



Standard Practice for Probability of Detection Analysis for Hit/Miss Data¹

This standard is issued under the fixed designation E2862; 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 practice defines the procedure for performing a statistical analysis on nondestructive testing hit/miss data to determine the demonstrated probability of detection (POD) for a specific set of examination parameters. Topics covered include the standard hit/miss POD curve formulation, validation techniques, and correct interpretation of results.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards*:²

E1316 [Terminology for Nondestructive Examinations](#)

2.2 *Department of Defense Handbook*:

MIL-HDBK-1823A [Nondestructive Evaluation System Reliability Assessment](#)³

3. Terminology

3.1 *Definitions of Terms Specific to This Standard*:

3.1.1 *analyst, n*—the person responsible for performing a POD analysis on hit/miss data resulting from a POD examination.

3.1.2 *demonstrated probability of detection, n*—the calculated POD value resulting from the statistical analysis on the hit miss data.

3.1.3 *false call, n*—the perceived detection of a discontinuity that is identified as a find during a POD examination when no discontinuity actually exists at the inspection site.

3.1.4 *hit, n*—an existing discontinuity that is identified as a find during a POD demonstration examination.

3.1.5 *miss, n*—an existing discontinuity that is missed during a POD examination.

3.1.6 *probability of detection, n*—the fraction of nominal discontinuity sizes expected to be found given their existence.

3.2 *Symbols*:

3.2.1 a —discontinuity size.

3.2.2 a_p —the discontinuity size that can be detected with probability p .

3.2.2.1 *Discussion*—Each discontinuity size has an independent probability of being detected and corresponding probability of being missed. For example, being able to detect a specific discontinuity size with probability p does not guarantee that a larger size discontinuity will be found.

3.2.3 $a_{p/c}$ —the discontinuity size that can be detected with probability p with a statistical confidence level of c .

3.2.3.1 *Discussion*— $a_{p/c}$ is calculated by applying a statistical uncertainty bound to a_p . The uncertainty bound is a function the amount of data, the scatter in the data, and the specified level of statistical confidence. The resulting value represents how large the discontinuity with POD equal to p could be when uncertainty associated with estimating a_p is accounted for. Hence $a_{p/c} > a_p$. Note that POD is equal to p for both $a_{p/c}$ and a_p . a_p is based solely on the hit/miss data resulting from the examination and represents a snapshot in time, whereas $a_{p/c}$ accounts for the uncertainty associated with limited sample data.

4. Summary of Practice

4.1 This practice describes step-by-step the process for analyzing nondestructive testing hit/miss data resulting from a POD examination, including minimum requirements for validating the resulting POD curve.

4.2 This practice also includes definitions and discussions for results of interest (for example, $a_{90/95}$) to provide for correct interpretation of results.

¹ This practice is under the jurisdiction of ASTM Committee E07 on Nondestructive Testing and is the direct responsibility of Subcommittee E07.10 on Specialized NDT Methods.

Current edition approved Jan. 15, 2012. Published February 2012. DOI:10.1520/E2862-12.

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.

³ Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://dodssp.daps.dla.mil>.