



Designation: A986/A986M – 01 (Reapproved 2021)

Standard Specification for Magnetic Particle Examination of Continuous Grain Flow Crankshaft Forgings¹

This standard is issued under the fixed designation A986/A986M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the magnetic particle examination of forged continuous grain flow (CGF) crankshafts intended for medium speed diesel engines.

1.2 For the purpose of magnetic particle indication assessment, the crankshaft is divided into four zones of decreasing operational stress. Acceptance criteria have been set for each zone.

1.3 The engines to which these crankshafts are fitted are commonly used for diesel electric locomotives, marine propulsion, and power generation. Engines fueled by natural gas also fall into this medium speed category.

1.4 Specification A983/A983M is a product specification that covers the manufacture of CGF crankshafts.

1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not necessarily exact equivalents; therefore, to ensure conformance with the standard, each system shall be used independently of the other, and values from the two systems shall not be combined.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

A788/A788M Specification for Steel Forgings, General Requirements

¹ This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.06 on Steel Forgings and Billets.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

A966/A966M Practice for Magnetic Particle Examination of Steel Forgings Using Alternating Current
A983/A983M Specification for Continuous Grain Flow Forged Carbon and Alloy Steel Crankshafts for Medium Speed Diesel Engines

3. Ordering Information

3.1 Specification A983/A983M requires that crankshafts made to that specification be examined in accordance with Specification A986/A986M for magnetic particle examination. It is the responsibility of the purchaser to specify any changes to the zone allocations for the crankshaft surfaces.

4. Procedure

4.1 Magnetic particle examination shall be conducted in accordance with Practice A966/A966M. The use of prod type contacts is not permitted on finished crankshaft surfaces. Magnetic leeches may be used only on flat noncritical surfaces, and within the limitations specified in Practice A966/A966M.

4.2 The magnetic particle examination shall be conducted using the wet fluorescent method described in Practice A966/A966M.

5. Areas of Examination

5.1 *Zone 1—Major Critical Areas:*

5.1.1 *Crankpin Journals*—The major critical area of each crankpin journal shall include that area ± 60 from the 6 o'clock position of the crankpin and extend $\frac{3}{8}$ in. [10 mm] above the fillet collar and $\frac{5}{8}$ in. [15 mm] along the crankpin surface as measured from the blend of the fillet radius and the journal surface. These positions are shown in Fig. 1.

5.1.2 *Main Bearing Journals*—The major critical areas of any main bearing journal shall include that area ± 60 from the 12 o'clock position on top of the journal and extend $\frac{3}{8}$ in. [10 mm] above the fillet collar and $\frac{5}{8}$ in. [15 mm] along the journal as measured from the blend of the fillet radius and the journal surface. These positions are shown in Fig. 1.

5.1.3 *Oil Holes*—The major critical areas in also shall include the surfaces surrounding the journal oil holes. The diameter of this critical area shall be 3d, where d is the oil hole diameter before the radius. The critical area shall be centered on the centerline of the oil hole. In addition, the Zone 1 critical

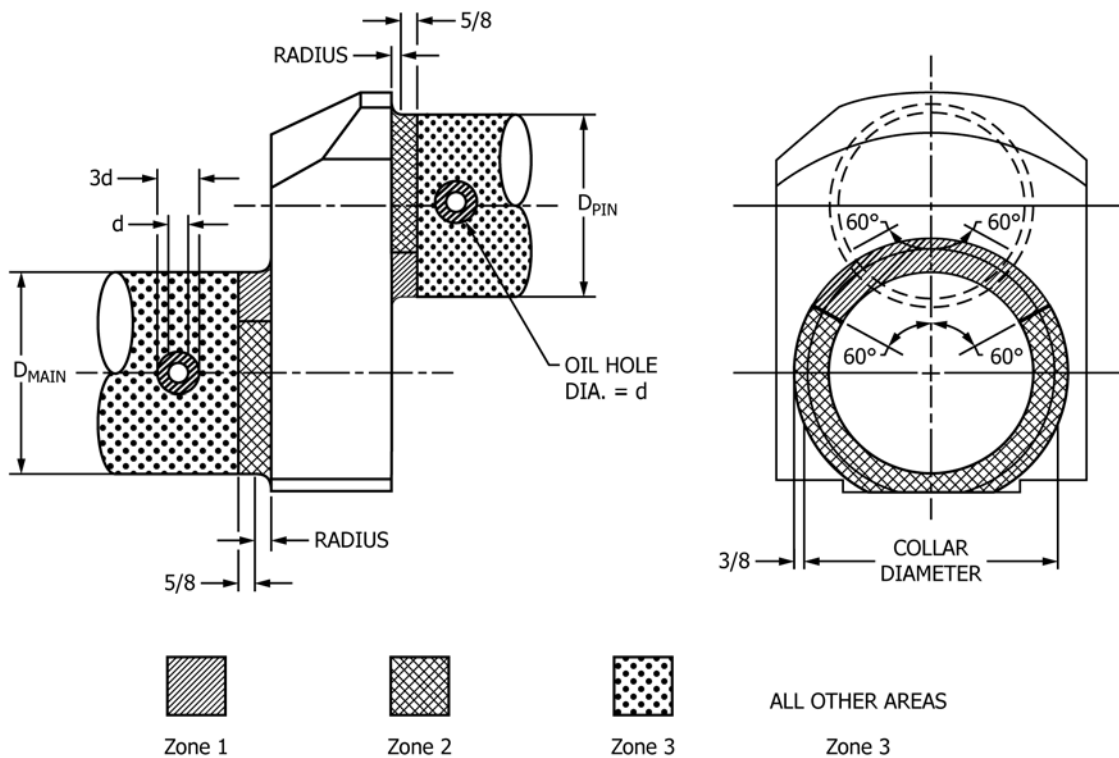


FIG. 1

area shall extend down the oil hole for a distance from the journal surface equal to the hole diameter.

5.2 Zone 2—Minor Critical Areas:

5.2.1 The Zone 2 minor critical areas shall include the balance of the fillet radii of the crankpin and main bearing journals not included in the major critical areas.

5.2.2 When counterweights are attached to the crankshaft webs by welding, the weld surfaces and $1/2$ in. [13 mm] of the adjacent surfaces shall be considered minor critical areas.

5.3 Zone 3—Journal Running Surfaces:

5.3.1 Zone 3 includes the remainder of the crankpin and main bearing journal surfaces not covered by the major and minor critical areas.

5.3.2 Zone 3 also includes the bearing journal surfaces for auxiliary drives, gear fit surfaces, keyways, and coupling flange radii.

5.4 Zone 4—All Other Areas:

5.4.1 Zone 4 includes the crankpin web surfaces, excluding areas covered by the major and minor critical areas, flange faces and periphery, and any other surfaces not included in Zones 1, 2, or 3.

6. Classification of Indications

6.1 Surface magnetic particle indications shall be classified as open or non-open.

6.1.1 Open indications are defined as those being visible after removal of the magnetic particles under a minimum 5 times optical magnification.

6.1.2 Non-open indications are not visible after removal of the magnetic particles.

7. Acceptance Criteria

7.1 Zone 1:

7.1.1 Indications are not permitted and must be removed by grinding or polishing. The original shape of the fillet must be maintained, when indications have been removed. The blended area shall not be deeper than 0.006 in. [0.15 mm] below the minimum drawing fillet dimension for the location.

7.1.2 The total area blended at less than the relevant minimum dimension shall not exceed 5 % of the major critical area of the particular crankpin or main bearing fillet or designated surface at an oil hole.

7.2 Zone 2:

7.2.1 Open indications are not permitted and must be removed. The depth of the resulting depression shall not exceed 0.010 in. [0.25 mm] below the minimum fillet dimension for the location. The total area of depressions or dimples in a Zone 2 fillet shall not exceed 5 % of the Zone 2 fillet area.

7.2.2 Non-open indications are permitted up to a maximum length of 2 % of D , where D is the diameter of the journal in question. The maximum total length of non-open indications in a Zone 2 fillet location shall not exceed 0.75 in. [20.0 mm], and the individual indications must be separated from each other by a minimum length of 2 % of D .

7.2.3 Non-open indications exceeding the length limitations of 7.2.2, either individually or in total, may be dimpled to a maximum depth of 0.010 in. [0.25 mm] below the minimum drawing dimension, but the aggregate length and area limitations of 7.2.1 and 7.2.2 shall apply.

7.2.4 The combined dimple areas in any main or crankpin journal fillet shall not exceed 8 % of the total fillet area.