



Standard Practice for Adjusting the Operational Sensitivity Setting of In-Plant Walk-Through Metal Detectors¹

This standard is issued under the fixed designation C1269; 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.

INTRODUCTION

Nuclear regulatory authorities require personnel entering designated security areas to be screened for concealed weapons. Additionally, in security areas containing specified quantities of special nuclear materials, personnel exiting the facility are required to be screened for metallic nuclear shielding material. Walk-through metal detectors are widely used to implement these requirements. Nuclear regulatory authorities usually specify an assortment of metal detector test objects that must all be detected by walk-through metal detectors. This practice provides a procedure for adjusting the operational sensitivity setting to the lowest setting necessary to detect the least likely to-be-detected test object in its least likely to-be-detected orientation while passing through the detection zone in the weakest known detection path. All other test objects will then be detected at this sensitivity setting anywhere in the detection zone.

1. Scope

1.1 This practice covers a procedure for adjusting the operational sensitivity of in-plant walk-through metal detectors. Performance of this procedure should result with in-plant walk-through metal detectors being adjusted to an initial operational sensitivity setting suitable for performance testing.

1.2 This practice does not set test object specifications or specify specific test objects. These should be specified by the regulatory authority.

1.3 This practice uses information developed by Practice [C1270](#), or an equivalent procedure, which identifies the critical test object (from a specified set of test objects), its critical orientation, and the critical test path through the detection zone. In the case of Practice [C1270](#), the information is found on the detection sensitivity map(s) for each in-plant walk-through metal detector.

1.4 This practice is one of several developed to assist operators of nuclear facilities with meeting the metal detection performance requirements of the regulatory authorities (see Appendix).

1.5 This standard practice is neither intended to set performance levels nor limit or constrain technologies.

1.6 This practice does not address safety or operational issues associated with the use of walk-through metal detectors.

1.7 The values stated in SI units are to be regarded as standards. The values given in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards*:²

[C1238](#) Guide for Installation of Walk-Through Metal Detectors

[C1270](#) Practice for Detection Sensitivity Mapping of In-Plant Walk-Through Metal Detectors

[C1309](#) Practice for Performance Evaluation of In-Plant Walk-Through Metal Detectors

[F1468](#) Practice for Evaluation of Metallic Weapons Detectors for Controlled Access Search and Screening

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *clean-tester, n*—a person who does not carry any extraneous metallic objects that would significantly alter the signal produced when the person carries a test object.

3.1.1.1 *Discussion*—Smaller test objects require more complete elimination of metallic objects. By example but not

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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.

limitation, such extraneous metallic objects may include: metallic belt buckles, metal buttons, cardiac pacemakers, coins, metal frame eyeglasses, hearing aids, jewelry, keys, mechanical pens and pencils, shoes with metal shanks or arch supports, metallic surgical implants, undergarment support metal, metal zippers, etc. In the absence of other criteria, a clean tester passing through a metal detector shall not cause a disturbance signal greater than 10 % of that produced when carrying the critical test object through the detector. Test objects requiring more complete elimination of extraneous metal to obtain less than 10 % signal disturbance.

3.1.1.2 *Discussion*—The tester shall have a weight between 50 to 104 kg (110 to 230 lb) and a height between 1.44 to 1.93 m (57 to 75 in.). Should a given detector be sensitive to body size because of design or desired sensitivity, the physical size of testers should be smaller and within a narrower range.

3.1.1.3 *Discussion*—It is recommended that the clean tester be surveyed with a high sensitivity hand-held metal detector to ensure that no metal is present.

3.1.2 *critical orientation*—the orthogonal orientation of a test object that produces the smallest detection signal or weakest detection anywhere in the detection zone; the orthogonal orientation of a test object that requires a higher sensitivity setting to be detected compared to the sensitivity settings required to detect the object in all other orthogonal orientations. See Fig. 1 for handgun orientations

3.1.2.1 *Discussion*—Critical orientations are determined by testing using a mapping procedure such as described in Practice C1270.

3.1.2.2 *Discussion*—The term critical orientation can be applied in two ways. Critical orientation can refer to the worst case orthogonal orientation in a single test path or the worst case orthogonal orientation for all the test paths (the entire detection zone). The two are coincident in the critical test path.

3.1.3 *critical sensitivity setting, n*—the lowest sensitivity setting of a detector at which the critical test object in its critical orientation is consistently detected (10 out of 10 test passes) when passed through the detection zone on the critical test path.

3.1.4 *critical test element, n*—see **test element**.

3.1.5 *critical test object, n*—see **test object**.

3.1.6 *critical test path, n*—the straight-line shortest-course path through the portal aperture, as defined by an element on the detection sensitivity map, that produces the smallest detection signal or weakest detection for the critical test object in its critical orientation. (see Figs. 2 and 3)

3.1.7 *detection sensitivity map, n*—(see Fig. 2) a depiction of the grid used to define test paths through the detection zone with each element of the grid containing a value, usually the sensitivity setting of the detector, that is indicative of the detectability of the test object.

3.1.7.1 *Discussion*—These values are relative and describe the detection sensitivity pattern within the detection zone for the specific test object. The values are derived by identically testing each defined test path using a specific test object in a single orthogonal orientation. The value is usually the minimum sensitivity setting of the detector that will cause a consistent alarm (10 out of 10 test passes) when the test object is passed through the detection field. Appendix X2 is a sample form for a potential detection sensitivity map configuration.

3.1.8 *detection zone*—the volume within the portal aperture.

3.1.9 *detector, n*—see **walk-through metal detector**.

3.1.10 *element, n*—see **test element**.

3.1.11 *grid, n*—see **test grid**.

3.1.12 *grid element, n*—(1) a single block on a detection sensitivity map; (2) the rectilinear volume through the detection zone defined by coincident elements of identical grid works placed on either side of the portal aperture. (see Figs. 2 and 3)

3.1.12.1 *test path, n*—as defined by an element on a detection sensitivity map, a straight-line shortest-course path

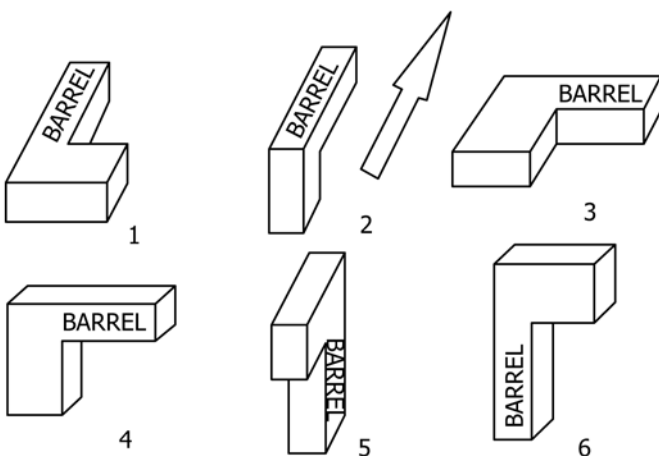


FIG. 1 Six Standard Orthogonal Orientations for a Handgun

52	68	52	52
49	55	75	71
50	52	75	73
48	58	74	70
35	63	81	72
47	62	89	74
47	69	79	75
57	71	81	79
62	74	74	69

critical
test
element

NOTE 1—Numbers are sensitivity setting values for a hypothetical detector. The numbers represent the lowest sensitivity setting at which the object was detected ten out of ten consecutive test passes through the indicated test path.

FIG. 2 Example of Detection Sensitivity Map