

**MSS SP-53-2012**

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

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**Magnetic Particle  
Examination Method**

**Standard Practice**  
Developed and Approved by the  
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## | FOREWORD |

Historically, magnetic particle inspection has been applied to steel castings since the mid-1900's. It became regarded as an aid to the manufacture of steel castings, particularly pressure containing castings, for use in "severe services". The application of magnetic particle inspection had progressed to the point of recognition in 1944, warranting the issuance by ASTM of its method of "Magnetic Particle Testing and Inspection of Commercial Steel Castings", known as ASTM A272-44 (withdrawn in 1945). It had been the practice of manufacturers and users of steel castings to survey castings for the type of defects as revealed by the procedures and to reach agreement on the extent and areas for which this procedure was to be used. There had been no standard establishing a dividing line between acceptable magnetic particle indications and those requiring probing or further exploration.

In the mid-1950's, there was an increasing demand on the part of certain users of steel valves, fittings, and flanges, particularly in the oil refining industry, to establish minimum requirements for freedom from discontinuities of the type revealed by magnetic particle tests. As the demand for such a quality level grew, it has become apparent that some uniform code of acceptance would have to be developed beyond the mere procedure for making the inspection. To this end the ASTM has promulgated E125, "Reference Photographs for Magnetic Particle Indications on Ferrous Castings". These photographs typify the type, character, and extent of indication relative to the quality definitions embraced in this MSS Standard Practice. The reference photographs were originally obtained by a procedure in accordance with ASTM E109, "Method for Dry Powder Magnetic Particle Inspection", which replaced ASTM A272 in regards to the type of castings covered herein are concerned. Note that ASTM E109 was eventually withdrawn in 1981 and subsequently replaced by ASTM E709.

The original selection of photographs and their interpretation was undertaken by the Steel Founders Society of America and were made available to ASTM Committee E-7 for the purpose of establishing the "Reference Photographs". These reference photographs served a parallel purpose to ASTM E71, "Industrial Radiographic Standards for Steel Castings", originally prepared by the Navy Department's Bureau of Ships as reference for repair and/or acceptance of steel castings upon a basis of radiographic inspections. Thus, the magnetic particle reference photographs were treated as another type of "go-no-go" gage in defining the original criteria established within this MSS Standard Practice. Note that ASTM E71 was withdrawn in 1974 and subsequently replaced by ASTM E446.

The MSS SP-53 was originally approved in January 1957. Complying with MSS SP-53 serves to codify a quality level in cast steel valves, fittings, and flanges involving casting discontinuities to an extent beyond that which may be attained through visual inspection. The quality herein implied is the minimum consideration of safety for the services in which such castings are to be used. There is no implication intended that "visual quality inspection" of steel casting will not fully support the ratings and requirements of ASME B16.5.

The ASTM E125 Reference Photographs were originally adopted at the prompting of a Joint Task Force promoted by Subcommittee 3, of ASA (later known as ANSI) Standards Committee B31, on Refinery Piping Systems; consisting of representatives of ASA, Steel Founders' Society of America (SFSA), ASTM, ASME, and MSS. In addition, the aforementioned Standards Committee B31 (developer of the standard known today as ASME B31 or the American National Standard Code for Pressure Piping), involving the section in B31 relating to Refinery Piping Systems, was concerned with pressure castings and expressed interest in MSS SP-53, given its scope and examination applicability. It was then contemplated during this time that MSS SP-53 would be employed by the B31 Refinery group as a "practical vehicle whereby the Pressure Piping Code's safe practice precepts may be exerted over the steel castings used in the manufacture of valves, fittings, and flanges".

This Forward is informational and provides a historical perspective on the subject. MSS acknowledges the original assistance and collaboration involving MSS SP-53 by the supporting members of the former ASA Standards Committee B31 as mentioned above.

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

**MAGNETIC PARTICLE EXAMINATION METHOD**

1. **SCOPE**

1.1 This 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 the examination of repairs and the initial examination of castings and forgings.

1.2 The methods contained in this Standard Practice provide uniform procedures that will produce satisfactory and consistent results upon which the acceptance standards of Table 1 may be used.

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

1.4 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, 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 E1316, "Standard Terminology for Nondestructive Examinations"; relating to magnetic particle inspection and 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 E709. For forgings, the examination procedures and personnel qualification requirements shall be in accordance with ASTM A275/A275M.

4. **ACCEPTANCE STANDARDS**

4.1 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 E125, Reference Photographs for Magnetic Particle Indications on Ferrous Castings.

5.2 Indications of weld discontinuities illustrated in ASTM E125 are merely examples of discontinuities in weld repairs and are not indicative of the degree of severity.