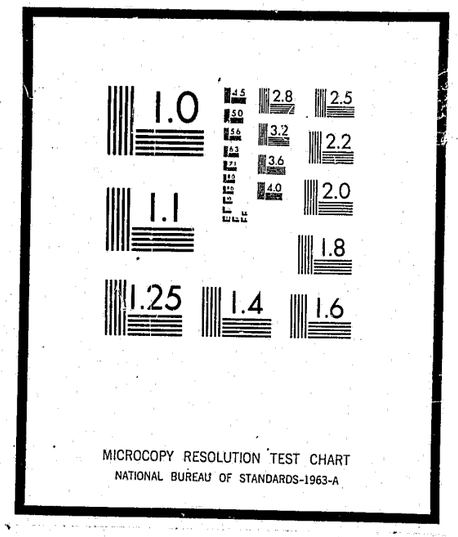

LAW ENFORCEMENT STANDARDS PROGRAM

NILECJ STANDARD FOR WALK-THROUGH METAL DETECTORS FOR USE IN WEAPONS DETECTION

A Voluntary National Standard Promulgated by the National Institute of Law Enforcement and Criminal Justice.

JUNE 1974

U.S. DEPARTMENT OF JUSTICE
Law Enforcement Assistance Administration
National Institute of Law Enforcement and Criminal Justice

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ACKNOWLEDGMENTS

This standard was formulated by the Law Enforcement Standards Laboratory of the National Bureau of Standards under the direction of Robert M. Mills, Manager, Investigative Aids Program, and Jacob J. Diamond, Chief of LESL. Technical research was performed by the staff of the NBS Measurement Engineering Division under the supervision of Kenneth W. Yee.

NILECJ Standard for Walk-Through Metal Detectors for Use in Weapons Detection

CONTENTS

FOREWORD

Following a Congressional mandate [1] to develop new and improved techniques, systems, and equipment to strengthen law enforcement and criminal justice, the National Institute of Law Enforcement and Criminal Justice (NILECJ) has established the Law Enforcement Standards Laboratory (LESL) at the National Bureau of Standards. LESL's function is to conduct research that will assist law enforcement and criminal justice agencies in the selection and procurement of quality equipment.

In response to priorities established by NILECJ, LESL is (1) subjecting existing equipment to laboratory testing and evaluation and (2) conducting research leading to the development of several series of documents, including national voluntary equipment standards, user guidelines, state-of-the-art surveys and other reports.

This document, NILECJ-STD-0601.00, Walk-Through Metal Detectors for Use in Weapons Detection, is a law enforcement equipment standard developed by LESL and approved and issued by NILECJ. Additional standards as well as other documents will be issued under the LESL program in the areas of protective equipment, communications equipment, security systems, weapons, emergency equipment, investigative aids, vehicles and clothing.

This equipment standard is a technical document, consisting of performance and other requirements together with a description of test methods. Equipment which can meet these requirements is of superior quality and is suited to the needs of law enforcement agencies. Purchasing agents can use the test methods described in this standard to determine firsthand whether a particular equipment item meets the requirements of the standard, or they may have the tests conducted on their behalf by a qualified testing laboratory. Law enforcement personnel may also reference this standard in purchase documents and require that any equipment offered for purchase meet its requirements and that this compliance be either guaranteed by the vendor or attested to by an independent testing laboratory.

The necessary technical nature of this NILECJ standard, and its special focus as a procurement aid, make it of limited use to those who seek general guidance concerning walk-through metal weapon detectors for use in weapons detection. The NILECJ Guideline Series is designed to fill that need. We plan to issue guidelines to this as well as other law enforcement equipment as soon as possible, within the constraints of available funding and the overall NILECJ program.

[1] Section 402(b) of the Omnibus Crime Control and Safe Streets Act of 1968, as amended.

The guideline documents to be issued are highly readable and tutorial in nature in contrast to the standards, which are highly technical, and intended for laboratory use by technical personnel. The guidelines will provide, in nontechnical language, information for purchasing agents and other interested persons concerning the capabilities of equipment currently available. They may then select equipment appropriate to the performance required by their agency. Recommendations for the development of particular guidelines should be sent to us.

NILECJ standards are subjected to continuing review. Technical comments and recommended revisions are invited from all interested parties. Suggestions should be addressed to the Program Manager for Standards, National Institute of Law Enforcement and Criminal Justice, Law Enforcement Assistance Administration, U.S. Department of Justice, Washington, D.C. 20530.

Lester D. Shubin, *Manager*
Standards Program

NILECJ STANDARD
for
WALK-THROUGH METAL DETECTORS FOR USE IN WEAPONS DETECTION

1. PURPOSE AND SCOPE

The purpose of this document is to establish performance requirements and test methods for walk-through metal detectors. These detectors are intended to indicate the presence of metal, in excess of a preselected amount, carried on a person passing through a specific space. For most security applications, the emphasis is on the ability to detect handguns.

2. CLASSIFICATION

2.1 Security Level

The detection capabilities and certain general characteristics determine a detector's suitability for use at a specific security level. A particular detector may meet the requirements for more than one security level by adjustment of controls or replacement of components as specified by the manufacturer.

2.1.1 Descriptions of Security Levels

Designation:

(1) Monitoring is primarily for deterrence. Threat is low. Person may carry normal pocket items and may have hand-carried items. Throughput must be high and false alarm rate very low. False alarms may be produced by large metal objects moving outside the detection space. Will operate in indoor environments.

Typical application: routine building surveillance.

(2) Person may carry normal pocket items. Throughput must be high and false alarm rate low. False alarms may be produced by large metal objects moving outside the detection space. Will operate in indoor environments.

Typical application: building surveillance.

(3) False alarms are expected from large or from a number of pocket items which have not been removed. False alarms may be produced by large metal objects moving outside the detection space. Will operate in indoor environments.

Typical applications: jails, courtrooms.

(4) All normal pocket items must be removed before monitoring if alarms on nearly all persons are to be avoided. Careful selection of the detector location may be required. Any nearby metal object must be stationary during monitoring. Large moving metal objects at a considerable distance may produce alarms. Allowable environment may be restricted.

Typical applications: jails, prisons, high-security courtrooms.

(5) All metal from clothing must be eliminated. Careful selection of the detector location may be required. Any nearby metal objects must be stationary during monitoring. Large moving metal objects at a considerable distance may produce alarms. Allowable environment may be restricted.

Typical application: prisons.

2.2 Level of Performance

2.2.1 Basic Class

A basic class detector meets the basic requirements identified as such in this standard for the various security levels.

2.2.2 Augmented Class

An augmented class detector meets certain supplementary requirements, identified as augmented requirements in this standard, in addition to the basic requirements. These augmented requirements are desirable for most applications, but may add to the cost of the detector.

2.3 Alarm Indication Class

2.3.1 Single Indication

The alarm indication is the same regardless of the region within the detection space through which excess metal has passed.

2.3.2 Zone Indication

The alarm indication indicates the region within the detection space through which excess metal has passed.

2.4 Detector Type

2.4.1 Passive Detector

A passive detector does not intentionally generate any magnetic field within the detection space. It usually responds only to ferromagnetic materials and magnets.

2.4.2 Active Detector

An active detector generates a magnetic field in the detection space. It usually responds to any metal but may be designed to indicate only ferromagnetic materials.

3. DEFINITIONS

3.1 Clean Tester

A person who performs a test pass while carrying no significant metal. Significant

metal includes the following: keys, coins, watches, wallets, purses, shoes with metal arch or heel supports, belt buckles, jewelry, pens, mechanical pencils, metal frame eyeglasses, hearing aids, cardiac pacemakers, metallic surgical implants, undergarment support metal, metal zippers, metal buttons, etc.

3.2 Detection Space

The region where passage of metal is intended to be detected.

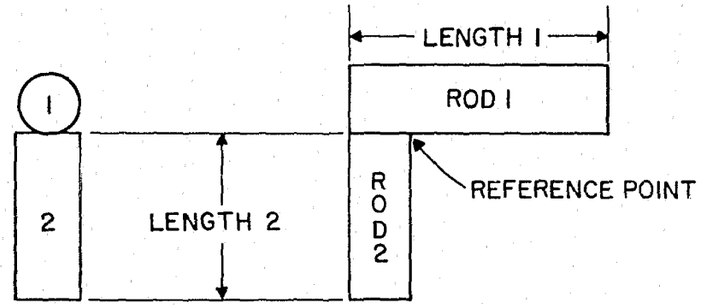
3.3 Discrimination

Although discrimination is ideally the ability of a detector to distinguish between weapons and other metal, discrimination for this standard is the ability to detect quantities of metal large enough to be a weapon while ignoring smaller quantities.

3.4 Reference Point

The specific point on a test object, identified in tables 1 and 2 and in figure 1, which is passed through a test location during a test pass.

TABLE 1.—*Shape–A test objects*



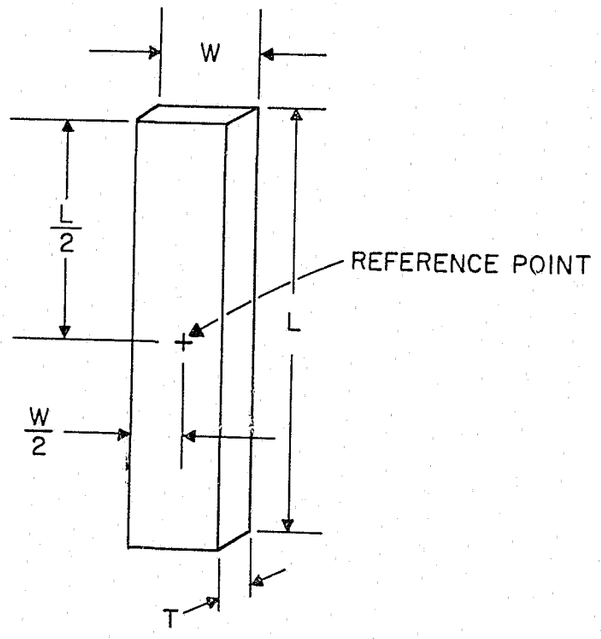
Use block (Fig. 4) to hold rods.

Shape–A number	Length 1		Length 2	
	Millimeters ± 1.6	Inches ± 0.06	Millimeters ± 1.6	Inches ± 0.06
1	25.4	1		None
2	50.8	2		None
3	50.8	2	25.4	1
4	76.2	3	25.4	1
5	76.2	3	50.8	2
6	101.6	4	50.8	2
7	127.0	5	50.8	2
8	152.4	6	50.8	2
9	152.4	6	76.2	3
10	177.8	7	76.2	3
11	177.8	7	101.6	4
12	203.2	8	101.6	4
13	228.6	9	101.6	4
14	254.0	10	101.6	4

All rods are 25.4±0.4 millimeters (1±0.016 inch) in diameter. Type AM (magnetic) rods are cold finished, annealed AISI 4140 steel. Type AN (nonmagnetic) rods are cold finished, annealed AISI 303 stainless steel.

TABLE 2.—*Shape-B test objects*

Material:	Carbon Steel, Hot Rolled Sheet, AISI Number Range C1015 to C1020
Width (W):	19.0 ± 0.8 millimeters (0.75 ± .03 inch)
Thickness (T):	16 gauge, 1.52 ± 0.15 millimeters (0.060 ± 0.006 inch)
Length (L):	See list below.



Shape-B number	Length	
	Millimeters ±1.6	Inches ±0.06
1	25.4	1.00
2	50.8	2.00
3	76.2	3.00
4	101.6	4.00
5	127.0	5.00
6	152.4	6.00
7	177.8	7.00

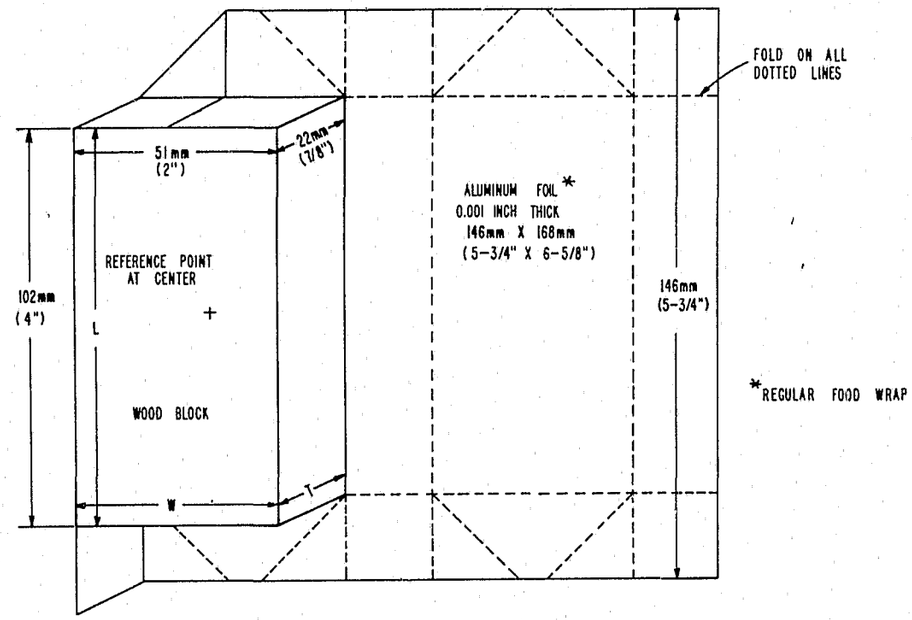


FIGURE 1. *Shape C test object—foil package construction.*

3.5 Test Location

A specific point relative to the floor and detector center line, as shown in figure 2, through which a test object moves during a test pass.

3.6 Test Object Designation

A code in which the first letter indicates shape, a second letter indicates magnetic (M) or non-magnetic (N) material, and a numeral indicates size.

3.7 Test Pass

Passage of a person carrying a test object through the detection space.

3.8 Throughput Rate

The number of people per minute who pass through the detection space.

4. REQUIREMENTS

4.1 Ambient Temperature

Detectors shall operate properly over the ambient temperature range of at least 18° C to 38° C (approximately 64° F to 100° F).

4.2 Ambient Static Magnetic Field

The detector shall be capable of adjustment to meet the detection requirements of 4.6 for any location where the vertical component of the ambient static magnetic field

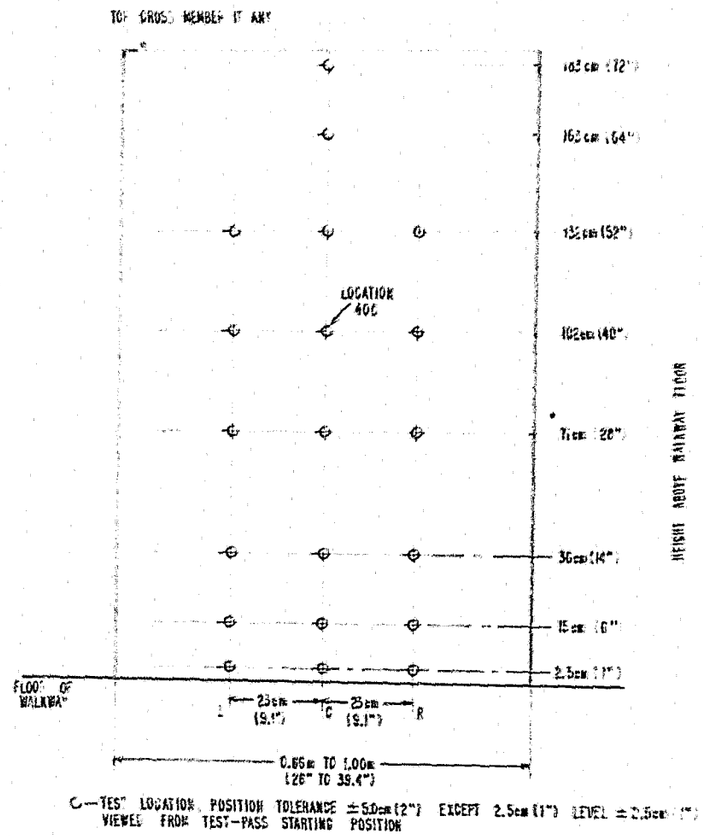


FIGURE 2. *Test Locations.*

between 30 microtesla and 60 microtesla (0.3 gauss and 0.6 gauss), with a maximum difference of not more than 10 microtesla (0.1 gauss) between any two of the test locations in figure 2.

4.3 Alarm Indicator

The detector shall have at least one inaudible on-off alarm indicator and shall have a control to selectively deactivate any audible alarm. At least one inaudible indicator shall be easily perceptible to an operator 6.0 meters (20 feet) from the detector walkway in an ambient light level of up to 1600 lux (150 foot-candles). This requirement may be satisfied by a remote indicator, if this indicator is easily perceptible from a distance of 1.2 meters (4 feet). The manufacturer shall specify the alarm indicator to be used for detection for each specific security level.

4.4 Controls

Any control accessible to the operator shall have a dial which allows resetting the control with sufficient precision to meet all detection requirements. Any control with numerical calibrations corresponding directly to the security level designations shall

be hidden from view in normal operation. The manufacturer shall specify the settings or a calibration procedure for all controls for each specific security level. As a part of the set-up procedure, one control corresponding to each zone may require an adjustment procedure based on calibration test objects, provided no more than 5 minutes is required by an operator familiar with the procedure to complete each setting.

4.5 Walkway Structure

The structure defining the detection space shall have an opening width not less than 0.66 meter (26 inches) at any height from 0.36 meter (14 inches) to 1.52 meters (60 inches) above the walkway floor. The opening width shall be not greater than 1.00 meter (39.4 inches) at 0.36 meter (14 inches) above the walkway floor. The width of the opening shall be fixed by a structural member, unless the walkway components are intended for custom permanent installation at a separation distance marked on the components. The detector structure shall be rigid enough to meet the detection test requirements when mounted on a hard or carpeted floor. The height from the walkway floor to any top crossmember shall be not less than 2.00 meter (78.7 inches).

4.6 Detection Performance

The detector shall meet the detection requirements for each security level at which it is required to operate. When tested in accordance with 5.3, each test object listed in table 3 under required detection for that security level shall cause an alarm for each of

TABLE 3.—*Detection performance requirements*

See Tables 1 and 2 and Figure 1 for test object designations. The test objects shall be held in the orientations given in Tables 4 and 5 unless noted otherwise in table below. Test locations within detection space are given in Figure 2.

Security level	Basic requirements				Additional augmented requirements			
	Required detection		Forbidden detection		Required detection		Forbidden detection	
	Test object	Location	Test object	Location	Test object	Location	Test object	Location
1	AM9	6 to 52 L., C., R.	AM4	6 to 52 L., C., R.	AM9	64C 72C		
			AN4	6 to 52 L., C., R.	AM9 Orientation 3	14 to 52 L., C., R.		
			B6	1 L., C., R.				
			C	28 and 40 L., R. 52C				
2	AM7	6 to 52 L., C., R.	AM3	6 to 52 L., C., R.	AN7	6 to 52 L., C., R. 64C 72C		
			AN3	6 to 52 L., C., R.	AM7	64C 72C		
			B6	1 L., C., R.	AM7 Orientation 3	14 to 52 L., C., R.		

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TABLE 3.—*Detection performance requirements*—Continued

Security level	Basic requirements				Additional augmented requirements			
	Required detection		Forbidden detection		Required detection		Forbidden detection	
	Test object	Location	Test object	Location	Test object	Location	Test object	Location
			C	28 and 40 L, R 52C	AN7 Orientation 3	14 to 52 L, C, R		
3.....	AM5	6 to 52 L, C, R	AM1	6 to 52 L, C, R	AM5	64C 72C	C	28 and 40 L, R 52C
			AN1	6 to 52 L, C, R	AN5	6 to 52 L, C, R		
			B6	1 L, C, R	AN5	64C 72C		
					AM5 Orientation 3	14 to 52 L, C, R		
					AN5 Orientation 3	14 to 52 L, C, R		
4.....	AM3	6 to 52 L, C, R 64C 72C	Clean tester					
	AN3	6 to 52 L, C, R						
	B6	1 to 52 L, C, R 64C 72C						
	AM3 Orientation 3	14 to 52 L, C, R						
	AN3 Orientation 3	14 to 52 L, C, R						
5.....	AM1	6 to 52 L, C, R 64C, 72C	Clean tester					
	AN1	6 to 52 L, C, R						
	B2	1 to 52 L, C, R 64C, 72C						

the first four test passes in 5.3.2 through each specified location. Conversely, each test object or the clean tester listed under forbidden detection shall not cause an alarm for any of the first four test passes through each specified location. For convenience, basic and augmented detection requirements for all security levels are listed by test object and characteristic in appendix A.

4.7 Stability

The detector shall meet the detection requirements for each required security level, as listed in table 3 under required detection and forbidden detection, after a warmup period of 15 minutes, and again after a period of 24 hours when tested in accordance with 5.4.

4.8 Walking Speed

The detector shall meet the detection requirements for each required security level for walking speeds of 0.45 meter per second (1.5 feet per second) and 1.8 meters per second (5.9 feet per second) when tested in accordance with 5.5.

4.9 Throughput Rate

The detector shall alarm for all test passes using the test objects listed under required detection in table 3, and shall not alarm for any test passes using the test objects (or clean tester) listed under forbidden detection when tested for each required security level in accordance with 5.6 at the throughput rates listed below:

Security level	*Throughput rate (people per minute)*
1.....	15
2.....	10
3.....	6
4.....	4
5.....	4

4.10 Power Line Voltage and Frequency

Line-powered detectors shall operate at power line voltages of 105 to 129 volts at 58 to 62 hertz, when tested for each required security level in accordance with 5.7.

4.11 Time Varying Generated Magnetic Field

When measured for each required security level in accordance with 5.8, the peak-to-peak time varying generated magnetic field shall be no greater than the value given as a function of frequency in figure 3, and the waveform shall consist of continuous unmodulated sinusoids within the frequency range given in that figure.

4.12 Static Magnetic Field

The static magnetic field, including any generated by the detector, shall be not greater than 1 millitesla (10 gauss) when measured for each required security level in accordance with 5.9.

4.13 Near-Field Moving Metal

Metal in motion shall not cause an alarm at distances from the detector greater than 1.2 meters (4.0 feet) for security levels 1 and 2, and 1.8 meters (6.0 feet) for security levels 3, 4, and 5, when the detector is tested in accordance with 5.10.

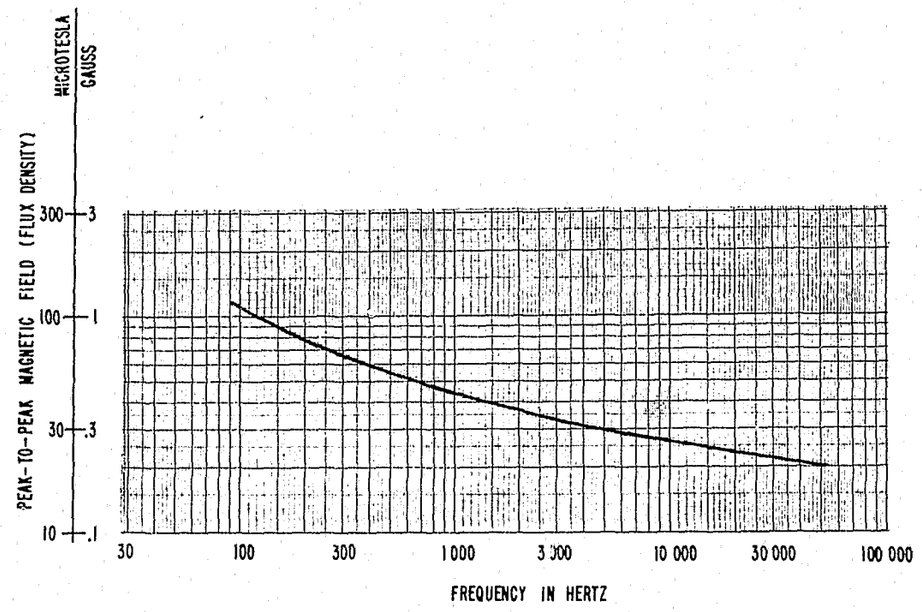


FIGURE 3. *Allowable generated magnetic field for continuous, unmodulated sinusoidal waveforms.*

4.14 Interaction

The detector shall not produce any alarms as a result of the operation of a second detector of the same model at a separation distance of 6.0 meters (20 feet), operating from the same power line outlet. The second detector shall not affect the required or forbidden detection at any of the required security levels as measured in 5.11. Simple field adjustments to meet this requirement are allowed.

4.15 Operation on Steel-Reinforced Floors

The detector shall meet the detection requirements for each required security level listed in table 3 under required detection and forbidden detection, when the detector is mounted and tested on a simulated steel-reinforced floor in accordance with 5.12.

4.16 Battery Condition

If batteries are used in the detector, the manufacturer shall provide a means of determining that the batteries require replacement before the detection performance is affected.

4.17 Interference

The detector shall comply with Federal Communications Commission Code of Federal Regulations; Title 47—Telecommunications; Part 15, Radio Frequency Devices.

4.18 Electrical Safety

The detector shall comply with the requirements of Underwriters' Laboratories Standard UL114 for Office Appliances and Business Equipment (ANSI X4.12–1970).[1]

[1] Copies of this standard may be obtained from Underwriters' Laboratories, Inc. 207 E. Ohio Street, Chicago, Ill. 60611.

4.19 Data Supplied by the Manufacturer

An operator's manual shall be supplied by the manufacturer or distributor with each detector. This manual shall clearly state the instructions for operation and maintenance of the device and shall include the following information:

Detector type (as classified in 2.4)
Alarm indicator class (as classified in 2.3)
Alarm indicator type or types (e.g., bell, light, siren, etc.)
Security level or levels at which the detector can be adjusted to operate
Dimensions of floor space occupied by the walkway
Weight of the walkway
Overall height of the walkway
Height of walkway opening
Width of a walkway opening at walkway floor
Minimum width of walkway opening between 0.36 meter and 1.52 meters above walkway floor
Overall dimensions of any component which is separate from walkway
Weight of any component which is separate from walkway
Power requirements
Operating ambient temperature range

5. TEST METHODS

5.1 General Test Conditions

5.1.1 Installation

The detector shall be installed and set up in accordance with the manufacturer's instructions unless they contradict any instruction in this standard. The floor area under the detector shall be free of metal for all tests except 5.12. The distance between any metal object and the closest part of the detector shall be not less than 3 meters (10 feet) on the ends of the walkway structure, and not less than the distances given below on each side. A walkway ramp or footbridge shall not be considered part of the detector for this purpose.

Security level	*Minimum side clearances*	
	(Meters)	*(Feet)*
1, 2, and 3	1.8	5.9
4	2.4	7.9
5	3.6	11.8

5.1.2 Environment

At the time of the tests the ambient temperature shall be between 18° C and 38° C; the temperature shall not vary over a range greater than 5° C; the relative humidity shall be between 20 percent and 80 percent; there shall be no extraneous moving metal in any direction (including above and below) from the detector within five times the side clearance distances given in 5.1.1 (if alarms are caused by moving metal at any distance, the testing shall be interrupted); if a passive detector, the vertical component of the ambient static magnetic field (flux density) shall be between 30 microtesla and 60 microtesla (0.3 gauss and 0.6 gauss) with a difference of not more than 10 microtesla between any two test locations in figure 2 as measured by 5.2.

5.1.3 Preparations

If the detector under test is line powered, supply voltage shall be between 114 volts and 121 volts at 59 hertz to 61 hertz. The electrical power at nominal levels shall be applied to the detector for a minimum of 15 minutes. Any adjustments specified by the manufacturer shall be performed. Any controls shall be set to the positions specified by the manufacturer for operation at the required security level.

5.2 Ambient Static Magnetic Field

For passive detectors, measure the vertical component of the ambient static magnetic field at each test location in figure 2 using a magnetometer having an accuracy of ±5 percent or better in the range of 30 to 60 microtesla.

5.3 Detection Performance Test

The detection performance is evaluated by test passes made by a clean tester carrying a specific test object through a specific test location in the required orientation.

5.3.1 Test Objects

Test objects of shapes A, B, and C, as described in tables 1 and 2 and figure 1, shall be of the materials and sizes indicated. Shape A simulates handguns, shape B simulates knives or shoe arch supports, and shape C simulates foil wrapped objects such as cigarette packages. The block shown in figure 4 shall be used to hold the rods described in table 1 in shape A.

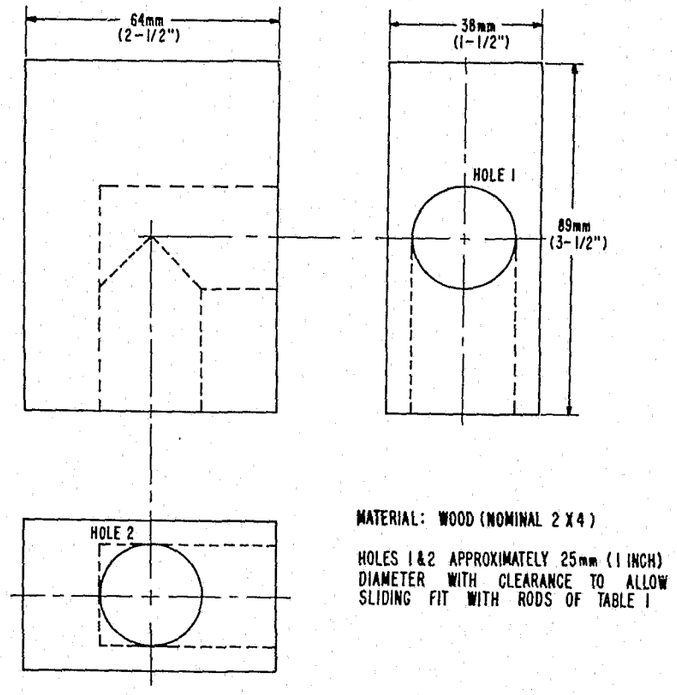


FIGURE 4. *Block for holding rods in shape A.*

Insert rod 1 to the bottom of hole 1, then insert rod 2 in hole 2

5.3.1.1 Demagnetization

Test objects shall be tested for magnetization in accordance with appendix B, and demagnetized if necessary by the procedures of appendix C. Demagnetization is not required if the detector is known to be an active detector generating a time-varying electromagnetic field.

5.3.2 Procedure

A clean tester shall hold a test object with its reference point at a position corresponding to the test locations shown in figure 2 and in the orientations specified by tables 4 and 5. For the 15 centimeter (6 inch) and 36 centimeter (14 inch) heights, the test object should be attached to the leg with a nonmetallic belt, strap or holder. Starting from a position 3 meters (10 feet) from the detector, a test pass is made by walking without hesitation, at a speed as close as possible to 1.2 meters per second (4 feet per second),

TABLE 4.—*Test object orientations as viewed from starting position of test pass*

Orientation Number		
1	Shape A	
2	Shape A	
	Rod 2 to tester's right for all passes if round-trip is used. Alternate right and left if single direction of travel.	
3	Shape A	
4	Shape B,C	
5	Shape B,C	
6	Shape B	
7	Shape B	
8	Shape B	

TABLE 5.—*Orientation of test object at each test location*

See table 4 for orientation number

			Height	
			Inches	CM
	3,7		72	183
	3,7		64	163
1,5	2,4,8	1,5	52	132
1,5	2,4,8	1,5	40	102
1,5	1,5	1,5	28	71
1,5	1,5	1,5	14	36
1,5	1,5	1,5	6	15
6	6	6	1	2.5
L	C	R		

to a point 3 meters (10 feet) beyond the detector. Note whether detection occurred. Unless a preferred direction of travel is stated by the manufacturer, another test pass may be made on the return part of a round trip. The time interval in seconds between passes shall not be shorter than 60 divided by the throughput rate requirement of 4.9. Each test object is carried on four test passes at each specified location. Repeat for each test object listed under required detection and forbidden detection at the locations specified in table 3 for the required security level. If no test objects are listed under forbidden detection, the clean tester shall make 40 test passes.

5.4 Stability Test

After the detector power has been off for at least four hours, apply power to the detector. After 15 minutes and again after 24 hours have elapsed repeat the detection test (5.3) using the test objects of type AM listed under required detection and forbidden detection in table 3 for each required security level. (Entries in table 3 for type AM test objects in orientation 3 are not to be included in these tests.) For single indication detectors only location 40C shall be tested. For zone indication detectors, one test location as given in figure 2, as close as possible to the center of each zone specified by the manufacturer, shall be tested.

5.5 Walking Speed Test

Repeat the detection test (5.3) using the test objects of type AM listed under required detection and forbidden detection in table 3 for each required security level with the following modifications. The average walking speed shall be as close as possible to 0.45 meters per second (1.5 feet per second) [approximately 13.3 seconds for a test pass]. The test shall be repeated again with an average walking speed as close as possible to 1.8 meters per second (6 feet per second) [approximately 3.3 seconds for a test pass]. Only location 40C shall be tested. (Entries in table 3 for type AM test objects in orientation 3 are not to be included in these tests.)

5.6 Throughput Rate Test

Successive test passes, in one direction, shall be made by two clean testers. One shall carry the test object of type AM listed under required detection (table 3) at location 40C; the second shall carry the test object of type AM listed under forbidden detection (if any) at location 40C. Test passes shall be made at 1.8 meters per second walking speed. The time interval in seconds between test passes shall be as close as possible to 60 divided by the throughput rate (people per minute) specified in 4.9 for the required security level. A total of six test passes shall be made by each tester for each required security level. (Entries in table 3 for type AM test objects in orientation 3 are not to be included in these tests).

5.7 Power Line Voltage Test

5.7.1 Equipment

Line power shall be applied to the detector through a variable autotransformer having nominal output of 0 to 140 volts and current rating as required by the detector under test. Monitor the output voltage of the autotransformer with a voltmeter having ± 2 percent accuracy or better in the range 105 to 129 volts ac.

5.7.2 Procedure

Adjust the voltage at the detector to 105 volts. After at least one-half hour, check the voltage and readjust if necessary. Then immediately perform the detection test (5.3) at test location 40C only, using the test objects of type AM listed under required detection and forbidden detection in table 3 for each required security level. Increase the voltage to 129 volts, and at least one hour later readjust the voltage if necessary and again perform the detection test (5.3) at test location 40C for the AM type test objects listed under required detection and forbidden detection in table 3 for each required security level. (Entries in table 3 for test objects in orientation 3 are not to be included in these tests.)

5.8 Time Varying Generated Magnetic Field Test

5.8.1 Equipment

The time varying generated magnetic field shall be measured using a field search coil which has 250 ± 5 turns of #34 AWG insulated magnetic wire [O.D. 0.19 ± 0.01 millimeter (0.0075 ± 0.0005 inch)] close wound in a single layer on a 50.8 millimeter (2.0 inch) diameter nonmetallic form. The approximate winding length is 50.8 millimeters (2.0 inches). The search coil shall be connected to an oscilloscope via 3 meters (10 feet) of type RG-108A/U cable with the shield connected only at one end to the oscilloscope case. The oscilloscope shall have a bandwidth of at least 500 kilohertz, an input resistance of at least 100 kilohms, and an input capacitance of not greater than 100 picofarads. The most sensitive vertical deflection range shall be such that 50 millivolts causes a vertical deflection of at least one centimeter, and the fastest horizontal sweep range shall be 10 microseconds per centimeter or faster. Both vertical deflection and horizontal sweep shall be calibrated to ± 5 percent accuracy or better.

5.8.2 Procedure

For each required security level, probe the detection space to determine the location and orientation of the coil which produces maximum oscilloscope deflection in the region between 2.5 centimeters (1 inch) and 1.73 meters (68 inches) above the walkway floor

and 15 centimeters (6 inches) or more from any side wall or defining structural member. Locations are with respect to the center of the coil. If the oscilloscope display is sinusoidal, record the peak-to-peak deflection in millivolts and the period in milliseconds. If the waveshape is nonsinusoidal, record the approximate waveshape. For sinusoidal waveforms compute the peak-to-peak magnetic field in microtesla as 0.31 VT, where V is the peak-to-peak coil output in millivolts, and T is the period in milliseconds.

5.9 Static Magnetic Field Test

Probe the detection space with a magnetometer having ±5 percent accuracy and determine the maximum static magnetic field present for each required security level.

5.10 Near-Field Moving Metal Test

5.10.1 Equipment

The metal test panel shall be carbon steel (AISI C1010 to C1020) sheet metal 36.0 centimeters by 48.0 centimeters ±0.3 centimeter (14.0 in × 19.0 in ±⅛ in), 0.318 centimeter (⅛ inch) thick. Before use with passive detectors, it shall be demagnetized as instructed in appendix C.

5.10.2 Procedure

Hold the metal panel vertical with one hand at the center of each long side. Hold the panel against the chest with the center 1.40 ±0.13 meters (55 ±5 inches) above the floor. Stand on the centerline of the walkway, facing the opening about 1.8 meters (6 feet) from the closest part of the detector. Rapidly thrust the arms forward to full extension keeping the panel vertical. Observe the alarm indicator. Repeat the test at various distances to determine the greatest distance from the walkway at which each of three successive thrusts produce an alarm. Measure the distance from the panel in the extended position to the closest part of the walkway structure other than a ramp or footbridge, to the nearest 0.1 meter (4 inches). Repeat the test at the side of the detector perpendicular to the direction of travel. If the walkway has significant length, perform the test opposite the center and edge of a walkway side. Repeat the entire test at each required security level.

5.11 Interaction Test

A second detector of the same model shall be located adjacent to the first with the walkways parallel and a centerline separation of 6.1 meters (20 feet). Both detectors shall be operated from the same power line outlet and at the same security level. The second detector shall be prepared as in 5.1.3. The alarm indicator of the first detector shall be observed while the following tests are performed on the second detector: switch the power on and off at 10-second intervals for four on-off cycles; make four test passes with an object which causes detection, simultaneously with a test pass of the AM test objects listed under required detection in table 3 at location 40C of the first detector; repeat the preceding test with the AM test object listed under forbidden detection at location 40C of the first detector. (Entries in table 3 for test objects in orientation 3 are not to be included in these tests.) Repeat the entire test at each required security level.

5.12 Test for Operation on a Steel-Reinforced Floor

5.12.1 Equipment

The simulated steel-reinforced floor shall be as shown in figure 5. The reinforcing wire shall be number 10 gauge (approximately 3.4 millimeters diameter) steel wire, nominal 6 inch (15 centimeter) square mesh welded at intersections. The reinforcing rods shall be nominal ½ inch (13 millimeter) diameter steel. The floor width shall be at least equal to the overall width of the walkway plus 0.6 meter (2 feet) and the floor length at least equal to the length of the walkway (parallel to the centerline of the walkway) plus 0.6 meter (2 feet). Install the detector walkway on top of the simulated steel-reinforced floor with the walkway centerline parallel to the reinforcing rods. The plywood shall be secured to the building floor or shimmed as necessary to provide a stable platform for the detector walkway.

5.12.2 Procedure

Repeat the detection test (5.3) for the following test objects and locations from table 3 under required detection and forbidden detection for the required security levels: test

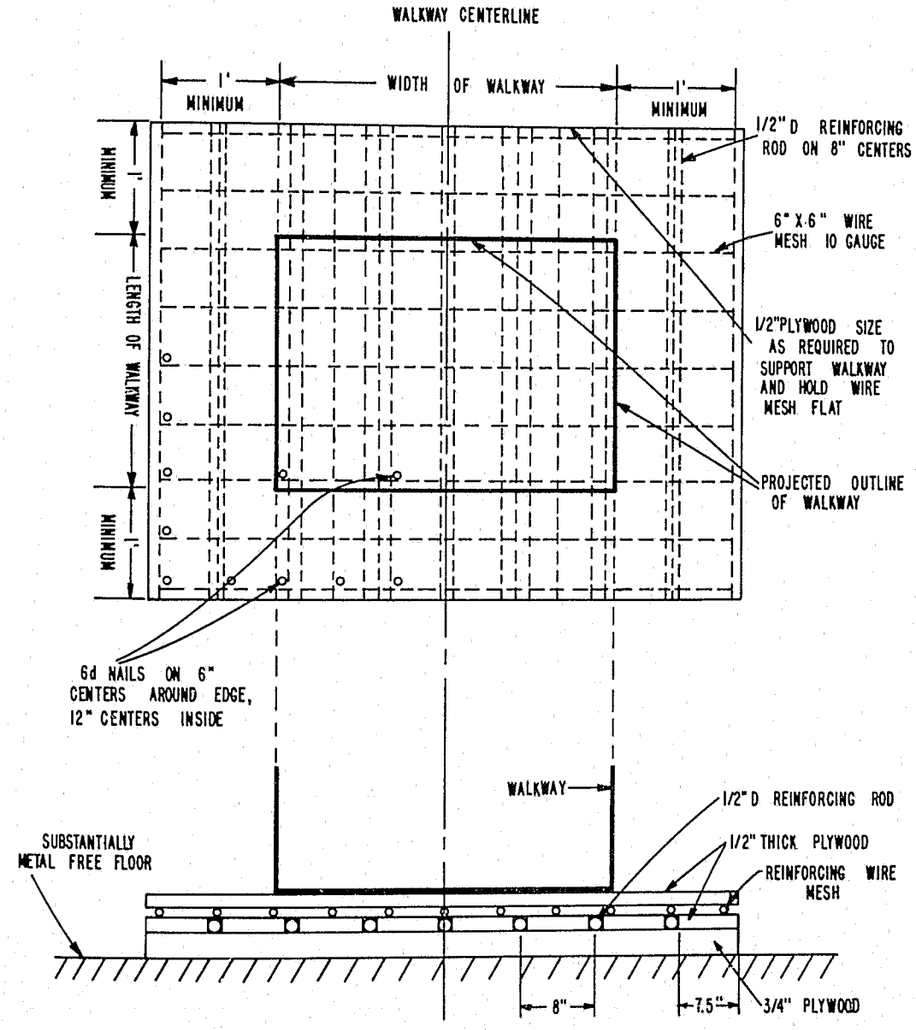


FIGURE 5. *Simulated steel-reinforced floor.*

objects of type AM at location 40C; all test objects listed with test locations at the 1-inch or 6-inch heights. (Entries in table 3 for test objects in orientation 3 are not to be included in these tests.)

Appendix A—SUMMARY OF DETECTION REQUIREMENTS

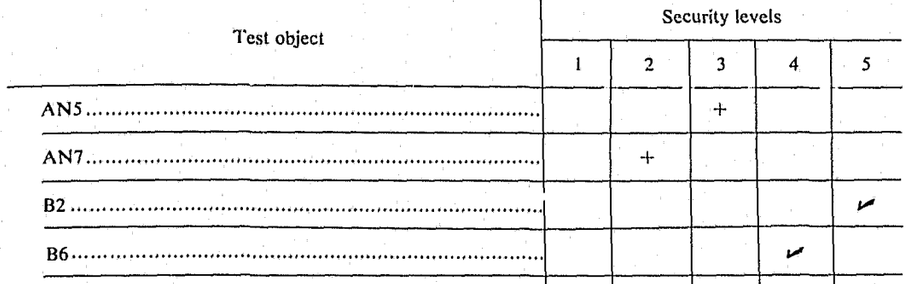
✓ Required for basic and augmented classes
X Forbidden for basic and augmented classes
\+ Required for augmented classes
– Forbidden for augmented classes

Test object	Security levels				
	1	2	3	4	5
All test locations, from 6 to 52 inches, L, C, R:					
AM1			X		✓
AM3		X		✓	
AM4	X				
AM5			✓		
AM7		✓			
AM9	✓				
AN1			X		✓
AN3		X		✓	
AN4	X				
AN5			+		
AN7		+			
B2					✓
B6				✓	
Test object C, locations 28 and 40, L, R, and 52C	X	X	–	X	X
Clean tester					
Head sensitivity, locations 64C and 72C:					
AM1					✓
AM3				✓	
AM5			+		
AM7		+			
AM9	+				

Appendix A—SUMMARY OF DETECTION REQUIREMENTS—Continued

Test object	Security levels				
	1	2	3	4	5
AN5			+		
AN7		+			
B2					✓
B6				✓	
Foot sensitivity, locations 1 L, C, R:					
B2					✓
B6	X	X	X	✓	
Horizontal weapon (orientation 3), locations 14 to 52, L, C, R:					
AM3				✓	
AM5			+		
AM7		+			
AM9	+				
AN3				✓	
AN5			+		
AN7		+			

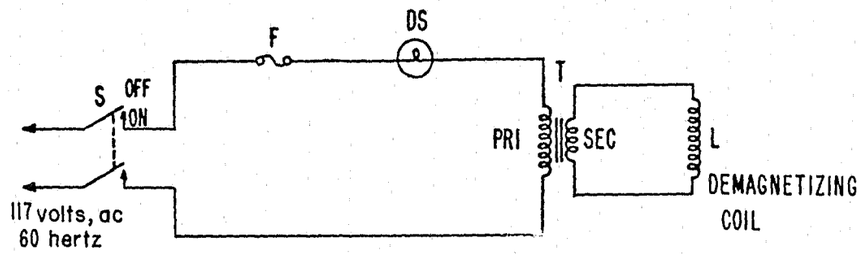
Appendix B—TEST FOR MAGNETIZATION



Orient the magnetometer probe for zero response to the earth's field. Position the object under test with its major axis nominally on probe axis as shown and note the reading of the magnetometer. Reverse the test object end-for-end repositioning it within 1.5 millimeters (1/16 inch) in all and note the second reading, a minus sign if the polarity is opposite the first reading. Subtract the two readings. The maximum difference in microtesla (0.01 gauss) shall be numerically equal to the length (in inches) of the test object or component. If it is not, repeat the demagnetization procedure.

Appendix C—SUGGESTED TEST OBJECT DEMAGNETIZER

Any degamnetizer may be used provided the resultant demagnetized test object passes the test for magnetization in appendix B.



NOTE: For intermittent operation only. Maximum ON time 1 minute. Minimum OFF time 1 minute.

S = Switch, double-pole, single-throw
F = Fuse, 1 ampere, slow-blow
DS = Lamp, 120-volt, 200-watt
T = Transformer, primary: 117 volts, 60 hertz; secondary: 6.3 volts at 10 amperes
L = Demagnetizing Coil, 50 turns of number 14 AWG, insulated, stranded, copper wire.
Coil Shape 1, for use with component rods M (Table 3) and shape B test objects (Table 4): 38 millimeters (1.5 inches) center diameter, approximately 38 millimeters (1.5 inches) long. A non-metallic tube may be used as a coil form.
Coil Shape 2, for use with metal test panel (5.10.1): Center opening 0.41 meter (16 inches) by 19 millimeters (0.75 inch), length approximately 38 millimeters (1.5 inches).

Demagnetizing procedure:
Turn the switch ON and pass the test sample through the coil opening three times in the same direction. Move the sample slowly and smoothly at about 25 millimeters (1 inch) per second. Do not shake or rotate the sample. On the final pass continue moving the sample along the axis of the coil to at least an arms length from the coil. Turn the switch OFF and wait at least 1 minute before repeating the procedure with another sample.

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