

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

**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.

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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.

| 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	Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings
E 709-1995	Standard Guide for Magnetic Particle Examination
E 1316-1997b	Standard Terminology for Nondestructive Examination

Publications of the following organization appear in the above list.

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

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

Number	
SP-4-1960	Standard Finishes for Contact Faces of Pipe Flanges and Connecting-end Flanges of Valves and Fittings
SP 5 1960	Spot Taping for Groove, Flare and Saddle Flanges
SP 12 1959	Standard Marking System for Valves, Fittings, Flanges and Unions
SP 42 1959	Class 150 Corrosion Resistant Cast, Globe, Angle and Check Valves with Flanged and Butt Weld Ends
SP 43 1959	(R 50) Mottled Stainless Steel Butt Welding Fittings
SP-44-1956	(R 50) Steel Pipeline Flanges
SP-44-1958	Bypass and Drain Connections
SP-51-1960	Class 1500W Corrosion Resistant Cast Flanges and Flanged Fittings
SP 52 1959	(R 50) Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method
SP 54 1959	(R 50) Quality Standard for Steel Castings for Valves, Flanges, and Fittings and Other Piping Components - Radiographic Examination Method
SP 55 1960	Quality Standard for Steel Castings for Valves, Flanges, Fittings, and Other Piping Components - Visual Method for Evaluation of Surface Imperfections
SP-58-1959	Pipe Hangers and Supports - Materials, Design and Manufacture
SP-60-1959	Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
SP-61-1959	Pressure Testing of Steel Valves
SP 67 1959	High Pressure Chemical Industry Flanges and Threaded Stubs for Use with Lens Gaskets
SP 67 1962	Butterfly Valves
SP 68 1957	High Pressure Butterfly Valves with Offset Design
SP 69 1956	Pipe Hangers and Supports - Selection and Application
SP 70 1956	Cast Iron Gate Valves, Flanged and Threaded Ends
SP-71-1957	Gray Iron Swing Check Valves, Flanged and Threaded Ends
SP-72-1959	Ball Valves with Flanged or Butt Welding Ends for General Service
SP-74-1957	(R 50) Drawing Symbols for Wrought and Cast Copper Alloy Solenoid Pressure Fittings
SP 75 1958	Specification for High Cast Wrought Butt Welding Fittings
SP 77 1955	(R 50) Guidelines for Pipe Support Contractual Relationships
SP 78 1956	Cast Iron Plug Valves, Flanged and Threaded Ends
SP 79 1959a	Socket Welding Reducer Inserts
SP-80-1957	Stem Gages, Globe, Angle and Check Valves
SP 81 1960	Stainless Steel, Duplex Steel, Flanged In-line Gate Valve
SP-82-1952	Valve Pressure Testing Methods
SP 83 1960	Class 3000 Steel Pipe Union, Socket Welding and Threaded
SP-85-1956	Cast Iron Globe & Angle Valves, Flanged and Threaded Ends
SP 86 1962	Guidelines for Metric Data in Standards for Valves, Flanges, Fittings and Actuators
SP 88 1953	(R 50) Diaphragm Valves
SP 89 1958	Pipe Hangers and Supports - Fabrication and Installation Practices
SP 90 1960	Guidelines on Technology for Pipe Hangers and Supports
SP-91-1952	(R 50) Guidelines for Manual Operations of Valves
SP 92 1959	MSS Valve User Guide
SP-93-1959	Quality Standard for Steel Castings and Forgings for Valves, Flanges, and Fittings and Other Piping Components-Liquid Penetrant Examination Method
SP-94-1959	Quality Std for Ferritic and Martensitic Steel Castings for Valves, Flanges, and Fittings and Other Piping Components-Ultrasonic Examination Method
SP 97 1960	Standard Nipples and Bull Plugs
SP 98 1960	Guidelines on Technology for Valves and Fittings
SP-99-1960	Integrity Reinforced Forged Branch Outlet Fittings-Socket Welding, Threaded, and Butt Welding Ends
SP-99-1960	Protective Coatings for the Interior of Valves, Hydrants, and Fittings
SP-99-1954	(R 50) Instrument Valves
SP-100-1957	Qualification Requirements for Standard Diaphragm for Nuclear Diaphragm Type Valves
SP 101 1959	(R 50) Ball Turn Valve Actuator Attachment Flange and Driving Component Dimensions and Performance Characteristics
SP 102 1959	(R 50) Ball Turn Valve Actuator Attachment Flange and Driving Component Dimensions and Performance Characteristics
SP-103-1955	(R 50) Wrought Copper and Copper Alloy Invert Fittings for Polyethylene Systems
SP 104 1955	Wrought Copper Solenoid Joint Pressure Fittings
SP-105-1956	(R 50) Instrument Valves for Code Applications
SP 106 1950	(R 50) Cast Copper Alloy Flanges and Flange Fittings, Class 125, 150 and 300
SP 107 1951	(R 50) Transition Union Fittings for Joining Metal and Plastic Products
SP 108 1952	Resilient Seated Cast Iron Reentrant Plug Valves
SP 109 1957	Welded Fabricated Copper Solder Joint Pressure Fittings
SP-110-1956	Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flanged Ends
SP-110-1960	Gray-Iron and Ductile-Iron Tapping Sleeves
SP-112-1959	Quality Standard for Evaluation of Cast Surface Finishes - Visual and Dye Penetration 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 1960	Connecting Joint Between Tapping Machines and Tapping Valves
SP 114 1960	Corrosion Resistant Pipe Fittings Threaded and Socket Welding, Class 150 and 1000
SP 115 1959	Excess Flow Valves 1 1/4" NPS and Smaller, for Natural Gas Service
SP-116-1956	Service Size Valves and Fittings for Drinking Water Systems
SP-117-1962	Bellows Seals for Globe and Gate Valves
SP-118-1956	Contact Steel Globe & Check Valves - Flanged, Flangeless, Threaded & Welding Ends (Chemical & Petroleum Refinery Service)
SP-119-1956	Ball and Socket Welding Fittings, Stainless Steel and Copper Nickel
SP 120 1957	Flexible Diaphragm Packing System for Rising Stem Steel Valves (Design Requirements)
SP 121 1957	Qualification Testing Methods for Stem Packing for Rising Stem Steel Valves
SP 122 1957	Plastic Industrial Ball Valves
SP 123 1958	Non Ferrous Threaded and Solder Joint Unions for Use With Copper Water Tube
SP 124 1960	Fabricated Tapping Sleeves
SP-125-1960	Gray Iron and Ductile Iron In-line, Spring-Loaded, Center-Guided Check Valves
SP-126-1960	Steel, In-line Spring-Assisted Center Guided Check Valves
SP-127-1960	Bracing for Piping Systems Subject-Wind-Dynamic Design, Selection, Application
(R 1960)	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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