

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

Liquid Penetrant Examination Method

Standard Practice
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Substantive changes in this 2020 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 2014 edition.

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FOREWORD

This MSS Standard Practice, SP-93, *Quality Standard for Steel Castings and Forgings for Valves, Flanges, Fittings, and Other Piping Components – Liquid Penetrant Examination Method*, 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.

This Standard Practice was reaffirmed in 1987 with essentially no changes.

The Third edition was reaffirmed in 1992 with essentially no changes.

The 1999 edition included minor revisions and was re-formatted to conform to MSS publication practices.

The 2008 edition included minor revisions and was re-formatted to conform to MSS publication practices.

The 2014 edition included editorial corrections, a clarification to Scope in Section 1, update of Section 7 and Table 1, and an update of Annex A references. It was also re-formatted to conform to current MSS publication practices.

This 2020 edition includes a new definition in Section 3.5, updated Annex A references, other minor revisions, and re-formatting to conform to current MSS publication practices.

This 2020 edition includes updates to the definitions in Section 3, updated Annex A references, other minor revisions, and re-formatting to conform to current MSS publication practices.

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Manufacturers Standardization Society of the Valve and Fittings Industry

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

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

2. REFERENCES

ASNT SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*

ASTM E165/E165M, *Standard Practice for Liquid Penetrant Examination for General Industry*

3. DEFINITIONS

3.1 **Indication** – The visible bleed-out of liquid from a discontinuity.

3.2 **Linear Indication** – An indication in which the length is three (3) or more times the width.

3.3 **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.

3.4 **Rounded Indication** – An indication which is circular or elliptical, with its length less than three (3) times its width.

3.5 **Surface Conditioning** – Metal removing processes such as filing, buffing, scraping, mechanical milling, drilling, reaming, grinding, liquid honing, sanding, Lathe cutting, tumble or vibratory deburring, and abrasive blasting, including abrasives such as glass beads, sand, aluminum oxide, lignocellulose pellets, metallic shot, etc., are often used to remove such soils as carbon, rust and scale, and foundry adhering sands, as well as to deburr or produce a desired cosmetic effect on the part.

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 E165/E165M.

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 Piping parts and components rejected through the application of the Acceptance Standards in Table 1 may be repaired. If welding is required, it shall be performed by qualified personnel and in accordance with the requirements 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 an acceptable level does not result in reducing wall thickness below the acceptable minimum, then the area shall be blended smoothly into the surrounding surface. Where removal of discontinuities results in a wall thickness that is below the acceptable minimum, then the resultant cavity may be repaired by welding. Welded areas shall be blended smoothly into the 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 Section 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 SNT-TC-1A provides a recommended practice for qualifying personnel.

TABLE 1
Acceptance Standard Criteria

A. CASTINGS
Maximum acceptable indications are as follows:
<u>Linear Indications as defined in Section 3.2</u> 0.3 in. (8 mm) long for materials up to 0.5 in. (13 mm) thick 0.5 in. (13 mm) long for materials over 0.5 in. to 1 in. (13 mm to 25 mm) thick 0.7 in. (18 mm) long for materials over 1 in. (25 mm) thick Linear indications must be separated by a distance greater than the length of the longest, adjacent acceptable linear indication.
<u>Rounded Indications as defined in Section 3.4</u> 0.3 in. (8 mm) diameter for materials up to 0.5 in. (13 mm) thick 0.5 in. (13 mm) diameter for materials over 0.5 in. (13mm) thick Four or more rounded indications in a line separated by 0.06 in. (2 mm) or less edge-to-edge are unacceptable, unless the total length does not exceed the individual diameter size allowed for the material thickness being evaluated.
B. FORGINGS
Maximum acceptable indications are as follows:
<u>Linear Indications as defined in Section 3.2</u> 0.2 in. (5 mm) long for materials up to 0.5 in. (13 mm) thick 0.4 in. (10 mm) long for materials over 0.5 in. to 1 in. (13 mm to 25 mm) thick 0.6 in. (15 mm) long for materials over 1 in. (25 mm) thick Linear indications must be separated by a distance greater than the length of the longest, adjacent acceptable linear indication.
<u>Rounded Indications as defined in Section 3.4</u> 0.2 in. (5 mm) diameter for materials up to 0.5 in. (13 mm) thick 0.3 in. (8 mm) diameter for materials over 0.5 in. (13 mm) thick Four or more rounded indications in a line separated by 0.06 in. (2 mm) or less edge-to-edge are unacceptable, unless the total length does not exceed the individual diameter size allowed for the material thickness being evaluated.

| ANNEX A |**Referenced 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	Description
<u>ASNT; ANSI/ASNT</u>	
SNT-TC-1A-2016	Personnel Qualification and Certification in Nondestructive Testing (includes ANSI/ASNT CP-105-2016, Standard Topical Outlines for Qualification of Nondestructive Personnel)
<u>ASTM</u>	
E165/E165M-2018	Standard Practice for Liquid Penetrant Examination for General Industry

The following organizations appear in the above list:

ANSI	American National Standards Institute, Inc. 25 West 43rd Street, Fourth Floor New York, NY 10036-7406
ASNT	The American Society for Nondestructive Testing, Inc. 1711 Arlingate Lane Columbus, OH 43228-0518
ASTM	ASTM International 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken, PA 19428-2959