INTERNATIONAL

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Standard Guide for Installation of Walk-Through Metal Detectors[1]

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1. Scope

1.1 Some facilities require that personnel entering designated areas be screened for concealed weapons and other metallic materials. Also, personnel exiting designated areas are often screened for metallic shielding material and other types of metallic contraband. Walk-through metal detectors are widely used to implement these requirements. This guide describes various elements to be considered when planning to install walk-through metal detectors.

1.2 This guide is not intended to set performance levels, nor is it intended to limit or constrain operational technologies.

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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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 *NRC Document:*[2]

NUREG-1329 Entry/Exit Control At Fuel Fabrication Facilities Using or Possessing Formula Quantities of Strategic Special Nuclear Material

2.2 *U.S. Government Documents:*[3]

DOE 5632.2A Physical Protection of Special Nuclear Materials and Vital Equipment, February 9, 1988

DOE 5633.3 Control and Accountabilityof Nuclear Materials, February 3, 1988

2.3 *National Fire Protection Associations (NPA) Document:*[4]

NFPA-101-1988 Life Safety Code Handbook, Chapter 28, Industrial Occupancy

2.4 *ANSI Standard:*[5]

ANSI Z41.1-PT-1983 Class 50 and 75—For Non-ferrous and Ferrous Safety Footwear

2.5 *National Institute of Law Enforcement and Criminal Justice (NILECJ) Standard:*[3]

NILECJ 0601.00 Standard for Design, Performance, and Allowable Magnetic Field Strength

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *continuous-wave-type metal detector*—a system generally employing one or more pairs of closely coupled coils; one coil is electrically energized to establish an electromagnetic field; the other detects disturbances in that field; in operation, the coils are configured so that the person or object being screened passes through the field; when metal passes through the field, the field is modified by the magnetic and electrical properties of the metal; any change in the field is sensed by measuring one or more of many possible parameters, including mutual inductance, power loss, phase shift, frequency shift, permeability, etc.

3.1.2 *nuisance alarm*—an alarm not caused by a weapon or shielding material but by other causes such as outside interference or other operationally or environmentally induced stimulus; in practice, these alarms are a nuisance because they are not obvious and must be investigated and the cause eliminated.

3.1.3 *pulse-wave-type metal detectors*—a system in which brief current pulses are generated in transmitter coils when they are switched on; the electromagnetic field generated by these pulses induces eddy currents in metallic objects in the field; the eddy currents decay when the transmitter coils are shut off; the decay of the eddy currents produces secondary voltages in the receiver coils, which are switched on only when the transmitter coils are switched off; the voltages induced in the receiver coils are processed and compared against a bias or background level.

[1] This guide is under the jurisdiction of ASTM Committee F12 on Security Systems and Equipment and is the direct responsibility of Subcommittee F12.60 on Controlled Access Security, Search, and Screening Equipment.

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[2] Available from U. S. Nuclear Regulatory Commission (NRC), 11555 Rockville Pk., Rockville, MD 20852, http://www.nrc.gov.

[3] Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, http://www.access.gpo.gov.

[4] Available from National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02169-7471, http://www.nfpa.org.

[5] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

3.1.4 *shielding*—a metallic material configured as a credible gamma-radiation shield for special nuclear materials (SNM).

3.1.5 *throughput*—the actual rate at which a metal detector and system can screen personnel for a given application.

3.1.6 *walk-through metal detector*—a free-standing screening device having an electromagnetic field within its portal structure (aperture) for detecting metallic objects, including some nuclear shielding materials, carried by persons walking through the aperture.

3.1.7 *weapon*—a device intended to do damage to personnel or equipment without intentionally harming the attacker, but requiring the attacker to physically activate or use the device.

4. Significance and Use

4.1 This guide is intended for use by the designers, evaluators, and users of walk-through metal detectors to be installed to screen persons entering or leaving a controlled access area. This guide is not meant to constrain design liberty but is to be used as a guide in the selection of location and installation of walk-through metal detectors.

5. Safety Considerations

5.1 Warning signs should be posted if the metal detector's electromagnetic field strength is of such a magnitude that personal medical devices may be affected or damaged when they pass through the portal. See NILECJ 0601.00.

5.2 Local fire and safety codes should be reviewed concerning requirements for areas selected for metal detector installation. Metal-detector installations needing exemption from the fire and safety requirements should be approved in advance.

6. Throughput Consideration

6.1 The rate at which persons may be screened is generally an important factor in security applications. Metal-detector systems should be capable of dealing with large transient traffic flow such as found during shift changes.

6.1.1 Throughput varies from one metal detector model to the next. Throughput also varies from one application to the next. Applications that require high-sensitivity settings will have lower throughput.

6.1.2 Once the application specific throughput for a detector model has been established, the number of detector lanes required to achieve system throughput at peak times can be calculated. See 9.2.

7. Other Considerations

7.1 Review applicable regulatory orders and policies of appropriate regulatory agencies and facilities for information pertinent to metal detector installation and operation.

7.2 Examine the power capability of the building electrical system to ensure that it is adequate to support the metal-detector system, especially current, voltage, and voltage stability.

7.3 Confirm that the available primary and emergency power are free of noise and transients. If not, install a filtering or regulating system, or both. An uninterruptable power system can provide both filtering and emergency power.

7.4 Establish where the metal-detector alarms are to be transmitted and who will be responsible for alarm assessment.

7.5 Provide a means for related functions such as space for nearby door opening and closing, door latching, and additional audible or visual alarms, or both, as needed to meet all safety and security requirements.

7.6 Where it is necessary to operate metal detectors in close proximity to each other, they should be of the same manufacturer and model so that the coils can be synchronized or operated at different frequencies in accordance with the manufacturer's recommendations. If it is necessary to operate metal detectors of different models or manufacturers, a test should be conducted for interference before the detectors are installed. Where metal detectors are not compatible it may be necessary to isolate the fields of each detector by as much as 20 to 30 ft.

7.7 If all electronic equipment is not designed for outdoor use, provide cover and protect the equipment from the elements, especially high temperature and high humidity. Adequate ventilation should also be provided. Make sure the metal-detector system is stable over a wide range of environmental factors (temperature, humidity, etc.). All metal detectors are sensitive to changes in the surrounding electromagnetic environment, and that should be the only factor affecting stable operation.

8. Layout of the Installation Site

8.1 The site layout for walk-through metal-detector installation should be designed to minimize the guard force personnel required and to avoid processing delays. The site may be in a new area or building, or in an existing area modified to house security screening devices.

8.2 It is good practice to channel people through separate entry and exit lanes. In areas where more extensive outbound screening is required, separate lanes and equipment are even more desirable so that equipment can be optimized for detection of the specified objects on entry or exit.

8.3 If alarms are remotely monitored, the response tactic (guard's action, intercept corridors, lockdown schemes, etc.) to alarms must be considered early in the design process to ensure effective and efficient interdiction.

8.4 Installation of equipment should be arranged to minimize nuisance alarms from outside interference. If nuisance alarms are too numerous, the guard force will lose confidence in the equipment, and security may be compromised.

8.5 Security equipment often must fit into a space-critical site, but adequate space is the single greatest asset for a security screening area. Maintaining a well-defined screening area is essential so that when an alarm occurs, the security inspector can clearly identify and isolate the person that caused the alarm.

8.5.1 Layout of the area selected for installation of a walk-through metal detector should provide adequate space for calibration and maintenance of the metal detector.

8.5.2 Locate equipment in a manner to clear doors, duct work, piping, and other equipment.

8.5.3 The site layout should provide an alternate means to screen personnel while the metal detector is out of service. See Appendix X1.

8.5.4 The layout should also provide adequate ventilation for the electronic equipment.

8.6 Since metal-detector portal width is typically less than the minimum doorway width required by the Life Safety Codes, bypass routes that meet the Life Safety Codes requirements should be included in the layout design. (See NFPA-101.)

8.7 Metal detector coil assemblies should be securely anchored to prevent swaying or tip over. The floor should be solid and not prone to transfer vibration to the metal detector. A reinforced concrete floor is recommended. The concrete should be free of steel except for grounded reinforcing bars and electrical conduit which should be grounded. Raised computer room floors are not solid and should be avoided.

8.8 A metal detector will respond to nearby moving metal objects, but its sensitivity is less for moving material outside than inside the detection zone. To minimize alarms from outside moving metal objects, the distance from the metal detector to the nearest outside metal object should be at least 3 ft. The exact minimum distance may vary and must be verified experimentally because response to external moving metal is dependent on the size configuration and type of metal in the object.

9. Operational Factors

9.1 Verify that metal-detector by-pass facilities, nonmetallic pass-around table, and operational procedures are in place before starting operation of a metal detector.

9.2 During off-hours and between shift changes, facility design of multi-detector systems should allow some entry and exit lanes to be closed to reduce manpower requirements.

9.3 Alarms caused by metallic items that people carry may decrease as people learn to limit these routine items. This learning process can be reinforced by recirculating the people that cause an alarm, having them remove metal items and trying again rather than hand-searching them. Recirculating these individuals will delay their entry and exit and encourage them to carry less metal on their person. It will also familiarize them with the objects that cause alarms.

9.4 Before starting operation of a site, procedures should be in place that address the response to different types of metal objects that cause an alarm. Specifically shoes that contain metal toe caps or metal arch supports and medically implanted metal should be addressed in these procedures. (See ANSI Z41.1-PT.)

9.5 Screening areas should have guard force personnel physically located in the area where people are to be screened so they can observe and respond. Guard force personnel should have good visual and audible interaction with both the equipment and the personnel.

10. Interferences to Metal Detector Operations

10.1 If two or more metal detectors are operating in close proximity, they should be synchronized or operated at separate frequencies according to the manufacturer's recommendations. See 7.6.

10.2 Very large metal objects such as metal plates or sheets, within 3 ft of the metal detector coil can reduce its detection sensitivity. If a large metal object is relocated near a metal detector, then recalibration and sensitivity testing is required. See Appendix X1.

10.3 A significant problem can be caused if the metal-detector assembly moves and causes alarms. To eliminate this possible cause of nuisance alarms, anchor the detector assembly firmly to the floor.

10.4 For high-sensitivity operations, extra caution must be taken to avoid the adverse influence of external moving metal surfaces. Examples of the moving metal objects are doors, conveyors, fans, elevators, walls, vehicles, and metal carts.

10.5 Electrical interference to metal detectors, both radiated and conductive, may be caused by electric motors, relay contact opening and closing, nearby high-voltage equipment, radio transmitters, computer cables, public-address systems and speakers, tube-type CCTV cameras and monitors, fluorescent lights, electric welders, and similar electrical equipment.

10.5.1 Electric interferences can be decreased by increasing the distance between a metal detector and the interfering source, rotating the position of the metal detector in relation to the interference, or by suppressing or shielding the source of the interference and the metal detector, or both.

11. Selecting and Installing Equipment

11.1 When selecting and installing walk-through metal detectors, the physical and electrical compatibility of the metal detector with other equipment that may be installed nearby, such as X-ray equipment, explosive detectors, and special nuclear materials detectors must be considered. See Appendix X2.

11.2 The metal-detector portal structure should provide, at minimum, a vertical head clearance of 6½ ft (1950 mm) and a horizontal width of 28 in. (700 mm). See 8.6.

11.3 The walk-through metal-detector portal should be constructed of materials which offer reasonable durability for the expected life of the equipment in the environment in which it will be operated.

11.4 The equipment controls and alarm sensitivity settings that are available to operating personnel should be provided with a lock and tamper alarm, or a keyed or password lockout, so that only authorized personnel have access to these controls, as required by the regulatory agency. See NRC NUREG-1329, DOE 5632.2A, and 5633.3.

11.5 The ease of spotting and correcting a malfunction by subassembly substitution is an important factor for minimizing down time. Where costs prohibit the availability of a complete spare system, it is essential that the system be restorable to service by means of readily available replaceable components or subassemblies.