

Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components

Liquid Penetrant Examination Method

Standard Practice

Developed and Approved by the
Manufacturers Standardization Society of the
Valve and Fittings Industry, Inc.

127 Park Street, N.E.
Vienna, Virginia 22180
(703) 281-6613



An MSS Standard Practice is intended as a basis for common practice by the manufacturer, the user, and the general public. The existence of an MSS Standard Practice does not in itself preclude the manufacture, sale, or use of products not conforming to the Standard Practice. Mandatory conformance is established only by reference in a code, specification, sales contract, or public law, as applicable.

Unless otherwise specifically noted in this MSS SP, any standard referred to herein is identified by the date of issue that was applicable to the referenced standard(s) at the date of issue of this MSS SP. (See Annex A.)

In this Standard Practice all notes, annexes, tables, and figures are construed to be essential to the understanding of the message of the standard, and are considered part of the text unless noted as "supplemental". All appendices appearing in this document are construed as "supplemental". "Supplemental" information does not include mandatory requirements.

U.S. customary units in this SP are the standard; the metric units are for reference only.

Substantive changes in this 1999 edition are "flagged" by parallel bars as shown on the margins of this paragraph. The specific detail of the change may be determined by comparing the material flagged with that in the previous edition.

Non-toleranced Dimensions in this Standard Practice are nominal, and, unless otherwise specified, shall be considered "for reference only."

Any part of this standard may be quoted. Credit lines should read 'extracted from SP-93, 1999, with permission of the publisher, the Manufacturers Standardization Society.' Reproduction prohibited under copyright convention unless written permission is granted by the Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

Originally Approved November 1982

Copyright®, 1983 by
Manufacturers Standardization Society
of the
Valve and Fittings Industry, Inc.
Printed in U.S.A.

| FOREWORD |

The MSS Standard SP-93 was originally adopted in 1982 for the purpose of providing a uniform method of Liquid Penetrant Examination. It was specifically developed for the valve/piping industry but may be used in any application where this type of examination is suitable.

I TABLE OF CONTENTS I

<u>SECTION</u>	<u>PAGE</u>
TERMS AND CONDITIONS	i
FOREWORD	ii
TABLE OF CONTENTS	iii
1. SCOPE	1
2. REFERENCES	1
3. DEFINITIONS	1
4. PROCEDURE	1
5. ACCEPTABLE STANDARDS	1
6. EVALUATION OF INDICATIONS	1
7. REMOVAL AND REPAIR OF DISCONTINUITIES	2
8. PERSONNEL REQUIREMENTS	2
TABLE 1 — Acceptance Standard Criteria	3
ANNEX A: Referenced Standards and Applicable Dates	4

LIQUID PENETRANT EXAMINATION METHOD**1. SCOPE**

1.1 This Standard Practice provides methods and acceptance standards for liquid penetrant examination of steel castings and forgings for valves, flanges, fittings and other piping components. It is applicable to examination of repairs as well as to initial examination of castings and forgings.

1.2 The methods of Section 4 provide uniform procedures which will produce satisfactory and consistent results upon which the Acceptance Standards of Table 1 may be used.

1.3 This Standard Practice includes the examination of pressure containing castings and forgings.

2. REFERENCES

ASTM E 165 Practice for Liquid Penetrant Inspection Method.

3. DEFINITIONS

3.1 Pressure Containing Part—A part whose failure would permit the contained fluid to escape to the atmosphere. For valves, the body and bonnet (cover) and end pieces (of multi-piece valve bodies, e.g., ball valves) shall be considered the pressure containing parts.

3.2 Indication—The visible bleedout of liquid from a discontinuity.

3.3 Linear Indication—An indication in which the length is three or more times the width.

3.4 Rounded Indication—An indication which is circular or elliptical with its length less than three times its width.

4. PROCEDURE

4.1 All exterior and accessible interior surfaces of the pressure containing parts shall be examined by the liquid penetrant method. Interior surfaces not accessible because of configuration, such as small holes or bores, need not be examined. Examination may occur prior to machining or after machining at the manufacturer's option.

4.2 Liquid penetrant examination procedure shall be in accordance with ASTM E 165.

5. ACCEPTANCE STANDARDS

5.1 Acceptance Standards for liquid penetrant indications shall be as shown in Table 1.

5.2 Broad areas of pigmentation which would mask indications of defects are unacceptable.

6. EVALUATION OF INDICATIONS

6.1 All indications shall be examined in terms of the Acceptance Standards of Table 1.

6.2 Any indications which exceed the Acceptance Standards in Table 1 shall be regarded as representing discontinuities and shall be re-examined to verify whether or not actual discontinuities are present. Surface conditioning may precede the re-examination.

6.3 An indication may be larger than the discontinuity which causes it. However, the size of the indication and not the size of the discontinuity is the basis of acceptance or rejection.

7. REMOVAL AND REPAIR OF DISCONTINUITIES

7.1 Parts rejected through the application of these standards may be repaired. If welding is required, it shall be in accordance with the requirement specified in the applicable steel casting or forging specifications.

7.2 Discontinuities in excess of those represented by acceptable indications shall be removed by suitable means. If removal of surface discontinuities to acceptable level does not result in reducing wall thickness below acceptable minimum, the area shall be blended smoothly into surrounding surface. Where removal of discontinuities results in a wall thickness below acceptable minimum, the resultant cavity may be repaired by welding. Welded areas shall be blended smoothly into surrounding surface.

7.3 Areas which as a result of liquid penetrant examination, have been weld repaired or from which discontinuities have been removed without requirement for weld repair, shall be re-examined by the liquid penetrant method.

7.4 The Acceptance Standards for liquid penetrant re-examination required under subsection 7.3 shall be as shown in Table 1.

8. PERSONNEL REQUIREMENTS

8.1 The manufacturer shall be responsible for assigning qualified personnel to perform liquid penetrant examinations in conformance with the requirements of this Standard Practice.

8.2 A qualification record of personnel considered suitable by the manufacturer to perform examinations in accordance with this Standard Practice shall be available upon request. ASNT Recommended Practice No. SNT-TC-1A provides a recommended procedure for qualifying personnel.

TABLE—1 ACCEPTANCE STANDARD CRITERIA**A. CASTINGS**

Maximum acceptable indications are as follows:

Linear Indications as defined in Subsection 3.3

- 0.3" (8 mm) long for materials up to 0.5" (13 mm) thick
- 0.5" (13 mm) long for materials 0.5" to 1" (13 mm to 25 mm) thick
- 0.7" (18 mm) long for materials over 1" (25 mm) thick

For linear indications, the indications must be separated by a distance greater than the length of an acceptable indication.

Rounded indications as defined in Subsection 3.4

- 0.3" (8 mm) dia. for materials up to 0.5" (13 mm) thick
- 0.5" (13 mm) dia. for materials over 0.5" (13mm) thick

Four or more rounded indications in a line separated by 0.06" (2 mm) or less edge to edge are unacceptable.

B. FORGINGS

Maximum acceptable indications are as follows:

Linear indications as defined in Subsection 3.3

- 0.2" (5 mm) long for materials up to 0.5" (13 mm) thick
- 0.4" (10 mm) long for materials 0.5" to 1" (13 mm to 25 mm) thick
- 0.6" (15 mm) long for materials over 1" (25 mm) thick

For linear indications, the indications must be separated by a distance greater than the length of an acceptable indication.

Rounded indications as defined in Subsection 3.4

- 0.2" (5 mm) dia. for materials up to 0.5" (13 mm) thick
- 0.3" (8 mm) dia. for materials over 0.5" (13 mm) thick

Four or more rounded indications in a line separated by 0.06" (2 mm) or less edge to edge are unacceptable.

| ANNEX A |
REFERENCED STANDARDS AND APPLICABLE DATES

This Annex is an integral part of this Standard Practice which is placed after the main text for convenience.

Standard Name or Designation

ASNT

SNT-TC-1A-1996	Recommended Practice for Personnel Qualifications and Certification in Nondestructive Testing
----------------	---

ASTM

Specification for:

E165-1991	Standard Practice for Liquid Penetrant Inspection
-----------	---

Publications of the following organizations appear in the above list.

ASNT	American Society for Nondestructive Testing 4153 Arlingate Plaza, Columbus, OH 43228
------	---

ASTM	American Society for Testing and Materials 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959
------	---

List of MSS Standard Practices
(Price List Available Upon Request)

Number	
SP-6-1996	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-1997	Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System For Valves, Fittings, Flanges and Unions
SP-42-1999	(R 95) Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 96) Wrought Stainless Steel Butt-Welding Fittings
SP-44-1996	Steel Pipeline Flanges
SP-45-1998	Bypass and Drain Connections
SP-51-1991	(R 95) Class 150LW Corrosion Resistant Cast Flanges and Flanged Fittings
SP-53-1999	Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-1996	Quality Standard for Steel Castings for Valves, Flanges and Fittings and Other Piping Components - Visual Method for Eval. of Surface Irregularities
SP-58-1993	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-60-1999	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-1999	Pressure Testing of Steel Valves
SP-65-1999	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP-67-1995	Butterfly Valves
SP-68-1997	High Pressure Butterfly Valves with Offset Design
SP-69-1996	Pipe Hangers and Supports - Selection and Application
SP-70-1998	Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-1997	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1999	Ball Valves with Flanged or Butt-Welding Ends for General Service
SP-73-1991	(R 96) Brazing Joints for Wrought and Cast Copper Alloy Solder Joint Pressure Fittings
SP-75-1998	Specification for High Test Wrought Butt Welding Fittings
SP-77-1995	Guidelines for Pipe Support Contractual Relationships
SP-78-1998	(R 92) Cast Iron Plug Valves, Flanged and Threaded Ends
SP-79-1999a	Socket-Welding Reducer Inserts
SP-80-1997	Bronze Gate, Globe, Angle and Check Valves
SP-81-1995	Stainless Steel, Bonnetless, Flanged, Knife Gate Valves
SP-82-1992	Valve Pressure Testing Methods
SP-83-1995	Class 3000 Steel Pipe Unions, Socket-Welding and Threaded
SP-85-1994	Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-1997	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-87-1991	(R 96) Factory-Made Butt-Welding Fittings for Class 1 Nuclear Piping Applications
SP-88-1993	Diaphragm Type Valves
SP-89-1998	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-1986	(R 91) Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operation of Valves
SP-92-1999	(R 92) MSS Valve User Guide
SP-93-1999	(R 92) Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components - Liquid Penetrant Examination Method
SP-94-1999	Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Ultrasonic Examination Method
SP-95-1999	(R 91) Swage (d) Nipples and Bull Plugs
SP-96-1996	Guidelines on Terminology for Valves and Fittings
SP-97-1995	Integrally Reinforced Forged Branch Outlet Fittings - Socket Welding, Threaded and Buttwelding Ends
SP-98-1996	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	Instrument Valves
SP-100-1997	Qualification Requirements for Elastomer Diaphragms for Nuclear Service Diaphragm Type Valves
SP-101-1989	Part-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-103-1995	Wrought Copper and Copper Alloy Insert Fittings for Polybutylene Systems
SP-104-1995	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	Instrument Valves for Code Applications
SP-106-1990	(R 96) Cast Copper Alloy Flanges and Flanged Fittings, Class 125, 150 and 300
SP-107-1991	Transition Union Fittings for Joining Metal and Plastic Products
SP-108-1996	Resilient-Seated Cast Iron-Eccentric Plug Valves
SP-109-1996	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-1996	Gray-Iron and Ductile-Iron Tapping Sleeves
SP-112-1999	Quality Standard for Evaluation of Cast Surface Finishes - Visual and Tactile Method. This SP must be sold with a 10-surface, three-dimensional Cast Surface Comparator, which is a necessary part of the Standard. Additional Comparators may be sold separately at \$19.00 each. Same quantity discounts apply on total order.
SP-113-1999	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-1995	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-1999	Excess Flow Valves for Natural Gas Service
SP-116-1996	Service Line Valves and Fittings for Drinking Water Systems
SP-117-1996	Bellows Seals for Globe and Gate Valves
SP-118-1996	Compact Steel Globe & Check Valves - Flanged, Flangeless, Threaded & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-1996	Belled End Socket Welding Fittings, Stainless Steel and Copper Nickel
SP-120-1997	Flexible Graphite Packing System for Rising Stem Steel Valves (Design Requirements)
SP-121-1997	Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP-122-1997	Plastic Industrial Ball Valves
SP-123-1998	Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube
(R-YEAR)	Indicates year standard reaffirmed without substantive changes

A large number of former MSS Practices have been approved by the ANSI or ANSI Standards, published by others. In order to maintain a single source of authoritative information, the MSS withdraws its Standard Practices in such cases.

Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.
127 Park Street, N.E., Vienna, VA 22180-4620 • (703) 281-6613 Fax # (703) 281-6671