



# Standard Reference Photographs for Magnetic Particle Indications on Ferrous Castings<sup>1</sup>

This standard is issued under the fixed designation E 125; 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 approval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense. These Reference Radiographs have been approved to replace MIL-M-11473 (ORD). These Reference Photographs<sup>2</sup> have been reproduced through the courtesy of the Steel Founders' Society from photographs obtained from its member companies.*

## 1. Scope

1.1 This collection of reference photographs covers types and degrees of discontinuities occurring in steel castings and other types of ferrous castings detectable by the dry powder magnetic particle method.

1.2 These reference photographs are intended to assist in the classification of those discontinuities revealed in ferrous castings subjected to magnetic particle examination.

1.3 These reference photographs are intended to be used for purposes of comparison with the magnetic particle indications observed on actual castings.

## 2. Referenced Documents

2.1 *ASTM Standards:*

E 709 Guide for Magnetic Particle Examination<sup>3</sup>

2.2 *ASTM Adjuncts:*

Reference Photographs for Magnetic Particle Indications<sup>2</sup>

## 3. Identification

3.1 The types of discontinuities covered by the reference photographs<sup>3</sup> are listed and described in Table 1. Each type of discontinuity is designated by Roman numerals I through VIII as given in the table.

3.2 The degrees of discontinuity severity, in increasing order where applicable, are denoted by numbers 1 through 5.

NOTE 1—To avoid any misunderstanding, it should be pointed out there is no correlation between degrees of the various defects. For instance, Degree 3 of Type I is not equivalent to Degree 3 of Type II.

3.3 Each reference photograph is identified with the proper number and letter designation.

<sup>1</sup> These reference photographs are under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and are the direct responsibility of Subcommittee E07.03 on Liquid Penetrant and Magnetic Particle Methods.

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<sup>2</sup> These reference photographs are available on four large charts arranged for each type of discontinuity. The charts are available from ASTM Headquarters. Order ADJE0125.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 03.03.

## 4. Preparation

4.1 The reference photographs represent magnetic particle indications as found on production steel castings. They represent the actual size of the indications and the procedure followed was in accordance with Guide E 709. The peak magnetizing current employed was from 600 to 800 A and prod spacing from 4 to 10 in.

4.2 The white line indications as illustrated in most of the photographs were obtained by painting the casting area with a slurry of lamp-black in kerosene, gasoline, or alcohol. A gray magnetic powder is then used. The result is a white indication under normal photographic methods.

4.3 The black line indications result from applying red magnetic powder to the casting surface and photographing the magnetic particle indications.

## 5. Basis for Use of Reference Photographs

5.1 These reference photographs are intended for use when they are specified in the inquiry, contract, order, material specifications, or applicable code, and when the limiting class of severity is mutually agreed upon by the manufacturer and the purchaser. It is admitted that it is impossible to rigidly interpret magnetic particle indications on castings to a set of photographic references; consequently there is a need for close cooperation between the manufacturer and the purchaser.

5.2 Unless otherwise specified all accessible surfaces of the casting shall be examined. On many castings, however, only certain areas are sufficiently critical to justify this type of examination. In these cases the locations to be examined shall be specifically agreed upon.

5.3 The severity class and the number of castings made from the same pattern to be given magnetic particle examination shall constitute a part of the inquiry, contract, or order, or shall be as specified in the material specification or applicable code.

5.4 The limiting size and shape of the unit area to be examined shall be established by the applicable code or by mutual agreement of the manufacturer and the purchaser.

**TABLE 1 Types of Discontinuities**

Type	Type of Discontinuity	Degree	Figure No. <sup>A</sup>	Definition
I	Linear discontinuities (hot tears and cracks)	1	I-1a, I-1b and I-1c	Ragged lines of variable width. May appear as a single jagged line or exist in groups. They may or may not have a definite line of continuity. They usually originate at the casting surface and generally become smaller as they go deeper.
		2	I-2a, I-2b and I-2c I-3a, I-3b and I-3c	
		3	I-4a, I-4b and I-4c I-5a, I-5b and I-5c	
		4		
		5 (3 examples each)		
II	Shrinkage	1 to 5	II-1, II-2, II-3, II-4 and II-5	Appears as a jagged area or irregular patches. Shrinkage is a subsurface discontinuity that may be brought to the surface by machining or other methods of metal removal.
III	Inclusions	1 to 5	III-1, III-2, III-3, III-4 and III-5	Isolated, irregular or elongated variations of magnetic particles occurring singly, in a linear distribution or scattered at random in feathery streaks. The indications are the result of the presence of sand, slag or oxides in the surface metal.
IV	Internal chills and unfused chaplets	1 to 5	IV-1, IV-2, IV-3, IV-4 and IV-5	A uniform line or band outlining the object and indicating lack of fusion between the metal object and the casting.
V	Porosity	2 examples	V-1 and V-2	Appears as rounded and elongated clusters of magnetic particles of various sizes; scattered at random.
VI	Welds: Weld porosity Incomplete penetration Undercutting Inclusions in weld Crater cracking	5 examples	VI-1 VI-2 VI-3 VI-4 VI-5	Incomplete fusion and penetration appears as a straight continuous or intermittent linear indication. Porosity, inclusions and linear discontinuities in welds appear as described above.
VII	False Indications: Prod pattern Powder lodged in surface depression Particles dropped from cables Chisel marks Wrinkles	5 examples	VII-1 VII-2 VII-3 VII-4 VII-5	
VIII	Magnetic Anomalies: Adhering scale Magnetic writing High external magnetic field Junction of materials of different permeability Powder build up at sharp fillet	5 examples	VIII-1 VIII-2 VIII-3 VIII-4 VIII-5	

<sup>A</sup> See Footnote 2.

When more than one type of discontinuity appears in the specified area, agreement on this situation should be established.

5.5 These indications, generally, represent evidence of surface discontinuities and any deductions or conclusions with regard to depth or extent of the interior nature of the discontinuity must be based on exploration by other test methods.

## 6. Keywords

6.1 discontinuities; ferrous castings; indications; magnetic particle indications; magnetic particle examination; magnetic particle inspection; photographs; reference photographs; steel castings

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