____	_____	_____	_____	_____

7.13 SCSSV CLASS 1 FLOW TEST (Enter results on Table 14)

7.13.1 Circulate fresh water through the system while bypassing the test valve until gas has been displaced from the system.

7.13.2 Adjust the water flow rate through the test valve to obtain a stable flow at the value specified in Table 15. Record the time at which flow is directed through the test valve. Flow water through the test valve at the specified rate for a minimum of 5 minutes.

7.13.3 Close the test valve against flow. Record the full-closed hydraulic control pressure and the water flow rate through the test valve at the time closure is initiated. The test valve must shut off a minimum of 95% of the specified flow at the first closure attempt in 15.0 seconds or less after the hydraulic control pressure reaches zero, or the test valve fails. Record the time required by the test valve to shut off the specified flow. If the test valve fails, discontinue testing.

7.13.4 Open the test valve. Record the full-open hydraulic control pressure.

7.13.5 Repeat 7.13.2 through 7.13.4 until the three fresh water closure rates have been completed or the test valve fails.

7.14 CONTROLLED TEMPERATURE TEST (Enter results on Table 16)

7.14.1 Install the test valve in the controlled temperature test stand. Temperature measurements shall be taken at the control line entry port area of the test valve.

7.14.2 Allow the test valve to reach a stable temperature of 100°F +/- 5°F (38°C +/- 3°C).

7.14.3 Apply nitrogen pressure at 25% +/- 5% of the rated working pressure of the test valve. Allow the temperature at the test valve to stabilize. Record test valve temperature and test valve bore pressure.

7.14.4 Cycle the test valve 10 times while maintaining the specified test valve temperature and pressure. Record the full-open and full-closed hydraulic control pressures at each cycle and the test valve temperature and bore pressure. If the hydraulic control pressures do not repeat within +/- 10% of their averages or +/- 100 psi (7 Bar), whichever is greater, or if body joint leakage (tubing retrievable only) is detected, the test valve fails. If the test valve fails, discontinue testing.

7.14.5 Connect a tube from the test valve hydraulic control line port to a container filled with water. Position the tube so any gas bubbles from the hydraulic control line port can be observed.

Table 15—SCSSV Liquid Flow Rates (+/-10%)
(Reference Sections 7.13 and 7.15)

Nominal Tubing or Casing Size	Circulation Rate B/D (m^3/d)			
	Class 1			Class 2
inches (mm)	Test No. 1	Test No. 2	Test No. 3	
$2^3/_8$ (60.3)	500 (79)	1000 (159)	1500 (238)	500 (79)
$2^7/_8$ (73.0)	780 (124)	1560 (248)	2340 (372)	780 (124)
$3^1/_2$ (88.9)	1120 (178)	2240 (356)	3360 (534)	1120 (178)
4 (101.6)	1500 (238)	3000 (477)	4500 (715)	1500 (238)
$4^1/_2$ (114.3)	1920 (305)	3840 (610)	5760 (915)	1920 (305)
5 (127.0)	2430 (386)	4860 (722)	7290 (1159)	2430 (386)
$5^1/_2$ (139.7)	3000 (477)	6000 (954)	9000 (1431)	3000 (477)
$6^1/_2$ (165.1)	4320 (686)	8640 (1373)	12960 (2060)	4320 (686)
7 (177.8)	5880 (935)	11760 (1869)	17640 (2804)	4700 (747)

The manufacturer establishing sizes not covered by this specification may interpolate or extrapolate by a ratio of the square of the diameter versus the parameter involved.

Table 16—Controlled Temperature Test
(Reference Section 7.14)

Test Report No._____ Date: _____ Test Stand # _____

CHECK THE APPROPRIATE TEST CONDITION:

___ 20-30% of the Rated Working Pressure (RWP):_____ to _____ PSI
___ 70-80% of the Rated Working Pressure (RWP):_____ to _____ PSI

CHECK THE APPROPRIATE TEST CONDITION:

___ 95-105°F
___ 175-185°F

Open/Close Cycles at the Specified Valve Temperature and Pressure:
Test Temperature: _____ °F Valve Bore Pressure: _____ PSI

Measurement	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Cycle 5	Cycle 6	Cycle 7	Cycle 8	Cycle 9	Cycle 10
Full-Open Hydraulic Control Pressure	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI
Full-Closed Hydraulic Control Pressure	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI	____ PSI

Was Body Joint Leakage Detected (Tubing Retrievable Only) Yes: ____ No: ____
Average Full-Open Hydraulic Control Line Pressure for 10 Open/Close Valve Cycles: _____ PSI +10% _____ PSI -10% _____ PSI
Average Full-Closed Hydraulic Control Line Pressure for 10 Open/Close Valve Cycles: _____ PSI +10% _____ PSI -10% _____ PSI
Test Passed? Yes: ____ No: ____

Control Line Leakage Test at the Specified Valve Temperature and Pressure:
3 Minute Waiting Period Prior to the Control Line Leakage Test: Start Time _____ Stop Time _____
5 Minute Observation Period for Control Line Leakage Test: Start Time _____ Stop Time _____ Leak Detected: Yes _____ No _____
Was Body Joint Leakage Detected (Tubing Retrievable Only) Yes: ____ No: ____
Test Passed? Yes: ____ No: ____

Closure Mechanism Leakage Test at the Specified Valve Temperature and Pressure Below the Closure Mechanism:
Test Temperature: _____ °F
Time at which Bore Pressure Above the Closure Mechanism Is Bled to Zero psi: _____
Valve Bore Pressure Below the Closure Mechanism: _____ PSI
1 Minute Waiting Period Prior to the Closure Mechanism Leakage Test: Time Start: _____ Time Stopped: _____
Leakage Rate: _____ SCFM
Test Passed? Yes: ____ No: ____

* The 10 individual opening and closing pressures must each repeat within +/-10% or +/-100 PSI of the average, whichever is greater.

Conducted by:

Signature:_____ Date: _____

7.14.6 With the test valve bore filled with nitrogen gas at the specified temperature and pressure, wait a minimum of 3 minutes and then observe the gas bubble leakage rate for a minimum of 5 minutes. Record the times at which the 3 minute waiting period, preceding the leakage test, begins and ends and the times at which the 5 minute gas bubble leakage observation period begins and ends. If continuous leakage from the control line is observed for at least 1 minute during the observation period, or if body joint leakage (tubing retrievable only) is detected, the test valve fails. If the test valve fails, discontinue testing.

7.14.7 Repeat 7.14.2 through 7.14.6 using a test valve bore pressure of 75% +/- 5% of the rated working pressure of the test valve.

7.14.8 Bleed nitrogen pressure above the closure mechanism to zero. Adjust and stabilize the pressure below the closure mechanism to 75% +/- 5% of the rated working pressure of the test valve. Wait a minimum of 1 minute; then measure any nitrogen leakage. Record the test valve bore pressure below the closure mechanism, the leakage rate and start and completion times of the waiting period. If the leakage rate is greater than 5 standard cubic feet (.14m^3) per minute, or if any body joint leakage (tubing retrievable only) is detected, the test valve fails. If the test valve fails, discontinue testing.

7.14.9 Repeat 7.14.2 through 7.14.8 using a test temperature of 180°F +/- 5°F (82°C +/- 3°C).

7.14.10 Bleed all pressure to zero. Allow the test valve to cool. Remove the test valve from the controlled temperature test stand.

7.15 SCSSV CLASS 2 FLOW TEST (Enter results on Table 18)

7.15.1 Prepare a slurry consisting of 80 - 100 U.S. mesh (180-150 μm) sand and viscosified water.

7.15.2 Determine the sand content of the slurry according to the API Manual of Petroleum Measurement Standards, Chapter 10.4. Adjust the sand content to 2% +/- 0.5% by adding 80 - 100 U.S. mesh (180-150 μm) sand or diluting the slurry with fresh water.

7.15.3 Determine the viscosity of the slurry sample with a Marsh funnel viscometer according to API RP 13B1. Adjust the viscosity to 70 seconds +/- 5 seconds by adding a viscosifier or diluting the slurry with fresh water.

7.15.4 The viscosity and sand content specified above, must be met before proceeding.

7.15.5 Adjust the slurry circulation rate to the value specified in Table 15. Record the slurry circulation rate, sand

Table 17—Opening Pressure Repeatability Test
(Reference Test Steps 7.5.17)

Test Report No._____ Date: _____ Test Stand #_____

Hydraulic Control Pressures Measured During Test Step 7.5.17 of the Class 1 Test:

Full-Open Hydraulic Control Pressure:_____ PSI
Full-Closed Hydraulic Control Pressure:_____ PSI

Full-Open Hydraulic Control Pressure:_____ PSI
Full-Closed Hydraulic Control Pressure:_____ PSI

Full-Open Hydraulic Control Pressure:_____ PSI
Full-Closed Hydraulic Control Pressure:_____ PSI

Full-Open Hydraulic Control Pressure:_____ PSI
Full-Closed Hydraulic Control Pressure:_____ PSI

Full-Open Hydraulic Control Pressure:_____ PSI
Full-Closed Hydraulic Control Pressure:_____ PSI

Conducted by:

Signature:_____ Date: _____

Table 18—SCSSV Class 2 Flow Test
(Reference Section 7.15)

Test Report No._____ Test Stand # _____

	Step 7.5.20 Cycle 1	Step 7.5.21 Cycle 2	Step 7.5.21 Cycle 3	Step 7.5.21 Cycle 4	Step 7.5.21 Cycle 5	Step 7.5.21 Cycle 6	Step 7.5.21 Cycle 7
Date of Test	_____	_____	_____	_____	_____	_____	_____
Time at Start of Slurry Circulation Through the Valve	_____	_____	_____	_____	_____	_____	_____
Flow Rate at Start of Circulation Period	____ B/D	____ B/D	____ B/D	____ B/D	____ B/D	____ B/D	____ B/D
Sand Concentration at Start of Circulation Period	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
Slurry Viscosity at Start of Circulation Period	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S
Time at Valve Closure (Against Slurry Flow)	_____	_____	_____	_____	_____	_____	_____
Closure Data:							
Slurry Flow Rate	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D
Full-Closed Hydraulic Control Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Time To Close	_____ S	_____ S	_____ S	_____ S	_____ S	_____ S	_____ S
Sand Concentration at Completion of Circulation Period	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
Slurry Viscosity at Completion of Circulation Period	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S	___ Marsh S
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:	_____	_____	_____	_____	_____	_____	_____

content, and slurry viscosity. Record the time at which the slurry circulation begins.

7.15.6 Circulate the slurry through the test valve at the specified rate for a minimum of 1 hour, and then close the test valve against the specified rate.

7.15.7 Record the full-closed hydraulic control pressure and the slurry flow rate through the test valve at the time closure is initiated. The test valve must shut off a minimum of 95% of the specified flow at the first closure attempt in 15.0 seconds or less after the hydraulic control pressure reaches zero or the test valve fails. Record the time required for the test valve to shut off the specified flow. If the test valve fails, discontinue testing.

7.15.8 At the completion of the flow period, measure and record the sand content of the slurry and slurry viscosity.

7.16 SSCSV VERIFICATION TEST PROCEDURE

7.16.1 Verify that the model and serial numbers appearing on the test valve assembly are in agreement with the Manufacturer's application before leaving the Test Agency.

7.16.2 Perform the SSCSV Gas Closure Test (Section 7.17). For velocity type SSCSV, use the gas flow test stand to conduct the test.

7.16.3 Perform the initial Liquid Closure Test (Section 7.18) using water as the test medium.

7.16.4 Perform the Liquid Leakage Test (Section 7.8).

7.16.5 Perform the Propane Test (Section 7.11), omitting 7.11.2 and 7.11.5. Replace 7.11.9 with: Conduct the Liquid Closure Test (Section 7.18), using water as the test medium. The closing flow rate for velocity type SSCSV or the closing pressure for tubing pressure type SSCSV shall repeat within +/- 15% of the closing flow rate or pressure of 7.16.3 or the test valve fails the test. If the test valve fails, discontinue testing.

7.16.6 Perform the Nitrogen Leakage Test (Section 7.12), omitting 7.12.4.

7.16.7 Perform the SSCSV Class 1 Flow Test (Section 7.19).

7.16.8 Repeat 7.16.6 and 7.16.7 fourteen additional times. The closing flow rate for velocity type SSCSVs or the closing pressure for low tubing pressure type SSCSVs shall repeat within +/- 15% of the closing flow rate or pressure of 7.16.3 above, or the valve fails the test. If the test valve fails, discontinue testing.

7.16.9 Perform the Liquid Leakage Test (Section 7.8). If the test valve is being qualified for Class 1 service only, proceed to 7.16.14.

7.16.10 Perform the Nitrogen Leakage Test (Section 7.12), omitting 7.12.4.

7.16.11 Perform the Class 2 Flow Test (Section 7.20).

7.16.12 Repeat 7.16.10 and 7.16.11 six additional times. The closing flow rate for velocity type SSCSV or the closing

Table 19—Verification Test Summary

Test Agency:_____ Test Report No._____
Test Start Date:_____ Test Completion Date:_____
Manufacturer:_____
Model No.:_____ Serial Number:_____
Nominal Tubing Size:_____ inches Rated Working Pressure:_____ PSI

SERVICE CLASS TESTED:_____
CLASS PASSED: 1:____ 2:____

If Valve Failed the Test:
Step at Which Failure Occurred:_____
Reason for Failure:_____

Remarks: (Describe any non-specified equipment or procedures requested by the valve manufacturer, unusual conditions observed during the test, etc.)

_____

_____

_____

_____

_____

_____

_____

Test Report Approved By:_____ Date:_____
(Test Agency Approval Authority)

pressure for tubing pressure type SSCSV shall repeat within +/- 15% of the closing flow rate or pressure of 7.16.3, or the test valve fails the test. If the test valve fails, discontinue testing. The slurry may be allowed to stagnate in the test section overnight. Record the times at which each stagnation period begins and ends.

7.16.13 Perform the Liquid Leakage Test (Section 7.8).

7.16.14 If the test valve has performed within the limits specified, it has passed the Verification Test requirements.

7.16.15 Summarize the Verification Test data on Table 19 and attach the completed data forms. Calibration records shall be included with the Verification Test Report. Each data form must be signed and dated by the person(s) conducting the test. Table 19 must be signed and dated by the Test Agency's designated approval authority.

7.17 SSCSV GAS CLOSURE TEST (Enter results on Table 20)

7.17.1 Increase gas pressure in the system to between 2,000 (138 Bar) and 2,500 psi (173 Bar).

7.17.2 Close the test valve as follows:

a. Velocity Type SSCSV: Increase the gas flow rate through the test valve until the test valve closes. The test valve must close at a flow rate of at least +/- 25% of the design closing flow rate indicated in Table 5.1 in 30 seconds or less from the time this flow rate is achieved or the test valve fails the test. If the test valve fails, discontinue testing. Record the initial pressure upstream of the test valve, the differential pressure across the test valve closure mechanism, and the gas flow rate through the test valve at closure.

b. Tubing Pressure Type SSCSV: Adjust the gas pressure downstream of the test valve to ensure the test valve is open. Decrease the downstream pressure until the test valve closes. The test valve must close at a downstream pressure of at least 75% of the design closing pressure indicated in Table 11. The minimum allowable downstream pressure is 50 psi (3.5 Bar). The test valve must close in 30 seconds or less from the time this minimum pressure is achieved or the test valve fails the test. Record the initial pressure downstream of the test valve and the pressure downstream of the test valve at closure. If the test valve fails, discontinue testing.

Table 20—SSCSV Gas Closure Test
(Reference Section 7.17)

Test Report No. _____

Test Start Time: _____ Test Completion Time: _____ Date: _____

For Velocity-Type SSCSV:

Initial Test Valve Upstream Pressure: _____ PSI
Closing Flow Rate (Gas): _____ SCFD
Differential Closing Pressure: _____ PSI
Design Closing Rate (gas): _____ SCFD
Maximum Closing Rate, Design Closing Rate (gas) +25%: _____ SCFD
Minimum Closing Rate, Design Closing Rate (gas) -25%: _____ SCFD

For Tubing-Pressure-Type SSCSV:

Initial Test Valve Downstream Pressure:_____ PSI
Downstream Closing Pressure:_____ PSI
Design Closing Pressure _____ PSI
Maximum Closing Rate, Design Closing Rate (gas) +25%: _____ PSI
Minimum Closing Rate, Design Closing Rate (gas) -25%: _____ PSI

Nitrogen Leakage Data:

Test Valve Bore Pressure:_____ PSI
Leakage Rate:_____ SCFM

Test Passed? Yes:___ No:___

Conducted By:

Signature:_____ Date: _____

Table 21—Initial Liquid Closure Test
(Test Procedure Step 7.16.3)

Test Report No._____

Date:_____ Test Start Time:_____ Test Completion Time:_____

For Velocity-Type SSCSV:

Initial Test Valve Downstream Pressure:_____ PSI
Closing Flow Rate (Water):_____ B/D
Differential Closing Pressure:_____ PSI
Design Closing Flow Rate (liquid): _____ B/D
Maximum Closing Rate, Design Closing Rate (liquid) +25%: _____ B/D
Minimum Closing Rate, Design Closing Rate (liquid) -25%: _____ B/D

For Low-Tubing-Pressure-Type SSCSV:

Initial Test Valve Downstream Pressure:_____ PSI
Downstream Closing Pressure:_____ PSI
Maximum Closing Rate, Design Closing Rate (liquid) +25%: _____ B/D
Minimum Closing Rate, Design Closing Rate (liquid) -25%: _____ B/D

Test Passed? Yes:___ No:___

Conducted By:

Signature:_____ Date: _____

7.17.3 Bleed the valve bore downstream pressure to zero. Adjust the test valve bore upstream pressure to 1200 psi +/- 5% (83 Bar +/- 4 Bar). Wait a minimum of 1 minute; then measure any gas leakage through the closure mechanism. Record the test valve bore pressure, the leakage rate and the start and completion times of the waiting period. If the leakage rate is greater than 5 standard cubic feet (.14m^3) per minute, the test valve fails. If the test valve fails, discontinue testing.

7.17.4 Bleed all pressure to zero.

7.18 LIQUID CLOSURE TEST (Enter results on Table 21)

7.18.1 Circulate liquid through the system while bypassing the test valve until gas has been displaced from the system.

7.18.2 Adjust the circulation rate through the test valve to obtain a flow at the rate specified in Table 25.

7.18.3 Close the test valve as follows:

a. Velocity Type SSCSV: Adjust pressure downstream of the test valve to between 50 and 55 psi (3.5 and 3.8 Bar). Increase the circulation rate through the valve until the valve closes. The circulation rate shall be increased such that the pressure downstream of the test valve can be maintained between 50 and 55 psi (3.5 and 3.8 Bar). The test valve must close at a flow rate of at least +/- 25% of the design closing flow rate indicated in Table 5.1 in 30 seconds or less from the time this flow rate is achieved or the test valve fails the test. If the test valve fails, discontinue testing. Record the initial pressure upstream of the test valve, the differential pressure across the valve closure mechanism, and the flow rate through the valve at closure.

b. Tubing Pressure Type SSCSV: Decrease the downstream pressure until the test valve closes. The test valve must close at a downstream pressure of at least 75% of the design closing pressure indicated in Table 1. The minimum allowable downstream pressure shall be 50 psi (3.5 Bar). The valve must close in 30 seconds or less from the time this pressure minimum is achieved or the valve fails the test. Record the initial pressure downstream of the test valve and the pressure downstream of the test valve at closure. If the test valve fails, discontinue testing.

7.19 SSCSV CLASS 1 FLOW TEST (Enter results on Table 24)

7.19.1 Circulate water through the system while bypassing the test valve until gas has been displaced from the system.

7.19.2 Adjust the water circulation rate through the test valve to obtain a flow rate at the value specified in Table 25. Record the time at which flow is directed through the test valve and the circulation rate. Circulate water through the test valve at the specified rate for a minimum of 1 hour.

Table 22—Propane SSCSV Test
(Reference Section 7.16.5)

Propane Soak Period:

Date:_____
2 Hour Soak Period: Start: _____ Stop: _____
Valve Bore Pressure at End of 2 Hour Soak Period: ____ PSI

Closure After Propane Soak

Test Start Time: _____ Test Completion Time: _____ Date: _____

For Velocity-Type SSCSV:

Initial Test Valve Downstream Pressure:_____ PSI
Closing Flow Rate (Water):_____ B/D
+15% of Table 7.18 Cycle Value:_____ B/D
-15% of Table 7.18 Cycle Value:_____ B/D
Differential Closing Pressure:_____ PSI

For Low-Tubing-Pressure-Type SSCSV:

Initial Test Valve Downstream Pressure:_____ PSI
Downstream Closing Pressure:_____ PSI
+15% of Table 7.18 Cycle Value:_____ PSI
-15% of Table 7.18 Cycle Value:_____ PSI

Test Passed? Yes:____ No:____

Conducted By:

Signature:_____ Date: _____

7.19.3 Close the test valve using the Liquid Closure Test Procedure (Section 7.18), using water as the test medium and omitting 7.18.1 and 7.18.2.

7.20 SSCSV CLASS 2 FLOW TEST (Enter results on Table 26)

7.20.1 Prepare a slurry consisting of 80 - 100 U.S. mesh (180-150 μm) sand and viscosified water.

7.20.2 Determine the sand content of the slurry according to the API Manual of Petroleum Measurement Standards, Chapter 10.4. Adjust the sand content to 2% +/- 0.5% by adding 80 - 100 U.S. mesh (180-150 μm) sand or diluting the slurry with water.

7.20.3 Determine the viscosity of the slurry sample with a Marsh funnel viscometer according to API RP 13B1. Adjust the viscosity to 70 seconds +/- 5 seconds by adding a viscosifier or diluting the slurry with water.

7.20.4 The viscosity and sand content specified above, must be met before proceeding.

7.20.5 Adjust the slurry circulation rate to the value specified in Table 25. Record the slurry circulation rate, sand content, and slurry viscosity. Also, record the time at which the slurry circulation begins.

7.20.6 Circulate slurry through the test valve at the specified rate for a minimum of 1 hour, and then close the test valve using the Liquid Closure Test Procedure (Section 7.18), using slurry as the test medium and omitting 7.18.1 and 7.18.2.

7.20.7 At the completion of the circulation period, measure and record the sand content and slurry viscosity.

7.21 SCSSV FUNCTIONAL TESTING

7.21.1 A typical Manufacturer's test facility is shown in Figure 7 and includes:

a. Test section installed vertically.
b. Test section and hydraulic control section pressure measurement devices.
c. Pressurized gas source.
d. Hydraulic control pressure system.
e. Flow rate measurement devices.
f. Pressurized water system.
g. A time based recorder to simultaneously record the required data.
h. Internal and external drifts.

Table 23—SSCSV Nitrogen Leakage Test
(Reference Section 7.16.6)

Test Report No._____ Test Section # _____
Enter the Following Test Valve Parameter: 20-30% of the Rated Working Pressure (RWP):_____ to _____ PSI

Class 1

	Step 7.16.6 Cycle 1	Step 7.16.8 Cycle 2	Step 7.16.8 Cycle 3	Step 7.16.8 Cycle 4	Step 7.16.8 Cycle 5	Step 7.16.8 Cycle 6	Step 7.16.8 Cycle 7	Step 7.16.8 Cycle 8	Step 7.16.8 Cycle 9	Step 7.16.8 Cycle 10	Step 7.16.8 Cycle 11	Step 7.16.8 Cycle 12	Step 7.16.8 Cycle 13	Step 7.16.8 Cycle 14	Step 7.16.8 Cycle 15
Date of Test															
Valve Bore Test Pressure (190-210 PSI)	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI
Time at Start of Waiting Period															
Time at Completion of Waiting Period															
Measured Gas Leakage Rate	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM
Valve Bore Test Pressure (20-30% RWP)	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI
Time at Start of Waiting Period															
Time at Completion of Waiting Period															
Measured Gas Leakage Rate	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM	_SCFM
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:															

Table 24—SSCSV Class 1 Flow Test
(Reference Section 7.19)

Test Report No._____ Test Stand # _____

For Velocity-Type SSCSVs: +15% _____B/D -15% _____ B/D of Closing Flow Rate: From Table 7.18
For Low-Tubing-Pressure-Type SSCSVs: +15% _____PSI -15% _____ PSI of Closing Pressure: From Table 7.18

	Step 7.16.7 Cycle 1	Step 7.16.8 Cycle 2	Step 7.16.8 Cycle 3	Step 7.16.8 Cycle 4	Step 7.16.8 Cycle 5	Step 7.16.8 Cycle 6	Step 7.16.8 Cycle 7	Step 7.16.8 Cycle 8	Step 7.16.8 Cycle 9	Step 7.16.8 Cycle 10	Step 7.16.8 Cycle 11	Step 7.16.8 Cycle 12	Step 7.16.8 Cycle 13	Step 7.16.8 Cycle 14	Step 7.16.8 Cycle 15
Date of Test	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Time at Start of Circulation Through the Valve	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
Flow Rate at Start of Circulation Period	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D
Time at Valve Closure	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
For Velocity-Type SSCSVs:															
• Initial Downstream Pressure	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI
• Water Flow Rate at Closure	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D	___ B/D
• Differential Pressure Across Valve at Closure	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI
For Low-Tubing-Pressure-Type SSCSVs:															
• Initial Downstream Pressure	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI
• Downstream Pressure at Closure	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI	___ PSI
	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___	Yes:___
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____

7.21.2 SCSSV Functional Testing Procedure

All test section pressures shall be measured with calibrated devices and recorded.

a. Record serial number.
b. Place SCSSV in fixture capable of retaining and sealing the valve in a vertical position.
c. Open SCSSV with zero pressure in the test section. Adjust and stabilize the hydraulic control pressure to the Manufacturer's recommended hold open pressure. Isolate the hydraulic control pressure from the source. Monitor for a minimum of 5 minutes. If a loss greater than 5% of the applied pressure is detected after stabilization, the SCSSV fails the Functional Test.
d. Close and open the SCSSV five times with zero pressure in the test section. Record the full-closed and full-open hydraulic control pressures. Each control pressure must repeat within +/- 5% of the average pressure of the five valve cycles as well as falling within the Manufacturer's specified control pressure tolerance. If each pressure is not within these the limits, the SCSSV fails the Functional Test.
e. Fill test section with water or other suitable liquid to displace air from the test section.

Wireline Retrievable SCSSV: Close the SCSSV. Adjust and stabilize pressure across the entire test section to 150% +/- 5% of the rated working pressure of the SCSSV. Hold the pressure for a minimum of five minutes. Reduce pressure in the test section to zero. Repeat test once. The SCSSV fails the Functional Test if leakage is detected through the hydraulic control port(s).

Tubing Retrievable SCSSV: Close the SCSSV. Thoroughly dry the test valves exterior. Adjust and stabilize the pressure in the entire test section to 150% +/- 5% of the rated working pressure of the SCSSV. Hold the pressure a minimum of five minutes. Reduce pressure in the test section to zero. Repeat test once. The SCSSV fails the Functional Test if leakage is detected on the exterior or through the hydraulic control line port(s).
f. Open and close SCSSV with zero pressure in test section and record full-open and full-closed hydraulic control pressures. Open the SCSSV.
g. Adjust and stabilize the pressure in entire test section to 50% +/- 5% of the SCSSV's rated working pressure.
h. Close and open the SCSSV five times. Record the full-closed and full-open hydraulic control pressures and the test section pressure during each cycle. Hydraulic control pressure must repeat within the greater of (1) +10% or -5% or (2) 100 psi (7 Bar) of the values specified by the Manufacturer. Each hydraulic control pressure must repeat within +/- 5% of the average pressure of the five cycles. If each of the control pressures is not within these limits, the SCSSV fails the Functional Test.
i. Adjust and stabilize the test section pressure to 100% +/- 5% of the rated working pressure of the SCSSV. Close the SCSSV. Record the full-closed hydraulic control pressure. Bleed hydraulic control pressure to zero.
j. Adjust and stabilize the test section pressure to 100% +/- 5% of rated working pressure of the SCSSV. Monitor for leakage at hydraulic control line port(s) for a minimum of five minutes. If any leakage is detected, the SCSSV fails the Functional Test.
k. Bleed the pressure above the SCSSV closure mechanism to zero. Adjust and stabilize the pressure below the closure mechanism to 100% +/- 5% of the rated working pressure of the SCSSV. Measure liquid leakage for a minimum of five minutes. If the leakage rate exceeds 10 cc/min, the SCSSV fails the Functional Test.
l. Remove the liquid from the test section.
m. Open the SCSSV. Record the full-open hydraulic control pressure.
n. Adjust and stabilize the pressure in the entire test section with gas to 200 psi (14 Bar) +/- 5%. Close the SCSSV. Record the full-closed hydraulic control pressure. Bleed the hydraulic control pressure to zero.
o. Adjust and stabilize the test section pressure with gas to 200 psi (14 Bar) +/- 5%. Monitor for gas leakage at the hydraulic control port(s) for a minimum of five minutes. If any leakage is detected, the SCSSV fails the Functional Test.
p. Bleed the pressure above the SCSSV's closure mechanism to zero. Adjust and stabilize the pressure below the SCSSV's closure mechanism to 200 psi (14 Bar) +/- 5% with gas. Measure the leakage rate for a minimum of five minutes. If the leakage rate exceeds 5 standard cubic feet ($.14m^3$) per minute the SCSSV fails the Functional Test.
q. Repeat Steps o and p with 1200 psi (83 Bar) +/- 5% gas.
r. Bleed all pressures to zero.
s. Open and close the SCSSV two times. Record the full-open and full-closed hydraulic control pressures.
t. Prepare the SCSSV for drift tests. Open the SCSSV.

Drift interior of SCSSV assembly with Manufacturer's specified drift bar. Pass the drift bar completely through the test valve in a manner that does not cause the test valve's closure mechanism to be opened.

Drift exterior of wireline retrievable SCSSV with Manufacturer's specified drift sleeve. If the SCSSV fails the drift test, the SCSSV fails the Functional Test.

Record the drift's unique identifiers and nominal drift sizes.

u. Special features unique to a Manufacturer's SCSSV shall be tested in accordance with the Manufacturer's operating manual. Failure to meet the requirements of these tests, fails the SCSSV. These tests can be installed into the existing sequence of the Functional Test. Such special feature testing procedures, sequence and results shall be fully described in the test report.

v. If the SCSSV performed within the limits of the Functional Test, it has passed the Functional Test. Attach recorded data to the Manufacturer's test form. Certify the test with the appropriate Manufacturer's approval signatures and dates.

Table 25—SSCSV Liquid Flow Rates (+/-10%) (Reference Sections 7.18, 7.19, and 7.20)

Normal Tubing or Casing Size inches (mm)		Circulation Rate B/D (m^3d) Class 1 & 2	
$2^3/_8$	(60.3)	500	(79)
$2^7/_8$	(73.0)	780	(124)
$3^1/_2$	(88.9)	1120	(178)
4	(101.6)	1500	(238)
$4^1/_2$	(114.3)	1920	(305)
5	(127.0)	2430	(386)
$5^1/_2$	(139.7)	3000	(477)
$6^1/_2$	(165.1)	4320	(687)
7	(177.8)	5880	(935)

The manufacturer establishing sizes not covered by this specification may interpolate or extrapolate by a ratio of the square of the diameter versus the parameter involved.

7.22 SSCSV FUNCTIONAL TESTING

7.22.1 A typical Manufacturer's test facility is shown in Figure 8 and includes:

a. Test section installed vertically.
b. Test section pressure measurement devices.
c. Pressurized gas source.
d. Flow rate measurement devices.
e. Pressurized water system.
f. A time based recorder to simultaneously record the required data.
g. Drift sleeve.

7.22.2 SSCSV Functional Testing Procedure—Velocity Type.

a. Record serial number.
b. Place SSCSV in a fixture capable of retaining and sealing the valve in a vertical position.
c. Initiate a flow against a minimum back pressure of 50 psi (3.5 Bar).
d. Check operation of recorders for flowrate, upstream pressure and downstream pressure.
e. Increase flow rate until the SSCSV closes.
f. Record the flow rate and the upstream and downstream pressures at time of valve closure. If closing rate and pressure differential are not within +/- 5% of the Manufacturer's specified values, the SSCSV fails the Functional Test.
g. Adjust and stabilize pressure upstream of SSCSV to 100% +/- 5% of the rated working pressure of the SCSSV.
h. Hold the upstream pressure for a minimum of five minutes and measure leakage rate. If the leakage rate exceeds 10 cc/min, the SSCSV fails the Functional Test.
i. Bleed pressure from below the SSCSV to a pressure 100 psi (7 Bar) greater than the closing differential pressure.
j. Adjust gas pressure to 200 psi (14 Bar) +/- 5% greater than the closing pressure differential.
k. Measure gas leakage rate for five minutes. If the leakage rate exceeds 5 standard cubic feet (.14m^3) per minute, the SSCSV fails the Functional Test.
l. Bleed all pressures to zero.
m. Prepare SSCSV for drift test. Drift exterior of SSCSV with drift sleeve. If SSCSV does not pass through the drift sleeve, it fails the Functional Test. Record the drift sleeve nominal size and the unique identifier.
n. If the SSCSV performed within the limits of the Functional Test, it has passed the Functional Test. Attach recorded data to the Manufacturer's test form. Certify the test with the appropriate Manufacturer's approval signatures and dates.

7.22.3 SSCSV Functional Testing Procedure—Tubing Pressure Type.

a. Record serial number.
b. Place SSCSV in a fixture capable of retaining and sealing the valve in a vertical position.
c. Adjust flow rate in accordance with Table 25.
d. Reduce downstream pressure until the SSCSV closes.
e. Record the flow rate and downstream pressure at the time of valve closure. If downstream pressure at closure is not within +/- 5% of the Manufacturer's specified pressure or 10 psi (7 Bar) whichever is larger, the SSCSV fails the Functional Test.
f. Bleed downstream pressure to zero.
g. Adjust and stabilize pressure upstream of SSCSV to 100% +/- 5% of the rated working pressure of the SSCSV.
h. Hold the upstream pressure for a minimum of five minutes and measure the leakage rate. If the leakage rate exceeds 10 cc/min. the SSCSV fails the Functional Test.
i. Bleed upstream pressure from the SSCSV to a pressure 100 psi (7 Bar) greater than the closing pressure.
j. Adjust the upstream pressure with gas to 200 psi (14 Bar) +/- 5% greater than the closing pressure.
k. Measure gas leakage rate for five minutes. If the leakage rate exceeds 5 standard cubic feet (.14m^3) per minute, the SSCSV fails the Functional Test.
l. Bleed all pressures to zero.
m. Prepare SSCSV for drift test. Drift exterior of SSCSV with drift sleeve. If SSCSV does not pass through the drift sleeve, it fails the Functional Test.
n. If the SSCSV performed within the limits of the Functional Test, it has passed the Functional Test. Attach recorded

Table 26—SSCSV Class 2 Flow Test
(Reference Section 7.20)

Test Report No._____ Test Stand # _____

For Velocity-Type SSCSVs: +15% _____B/D -15% _____ B/D of Closing Flow Rate: From Table 7.18
For Low-Tubing-Pressure-Type SSCSVs: +15% _____PSI -15% _____ PSI of Closing Pressure: From Table 7.18

	Step 7.16.11 Cycle 1	Step 7.16.12 Cycle 2	Step 7.16.12 Cycle 3	Step 7.16.12 Cycle 4	Step 7.16.12 Cycle 5	Step 7.16.12 Cycle 6	Step 7.16.12 Cycle 7
Date of Test	_____	_____	_____	_____	_____	_____	_____
Time at Start of Slurry Circulation Through the Valve	_____	_____	_____	_____	_____	_____	_____
Flow Rate at Start of Circulation Period	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D
Sand Concentration at Start of Circulation Period	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
Slurry Viscosity at Start of Circulation Period	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S
Time at Valve Closure (Against Slurry Flow)	_____	_____	_____	_____	_____	_____	_____
For Velocity-Type SSCSVs:							
• Initial Downstream Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
• Slurry Flow Rate at Closure	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D	_____ B/D
• Differential Pressure Across Valve at Closure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
For Low-Tubing-Pressure-Type SSCSVs:							
• Initial Downstream Pressure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
• Downstream Pressure at Closure	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI	_____ PSI
Sand Concentration at Completion of Circulation Period	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
Slurry Viscosity at Completion of Circulation Period	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S	____ Marsh S
Test Passed?	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___	Yes:___ No:___
Conducted By: Signature, Date:	_____	_____	_____	_____	_____	_____	_____

Table 27—Minimum Required SSSV Functional Test Data

Valve Data Manufacturer _____

Equipment Name _____ SSSV Type _____

SSSV Catalog or Model No. _____ Serial No. _____ Size _____

Safety Valve Lock _____ Serial No. _____ Size _____

Working Pressure Rating _____ Temperature Rating Min. _____ Max. _____

Tubing Retrievable Only: Internal Yield Pressure _____ psig Collapse Pressure _____ psig

Tensile Load Strength _____ lbs

Verification Test Certification No. _____ Date _____

Class of Service _____

Test Date _____

Functional Test Records.

Date _____ Performed By _____

data to the Manufacturer's test form. Certify the test with the appropriate Manufacturer's approval signatures and dates.

7.22.4 Functional Testing Of Other Type SSSV's

a. The apparatus and test procedure for a specific SSSV not included in previous sections must be specified by the Manufacturer.
b. The Manufacturer shall be responsible for assuring that the test procedures are not less stringent than those in this specification.
c. The Manufacturer shall document the Functional Test procedure and results.

7.23 SAFETY VALVE LANDING NIPPLE (SVLN) TESTING

7.23.1 SVLN Verification Testing

a. The minimum test apparatus shall be a test facility capable of providing and recording pressures at the rated working pressure of the SVLN.
b. The Manufacturer shall perform a body integrity pressure test of each size, type and model of SVLN at the rated working pressure of the SVLN according to a documented test procedure.
c. Each SVLN that contains control fluid redirection feature(s) shall be bore pressure tested at the rated working pressure of the SVLN in each alternate position of the control fluid redirection feature(s). This may be performed on typical components provided the operating components tested are of the same design, dimensions, clearances and equivalent material as those of the production SVLN. During these bore pressure tests, the control line ports shall be monitored for leakage. If, during these tests, any leakage is detected from a control line port that is designated as isolated from the SVLN bore (per the SVLN Operating Manual), the SVLN fails the test.
d. The Manufacturer shall have on file drawings which show all the applicable dimensions and tolerances of parts contained in the verification tested SVLN. Pre and post-test dimensional verification shall be conducted and documented by the Manufacturer.
e. The Manufacturer shall document the Verification Test procedures and results.

7.23.2 SVLN Functional Testing

a. Record serial number.
b. Each SVLN shall be dimensionally inspected to ensure compliance with all design specifications and drawings.
c. Each SVLN that contains a control fluid redirection feature shall be functionally tested in accordance with the SVLN Operating Manual. As a minimum, this shall include a body integrity pressure test at the rated working pressure of the SVLN. Any leaks shall cause a failure of the test.
d. The Manufacturer shall document the Functional Test procedures and results.

7.24 SAFETY VALVE (SV) LOCK TESTING

7.24.1 SV Lock Verification Testing

a. Each size, type and model SV Lock shall be installed in a landing nipple or test device and subjected to pressure from below equivalent to the rated working pressure of the SV Lock.
b. The Manufacturer shall have on file drawings which show all the applicable dimensions and tolerances of parts contained in the verification tested SV Lock. Pre- and post-test dimensional verification shall be conducted and documented by the Manufacturer.
c. The Manufacturer shall document the Verification Test procedure and results.

7.24.2 SV Lock Functional Testing

a. Record serial number.
b. Each SV Lock shall be dimensionally inspected to ensure compliance with all design specifications and drawings.
c. Each SV Lock shall be installed in a SVLN or test device with the Manufacturer's specified running tool. Each SV Lock shall be retrieved from the SVLN or test device using the Manufacturer's specified pulling tool. If the Lock fails to set or retrieve, it fails the Functional Test.
d. The Manufacturer shall document the Functional Test procedure and results.

7.25 VERIFICATION TEST FOR SEALS

7.25.1 Testing Apparatus

a. Test Mandrel
   1. O-Rings: The test mandrel shall have an Outside Diameter no greater than the Manufacturer's minimum diameter of the equipment on which the O-ring will be used. The Outside Diameter of the O-ring groove shall be the minimum diameter specified. The mandrel shall be designed so that pressure can be applied between two O-rings.
   2. Other Packing: The test mandrel shall have an Outside Diameter equal to the Manufacturer's minimum diameter of the equipment on which the packing will be used. The mandrel will be designed so that pressure can be applied between two sets of packing when the mandrel is placed inside the test nipple. The number of packing rings for each set tested shall be no greater than the number specified by the Manufacturer for the equipment on which the packing will be used.
b. The test nipple shall have an Inside Diameter equal to the maximum diameter of the Manufacturer's equipment and a finish no finer than the Manufacturer's maximum specification for the equipment.
c. Test baths shall be designed to safely contain the fluids in which the seals are to be immersed and shall be capable of withstanding test temperatures.

7.25.2 Procedures

a. Pressure Differential Test Procedure
   1. Install seals on test mandrel and place in test nipple, making sure test bath fluid fills the void between the seals being tested.
   2. Place mandrel and nipple in test oil heated to the maximum temperature rating of the seals and leave for three hours, maintaining maximum temperature. Test oil is to be a Heat Transfer oil or equivalent with an open cup flash point of 500°F (189°C).
   3. Apply pressure equal to 150% of the maximum working pressure rating of the seals between the two sets of seals and hold for ten minutes.
   4. Maximum leakage acceptable must be less than a pressure drop equal to 1% of the test pressure in 10 minutes for each 500 cc of test chamber volume.
b. Growth Test Procedure
   1. Place four seals on the test mandrel and measure the Outside Diameter of the seals.
   2. Immerse mandrel with seals in appropriate test oil heated to the maximum rated temperature of the seals and leave for two hours. Test oil for Class 1 and Class 2 service to be No. 2 diesel oil with closed cup flash point of approximately 165°F (74°C). Test oil for Class 3S service to be No. 2 diesel oil as above saturated with H_2S at 75°F (24°C) and 250 psia (17 Bar) (approximately 300,000 PPM H_2S).
   3. Remove test mandrel from test bath and immediately after removal, measure outside diameter of seals.
      a. The outside diameter of O-rings shall be limited to a 10% increase of the cross-sectional diameter.
      b. The outside diameter of other packings shall not exceed 2% growth based on packing diameter per 100°F (38°C) above ambient temperature, but not to exceed 0.125 inches (3.18 mm) of total growth.

8 Identification, Documentation and Shipping

8.1 IDENTIFICATION

SSSV Equipment furnished to this specification shall be permanently identified per the Manufacturer's written specifications. Identification shall include:

8.1.1 Manufacturer's name or trademark.

8.1.2 Manufacturer's size, type and model.

8.1.3 A unique identifying serial number.

8.1.4 Rated working pressure.

8.1.5 Date of original manufacture.

8.1.6 Class of Service Designation.

Class of service designations listed below may be combined to indicate the complete class of service. For example, 234 indicates sandy, sulfide stress and chloride stress cracking and weight loss corrosion service.

1—Standard service
2—Sandy service
3—Stress corrosion cracking service
3S—Sulfide stress cracking service.
3C—Chloride stress cracking service.
4—Weight loss corrosion service.

8.1.7 Orifice beans for velocity-type SSCSVs shall be identified with the orifice diameter.

8.2 SUPPLIED DOCUMENTATION

SSSV's, SV Locks and multiple part SVLN's shall be delivered to the Operator with a Manufacturer's Shipping and Receiving Report (Table 28) and an operating manual.

8.3 RETAINED DOCUMENTATION

8.3.1 The Verification Test file for the SSSV Equipment and seals shall be retained per 7.2.3g.

8.3.2 Quality Control documentation shall be retained per 6.2.

8.3.3 For a period of five years after the date of sale of SSSV Equipment, the Manufacturer shall retain and have available for inspection by the Operator documentation listed below:

a. Manufacturer's Quality Manual and applicable license or certification.
b. One complete set of drawings and written specifications, standards and procedures.
c. Manufacturing quality control reports.
d. Operators' equipment failure reports and records of corrective action.
e. Functional Test Files.
f. Copies of mill and other test reports.

8.4 SHIPPING

8.4.1 SSSV Equipment shall be packaged to prevent damage due to vibration and shock while in transit.

8.4.2 Sealing surfaces and external exposed threads shall be protected. All control line ports shall be protected to prevent entry of foreign material.

8.4.3 Temporary plugs, seals or protectors shall be readily identified.

8.5 MINIMUM CONTENTS OF MANUFACTURER'S OPERATING MANUAL

8.5.1 Size, Type and Model.

8.5.2 Classes of Service.

8.5.3 Operating Data:

a. Working Pressure
b. Temperature Range
c. Internal Yield Pressure*
d. Collapse Pressure*
e. Tensile Load Strength*
*Applies to tubing retrievable SSSV Equipment.

8.5.4 Dimensional Data: Including dimensions of Drift Bar and Drift Sleeve, if applicable.

8.5.5 Calculations:

a. SCSSVs: Calculation procedures used to determine maximum fail-safe setting depths, where applicable.
b. SSCSVs: Orifice coefficients, spring force, optimum operating range of pressure differential for velocity valves, etc.

8.5.6 Drawings and Illustrations.

8.5.7 Parts List with necessary information for reordering. Manufacturer's address and telephone number to be contacted.

8.5.8 Specific details of Functional Testing should be included if the test apparatus or procedures are significantly different than those included in this Specification.

8.5.9 Running Instructions.

8.5.10 Pulling Instructions.

8.5.11 Inspection and Testing Procedures.

8.5.12 Installation and Operating Procedures.

8.5.13 Troubleshooting and Maintenance Procedures.

8.5.14 Repair Procedures and Limitations.

8.5.15 Assembly and Disassembly Instructions and Limitations.

8.5.16 Operating Requirements.

a. SCSSV
1. Opening and closing procedures with opening and closing pressures.
2. Equalizing procedure including maximum allowable opening pressure differential.

Table 28—Subsurface Safety Valve Equipment—Shipping & Receiving Report (Minimum Data Requirement)

- Manufacturer Data:

  Manufacturer _____

  Catalog or Model No. _____ Equipment Name _____

  Serial No. _____ Size _____ Class of Service _____

- SSSV's Data:

  Pressure Rating _____ Temperature Rating: Max. _____ Min. _____

  Verification Test Agency _____ Test Report No. _____

  Date of Report _____

- SSSV Functional Test Summary:

  A. SCSSV's —

  1. Opening pressure with "O" psi in Test Section: Max. _____ Min. _____
  2. Closing pressure with "O" psi in Test Section: Max. _____ Min. _____
  3. Performed by _____ Date _____

  B. SSCSV's (Velocity Type) —

  1. Closing Flow Rates: Max. _____ Min. _____
  2. Orifice (Bean) Size _____
  3. Number and Length of Spacers _____
  4. Spring Rate _____ Lbs/In
  5. Performed by _____ Date _____

  C. SSCSV's (Low Tubing Pressure Type) —

  1. Downstream Pressure at Closure _____
  2. Performed by _____ Date _____

  D. SSSV's (Other Type) —

  1. Performed by _____ Date _____

- Operator Data:

  Date Received _____

  Company Name _____ Organization Unit _____

  Field _____ Lease _____ Well _____

  Condition of SSSV, SCSSV, SSCSV Prior to Installation:

  1. Connections Tight _____
  2. Opening Pressure* _____ Closing Pressure* _____
  3. General _____

  *Actuating Pressure

  Inspected by: _____ Date: _____

b. SSCSV
   1. Opening or equalization procedures.
   2. Optimum conditions to avoid nuisance closures and throttling.

8.5.17 Storage Recommendations.

8.6 FAILURE REPORTING AND ANALYSIS

Manufacturers providing SSSV Equipment in accordance with this specification shall make an analysis of failure reports submitted by Operator(s). The Manufacturer shall provide the Operator(s) with a written progress of the analysis within six weeks from receipt of a written failure report. The Manufacturer shall notify the Operator(s) in writing of the final results of the failure analysis and corrective action. The Manufacturer's final report shall include, as a minimum, the information contained in Table C.1. The Manufacturer shall make necessary design changes that result from the failure analysis on all affected SSSV Equipment. Design changes requiring equipment requalification and resulting from a failure history shall be communicated within thirty days after design change, by the Manufacturer to the Operator(s) having the failures of the SSSV Equipment and all Operator(s) having SSSV Equipment with similar potential problems.

APPENDIX A—SI UNITS

Note: This appendix is not part of API Specification 14A

The conversion of English units shall be made in accordance with ISO 31-3.

Table A-1—SI UNITS

Quantity	U.S. Customary Unit	SI Unit
Length	1 inch (in) 1 foot (ft)	25,4 mm (exactly) 304,8 mm or 0,3048 m (exactly)
Pressure	1 pound-force per square inch (lbf/in^2) or psi NOTE 1 bar = 10^5 Pa	6,894757 Pa
Strengt or stress	1 pound-force per square inch (lbf/in^2)	6,894757 Pa
Impact energy	1 foot-pound force (ft-lbf)	1,355818 J
Torque	1 foot-pound force (ft-lbf)	1,355818 N•m
Temperature	The following formula was used to convert degrees Fahrenheit (°F) to degrees Celsius (°C):	°C = 5/9 (°F-32)
Mass	1 pound (lb)	0,45359237 kg (exactly)
Volume	1 cubic foot (ft^3)	0,02831685 m^3 or 28,31685 dm^3
Flow rate	1 cubic foot per minute (ft^3/min)	0,02831685 m^3/min or 40,776192 m^3/day

APPENDIX B—SUGGESTIONS FOR ORDERING SUBSURFACE SAFETY VALVE EQUIPMENT

In placing orders for Subsurface Safety Valve equipment in accordance with API Spec 14A, Operator should specify the following on the purchase order:

Specification and Edition (API Monogram required)	Yes _____	No _____
Tubing Size, Weight, Grade, Connection.	Yes _____	No _____
SSSV Equipment		
Type System (See API RP 14B, Section 4.1, 4.2 and 4.4)	Yes _____	No _____
Type, Model and Quantity.	Yes _____	No _____
Class of Service — API Spec 14A, Section 1.4	Yes _____	No _____
Size — API Spec 14A, Tables 2 and 3	Yes _____	No _____
Rated Working Pressure — API Spec 14A, Section 4.3	Yes _____	No _____
Temperature Range — API Spec 14A,	Yes _____	No _____
Special Features — (See API RP 14B)	Yes _____	No _____
SCSSV		
Control System Pressure	Yes _____	No _____
Setting Depth — API Spec 14A, Section 8.5. (See API 14B)	Yes _____	No _____
Type Control fluid (See API RP 14B)	Yes _____	No _____
Strength (tubing retrievable only) API Spec 14A, Section 4.3.	Yes _____	No _____
SSCSV		
Orifice Size, Spring, Spacers, Dome Charge, etc. (See API RP 14B)	Yes _____	No _____
OTHER EQUIPMENT		
Safety Valve Lock — API Spec. 14A	Yes _____	No _____
Safety Valve Landing Nipple — API Spec 14A	Yes _____	No _____

APPENDIX C—FAILURE REPORTING

C.1 USER RECOMMENDATION

C.1.1 The operator of SSSV Equipment manufactured to this specification should provide to the Manufacturer a written report of equipment failure.

C.1.2 This report should include, as a minimum, the information included in Table C.1.

C.2

The Failure Report should be submitted to the equipment Manufacturer within 30 days from the discovery and identification of the failure. A copy should also be sent to Manager, API Production Quality Program. An investigation in the form of a failure analysis to define the cause of the failure should be performed and the results documented.

The Operator's options for performing failure analysis on failed equipment should be as follows:

a. The Operator removes the failed equipment from service and returns the equipment to the equipment Manufacturer who, in cooperation with the Operator, performs the failure analysis; or

b. The Operator does not immediately remove the equipment from service. However, if the Operator removes the equipment within five years from the date of the Shipping Report, the Operator should return the equipment to the equipment Manufacturer for failure analysis; or

c. The Operator elects to perform an independent failure analysis.

The Operator should notify the equipment Manufacturer of the option selected for failure analysis as part of the initial Failure Report. If option (c) is selected, upon completion of the failure analysis a copy of the analysis report should be sent to the equipment Manufacturer and the Manager, API Production Quality Program within 45 days of completion of the analysis.

C.3

After receiving a Failure Report from the Operator (Items C.2.a or C.2.b above), the equipment Manufacturer should respond in writing to the Operator within six weeks of receipt, describing progress in the analysis. He should also notify the Operator in writing of the final results of his analysis and the corrective action. If the failure analysis causes the equipment Manufacturer to change the design, assembly or operating procedures of a model equipment, he should, within 30 days of such changes, report them in writing to all Purchasers and known Operators of equipment having similar potential problems. Copies of all reports to the Operator should also be sent to the Manager, API Production Quality Program.

Table C.1—Failure Report Subsurface Safety Valve Equipment (Minimum Data)

OPERATOR DATA

I. Identification - Operator
- Operator
- Date
- Field and/or Area
- Lease Name and Well Number

II. SSSV Equipment Identification
- SSSV ___; SV Landing Nipple ___; SV Lock ___
- Make
- Model
  Tubing retrievable ___
  Wireline retrievable ___
  SCSSV ___
  SSCSV ___
- Serial Number
- Working Pressure
- Nominal Size
- Service Class ___

III. Well Data
- Well Test Rat
- Environmental Conditions
  - Percent Sand
  - H_2S
  - CO_2
- Pressures and Temperatures
  - Surface
  - Bottom Hole
- SSSV Equipment Setting Depth
- SSSV Equipment Installation Date
- Time Equipment in Service
- Unusual Operating Conditions

IV. Description of Failure
- Nature of Failure
- Observed conditions which could have caused failure

V. Operator's Signature and Date

MANUFACTURER DATA (Completed On Receipt of Equipment)

I. Failed Equipment Condition
- Condition as received
- Failed components
- Damaged components

II. Test Results
- Furnished by Operator and/or Conducted by Manufacturer
- Failure Mode
- Leakage Rate
- Control Fluid
- Operational Data (Opening and Closing Pressures, etc.)

III. Cause of Failure
- Probable Cause
- Secondary Cause

IV. Repair and Maintenance
- Parts Replaced
- Other Maintenance or Repair

V. Corrective Action to Prevent Recurrence
- Operator Procedures
- Design/Material Change
- Proper Equipment Application

VI. Additional Information
- Facility location where failed valve was originally manufactured
- Date of manufacture

VII. Manufacturer's Signature and Date
- Completed Report to be transmitted to Operator with a copy retained

APPENDIX D—TEST AGENCY LICENSE CRITERIA

D.1

The purpose of this Appendix is to provide the requirements by which laboratories may be licensed in accordance with the requirements of the definition of Test Agency.

D.2

Laboratories desiring licensing under this Appendix shall have a functional quality program in accordance with the ISO/IEC Guide 25-1982. "General Requirements for the Technical Competence of Testing Laboratories" and the following sections of API Spec Q1: 1.0 General, 2.0 Responsibilities, 3.0 Quality Program Criteria (except 3.6, Design Control; 3.8 Manufacturing Control; 3.11 Traceability; 3.12 Special Processes; 3.16 Acceptance Status and 3.21 Field Non-Conformance Reporting). API shall maintain a list of licensed laboratories, which shall appear in the API Composite List of Manufacturers Licensed for use of the API Monogram. Laboratories desiring licensing under this Appendix shall make application and pay fees as follows:

Initial License fee. The applicant will be assessed an initial license fee for the first Specification included in the application, and a separate fee for each additional Specification included in the application.

Annual License Fee. In addition to the initial license fee, laboratories will be assessed an annual renewal fee for each specification under which they are listed.

D.3

The laboratory shall submit a controlled copy of their Quality Manual to API. The manual will be reviewed by API Staff for conformance to the requirements of Section 2 of this Appendix and specific test methods identified in this or other API Specifications. Upon acceptance of the manual, API shall arrange for a survey, as follows:

Initial and Renewal Surveys. First-time applicants and current licensed laboratories on every third year renewal of licensing shall be surveyed by qualified surveyors. The parameters of these surveys shall be the appropriate API Specifications and the laboratory's API approved quality manual. The surveys will be performed to gather objective evidence for API's use in verifying that the laboratory is in conformance with the provisions of the Laboratory Quality Program as applicable to this API specification and the requirements of Section 2 of this Appendix. The laboratory will be invoiced for the cost of these surveys.

Periodic Surveys. Existing laboratories will be periodically surveyed by an approved API surveyor on a nondiscriminatory basis to determine whether or not they continue to qualify as a licensed laboratory. The frequency of the periodic surveys will be at the discretion of the staff of the Institute. The costs of periodic surveys will be paid by the Institute.

D.4

Removal of Laboratory from Licensed List shall occur due to the following:

(a) Failure to meet the requirements of the survey
(b) Failure to pay annual renewal fee

D.5 Reinstatement of License Rights

Laboratories who have been cancelled may request reinstatement at any time. If a request for reinstatement is made within sixty (60) days after cancellation, and if the reason for cancellation has been corrected, no new application is necessary. A resurvey of the laboratory's facilities will be made by an approved Institute surveyor prior to a decision to reinstate license rights. The laboratory will be invoiced for this resurvey regardless of the Institute's decision on reinstatement. If the result of the resurvey indicates to the API staff that the laboratory is qualified, the license list will be updated.

Request for reinstatement made more than sixty (60) days after cancellation shall be treated as a new application unless circumstances dictate an extension of this time period as agreed upon by the API staff.

D.6 Appeals

An interested party may appeal a decision by the Institute to withhold license rights. Appeals shall be directed to the Director, API Exploration & Production Department and handled by the General Committee of the Production Department with a further right of appeal to the API Management Committee. Competing suppliers of the service to which the standard applies or might apply may not be involved in appeals. The General Committee and the Management Committee may convene appeals boards to hear and act on appeals.

D.7

Test Reports completed by a licensed laboratory shall include the following:
(a) general information (date, location, manufacture, model, serial number, size, rating, etc.);
(b) summary of test results (quantities and characteristics);
(c) description of the characteristics of equipment under test;

(d) observed data (including calculations and test personnel);
(e) test conditions (limits required by the standard);
(f) identification of test methods and procedures;
(g) supporting data (log sheets, calibration records);
(h) graphic presentation (curves);
(i) identification of instruments involved in the test data;
(j) certification and license number;

Test reports shall be traceable to the tested equipment, and shall be certified by the laboratory.

D.8

Unless otherwise specified in the appropriate referenced standard(s), the Licensed Laboratory shall keep the following records for five years from completion of all tests for equipment tested:

(a) test data and test reports
(b) calibration
(c) non-conformance reports
(d) audit and corrective action records
(e) personnel qualification records
(f) test procedures
(g) special testing

D.9

Any changes to a Licensed Laboratory's approved Quality Assurance Manual must be approved by API in writing prior to implementation.

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