

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

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**Magnetic Particle  
Examination Method**

Standard Practice  
Developed and Approved by the  
Manufacturers Standardization Society of the  
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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.

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**| FOREWORD |**

The standard practice provides methods and acceptance standards for magnetic particle examination of ferritic steel valves, flanges, fittings and other piping components by use of dry magnetic powder or wet magnetic particles. It is applicable to examination of repairs as well as to initial examination of castings and forgings.

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**QUALITY STANDARD FOR STEEL CASTINGS AND FORGINGS FOR VALVES, FLANGES  
& FITTINGS & OTHER PIPING COMPONENTS**

**1. SCOPE**

1.1 The methods of Section 3.0 provide uniform procedures which will produce satisfactory and consistent results upon which the acceptance standards of Table 1 may be used.

1.2 This examination guide may be used on a voluntary basis or when specified in the inquiry, contract, or order and when mutually agreed upon by the manufacturer and the purchaser.

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

**2. DEFINITIONS**

2.1 Pressure Containing Piece - A piece 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 pieces.

2.2 Indication - A detectable magnetic particle accumulation resulting from a distortion of the magnetic field.

2.3 Linear Indication - An indication in which the length is more than three times the width.

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

2.5 Standard Definitions - See ASTM E 1316 Terminology for Nondestructive Examination.

**3. PROCEDURE**

3.1 All exterior and accessible interior surfaces of the pressure containing parts shall be examined by the magnetic particle method. Examination may occur prior to machining or after machining at the manufacturer's option. This standard practice may also be used for examination of other parts when mutually agreed upon by the manufacturer and the purchaser.

3.2 Magnetic particle procedures and personnel qualification requirements for casting examination shall be in accordance with ASTM E 709. For forging, the examination procedures and personnel qualification requirements shall be in accordance with ASTM A 275/A 275M.

#### **4. ACCEPTANCE STANDARDS**

Acceptance Standards for magnetic particle indications shall be as shown in Table 1.

#### **5. REFERENCE PHOTOGRAPHS**

5.1 Typical Magnetic Particle Indications are shown in ASTM E 125, Reference Photographs for Magnetic Particle Indications on Ferrous Castings.

5.2 Indications of weld discontinuities illustrated in ASTM E 125 are merely examples of discontinuities in weld repairs and not degree of severity.

5.3 The ten examples of false indications and magnetic anomalies illustrated in ASTM E 125 are necessary as a guide to the type of indications and not necessarily indicative of any conditions concerning integrity or usefulness under the scope of quality herein defined. It is recognized that in some instances surveys by methods other than magnetic particle examination may be necessary to establish what indications belong to these categories.

#### **6. REMOVAL AND REPAIR OF DISCONTINUITIES**

6.1 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.

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

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

6.4 The acceptance standards for magnetic particle re-examination required under Section 6.3 shall be as shown in Table 1.

**TABLE 1 - ACCEPTANCE STANDARDS****A. Castings**

Maximum acceptable indications are as follows:

Linear indications as defined in Subsection 2.3

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 2.4

0.3" ( 8 mm) dia. for materials up to 0.5" (13 mm) thick  
0.5" (13 mm) dia. for materials over 0.5" (13 mm) 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 indentions as defined in Subsection 2.3

0.2" ( 5 mm) long for materials 0.5" (13 mm) or less 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 2.4

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.

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| ANNEX A |

REFERENCE STANDARDS AND APPLICABLE DATES

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

Standard Name or Description

ASTM

A 275/A 275 M-1996	Standard Test Method for Magnetic Particle Examination of steel castings
E 125-1997 Particle Indications on	Standard Reference Photographs for Magnetic Ferrous Castings
E 709-1995 Examination	Standard Guide for Magnetic Particle Examination
E 1316-1997b Examination	Standard Terminology for Nondestructive Examination

Publications of the following organization appear in the above list.

ASTM 19428-2959	American Society for Testing and Materials 100 Barr Harbor Drive, West Conshohocken, PA
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## List of MSS Standard Practices (Price List Available Upon Request)

Number	
SP-6-2001	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-End Flanges of Valves and Fittings
SP-9-2001	Spot Facing for Bronze, Iron and Steel Flanges
SP-25-1998	Standard Marking System for Valves, Fittings, Flanges and Unions
SP-42-1999	Class 150 Corrosion Resistant Gate, Globe, Angle and Check Valves with Flanged and Butt Weld Ends
SP-43-1991	(R 01) Wrought Stainless Steel Butt-Welding Fittings
SP-44-1996	(R 01) Steel Pipeline Flanges
SP-45-1998	Bypass and Drain Connections
SP-51-2000	Class 150LW Corrosion Resistant Cast Flanges and Flanged Fittings
SP-53-1999	(R 02) Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP-54-1999	(R 02) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP-55-2001	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation 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-67-2002	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	(R 00) Guidelines for Pipe Support Contractual Relationships
SP-78-1998	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-81-2001	Stainless Steel, Bonnetless, Flanged Knife Gate Valves
SP-82-1992	Valve Pressure Testing Methods
SP-83-2001	Class 3000 Steel Pipe Unions, Socket Welding and Threaded
SP-85-1994	Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
SP-86-2002	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP-88-1993	(R 01) Diaphragm Valves
SP-89-1998	Pipe Hangers and Supports - Fabrication and Installation Practices
SP-90-2000	Guidelines on Terminology for Pipe Hangers and Supports
SP-91-1992	(R 96) Guidelines for Manual Operations of Valves
SP-92-1999	MSS Valve User Guide
SP-93-1999	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-95-2000	Swage(d) Nipples and Bull Plugs
SP-96-2001	Guidelines on Terminology for Valves and Fittings
SP-97-2001	Integrally Reinforced Forged Branch Outlet Fittings-Socket Welding, Threaded, and Buttwelding Ends
SP-98-2001	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1994	(R 01) Instrument Valves
SP-100-1997	Qualification Requirements for Elastomer Diaphragms for Nuclear Diaphragm Type Valves
SP-101-1989	(R 01) Part-Turn Valve Actuator Attachment-Flange and Driving Component Dimensions and Performance Characteristics
SP-102-1989	(R 01) Multi-Turn Valve Actuator Attachment - Flange and Driving Component Dimensions and Performance Characteristics
SP-103-1995	(R 00) Wrought Copper and Copper Alloy Insert Fittings for Polyethylene Systems
SP-104-1995	Wrought Copper Solder Joint Pressure Fittings
SP-105-1996	(R 01) 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	(R 00) Transition Union Fittings for Joining Metal and Plastic Products
SP-108-2002	Resilient-Seated Cast-Iron Eccentric Plug Valves
SP-109-1997	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1996	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
SP-111-2001	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 \$25.00 each. Same quantity discounts apply on total order.
SP-113-2001	Connecting Joint between Tapping Machines and Tapping Valves
SP-114-2001	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP-115-1999	Excess Flow Valves 1 1/4 NPS and Smaller, for Natural Gas Service
SP-116-1996	Service Line Valves and Fittings for Drinking Water Systems
SP-117-2002	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	Bellied 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-Perrous Threaded and Solder-Joint Unions for Use With Copper Water Tube
SP-124-2001	Fabricated Tapping Sleeves
SP-125-2000	Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves
SP-126-2000	Steel In-Line Spring-Assisted Center Guided Check Valves
SP-127-2001	Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, Application
(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 Practice in such cases

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