



# DRAFT TANZANIA STANDARD

**(Draft for comments only)**

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Specification for Handheld Metal Detectors for Use in Weapon Detection

Draft for Stakeholders' Comments Only

**TANZANIA BUREAU OF STANDARDS**

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## **0 National Foreword**

This draft Tanzania Standard is being prepared by the Alarm and Electronic Security Systems Technical Committee of the Tanzania Bureau of Standards (TBS), under the supervision of the Electrotechnical Divisional Standards Committee (EDC)

In the preparation of this draft Tanzania Standard, assistance was derived from:

IS 12126: 2016, *Hand Held Metal Detectors (Frisking) for Use in Weapon Detection*, published by the Bureau of Indian Standards.

In reporting the results of a test or analysis made in accordance with provision of this Tanzania Standard, if the final value observed or calculated is to be rounded off, it shall be done in accordance with TZS 4: 1999 *Rules for rounding-off numerical values*.

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## 1. SCOPE

- 1.1 This standard covers the methods of test and performance requirements of hand held metal detectors used for determining the location of metal weapons carried on a person and in a small package.
- 1.2 It does not cover metal detectors used for detecting the following:
- Wiring of explosives, and
  - Buried metals and metals in trenches.

## 2. NORMATIVE REFERENCES

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61010-1 *Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements*

IEC 61672-1 *Electroacoustics - Sound level meters - Part 1: Specifications*

ASTM A568 / A568M *Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for*

ASTM b121/b121m *Standard Specification for Lead Brass Plate, Sheet, Strip, and Rolled Bar*

ISO 16143-1 *Stainless steels for general purposes — Part 1: Corrosion-resistant flat products*

ASTM A510 / A510M *Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel*

ASTM B927/B927M *Standard Specification for Brass Rod, Bar, and Shapes*

IEC 60068-2-6 *Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)*

IEC 60068-2-27 *Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock*

IEC 60068-2-31 *Environmental testing - Part 2-31: Tests - Test Ec: Rough handling shocks, primarily for equipment-type specimens*

### 3. TERMINOLOGY

#### 3.1

##### **detection**

a positive audio alarm indication caused by a test object or a weapon.

#### 3.2

##### **positive alarm indication**

the change in sound level which is considered to indicate the presence of metal.

#### 3.3

##### **separation distance**

the separation distance is the shortest distance between the metal sensing area of the detector and a test object. If the metal sensing element has an open loop geometry, the surface of an imaginary membrane stretched over the metal sensing element shall be considered to be part of the sensing area.

### 4. CLASSIFICATION

**4.1 Security Applications** - A detector shall meet all the requirements of security applications as defined below. In designating test objects, a code in the first letter indicates magnetic (M) or non-magnetic (N) material, and a numeral indicates size as shown in Fig. 1, 2, 3 and 4.

**4.1.1 Application 1 - Open Search for Metal Weapons** - Open scanning of persons for guns and large knives constructed of either ferromagnetic or non-ferromagnetic metal including 4M and 4N.

**4.1.2 Application 2 - Open Search for Small Metal Weapons** - Open scanning for either ferromagnetic or non-ferromagnetic metal weapons as small as test objects 2N, 3M and 3N on persons who have supposedly removed all metal items.

**4.1.3 Application 3** - Open scanning for either ferromagnetic or non-ferromagnetic metal weapons as small as test objects 2N, 3M and 3N in concealed packages.

#### **4.2 Alarm Indication Class**

Alarm Indication - Alarm indication having only two states, one for the absence and the other for the presence of significant metal.

#### **4.3 Detector Type**

Active Detector - One which generates an external magnetic field. It usually responds to any metal.

## 5. REQUIREMENTS

**5.1 Ambient Temperature** - Detectors shall meet the requirements of this standard over the following ambient temperature range:

- a) -10 to +50°C - For normal application, and
- b) -25 to +55°C - For applications in severe environmental conditions.

**5.2 Controls** - The manufacturer shall specify the settings or a calibration procedure. The setting procedure shall not require more than ten seconds by a trained operator.

### 5.3 Alarm Indication

**5.3.1 Pilot Indication** - Any pilot indication which is on, whenever the detector power is applied must be separate and distinct (not varying in degree only) from the alarm indication for metal detection.

#### 5.3.2 Audible Alarm Indicators

- a) Any audible indicator other than an earphone shall produce an alarm-state sound pressure level at the ear of the operator of at least 60 decibels, measured in accordance with 6.2.1.2.  
The manufacturer shall meet the specific requirements of audio frequency and sound level requirements of user, arising out of its application.
- b) An audible indication in absence of metal shall give continuous alarm indicating unhealthy condition of battery as specified by the manufacturer.

**5.3.3 Visible Alarm Indicators** - There shall be visible indication for healthy battery condition and power on.

**5.3.4 Vibratory Alarm Indication** – The detector shall have the ability to indicate the presence of metal through vibration.

**5.4 Detection Performance** - The detector shall meet the detection performance requirements for all security application in which it is required to operate. When tested in accordance with 5.3, each test object listed in Table 1 under required detection for that security application shall be detected. Metal detector should have response such that large metal pieces are detected from greater distances and small metal pieces are detected from lesser distances. This guides the operator to get an idea regarding the size of metal pieces

being detected by the metal detector. Large size metal objects shall be detected by metal detector at small distance also.

**5.5 Search Loop Area** - The search loop of the metal detector shall have a search area of 125 cm<sup>2</sup>, *Min.*

**5.6 Weight of Metal Detectors** - The weight of the metal detectors shall not be more than 0.7 kg, including the batteries.

Table 1 - Detection performance requirements

(Clause 5.4)

SECURITY APPLICATION	REQUIRED DETECTION	
1	Objects	1M, 1N, 4M and 4N
2	Objects	1M, 1N, 2N, 3M and 4N
3	Objects	1M, 1N, 2N, 3M and 3N

NOTE - The test objects listed are given in Fig. 1, 2, 3 and 4.

**5.7 Time Varying Generated Magnetic Field** - The carrier frequency of any magnetic field generated by the detector shall be below 30 kHz.

**5.8 Operation Near Metal Walls** - The detector shall not produce a positive alarm indication, when tested in accordance with 6.4.

### 5.9 Batteries

**5.9.1 Minimum Battery Life** - Minimum battery life shall be 400 mAh and it should preferably be of rechargeable type and should be compatible for use with dry batteries without any modification.

**5.9.2** The battery consumption shall be 20 mA, Max in non-alarm state and 40 mA, Max in alarm state.

**5.10 Reset Time** - The reset time for the detector, after positive detection of metal, shall be less than two seconds.

### 5.11 Safety

5.11.1 Electrical Safety - If the potential difference between any two parts of the detector exceeds 42.4 volts (peak), the detector shall comply with IEC 61010-1.

5.11.2 General Safety - The metal detectors should not be used for frisking persons having implanted pacemakers.

**5.12 Stability of Settings** -The sensitivity shall remain stable for 1 h for 75 percent of the specified distance when adjusted to detect 1M and 1N test objects (temperature variation remaining within  $\pm 2$  percent) when checked at intervals of 10 minutes.

NOTE - For the purpose of checking this requirement, the sensitivity should be other than the critical.

**5.13 Construction Requirement** - The coil shall make an angle of about 15° with the plane of the body of the metal detector. The dimensions of the body of the metal detector shall be such that it facilitates gripping by the operator.

#### **5.14 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:

- a) Security application (as described in 4.1),
- b) Overall dimensions of detector,
- c) Dimensions of detector in the region normally gripped by hand,
- d) Weight of detector,
- e) Battery type and quantity,
- f) Operating ambient temperature range, and
- g) A circuit diagram with brief explanation along with fault finding procedures and test signal level/voltage.
- h) General safety (as described in 5.11.2)
- i) Signage guidance

NOTE - The manufacturer shall supply technical manual and the information given in (g) above when required by the user.

#### **5.15 Marking**

**5.15.1** The following information shall be marked on the metal detector indelibly and shall be externally visible:

- a) Serial number and model designation,
- b) Name and trade-mark of the manufacturer, and

c) Country of manufacture.

**5.15.2 Certification Marking** - The metal detector may also be marked with the TBS Certification Mark.

NOTE - The use of the Standard Mark is governed by the provisions of the Standards Act, 2009 and the Rules and Regulations made thereunder. Details of conditions under which a licence for the use of the TBS Certification Mark may be granted to manufacturers or processors may be obtained from the Tanzania Bureau of Standards.

## **6. TEST METHODS**

### **6.1 General Test Conditions**

**6.1.1 Test Location** - The distance between any metal object other than a test object and the closest part of the detector shall be greater than 0.90 metre.

**6.1.2 Environment** - At the time of the tests, the ambient temperature shall be between 5 and 40°C and the relative humidity shall be between 10 and 90 percent.

**6.1.3 Preparation** - New batteries of the type listed in the operator's manual shall be installed at the beginning of the tests and as instructed in any test method. Any set up or calibration adjustments specified in the operator's manual shall be performed, if required.

#### **6.1.4 Classification of Tests**

**6.1.4.1 Routine tests** - The following shall consist of routine tests:

- a) Battery consumption test (5.9.2), and
- b) Detection performance (6.3).

**6.1.4.2 Acceptance tests** - The following shall consist of acceptance tests:

- a) Weight (5.6),
- b) Battery consumption test (5.9.2), and
- c) Detection performance (6.3).

**6.1.4.3 Type tests** - The following shall consist of type tests:

- a) Weight (5.6),
- b) Battery consumption test (5.9.2),
- c) Alarm indication tests (6.2),
- d) Detection performance (6.3),
- e) Operation near metal wall (6.4),
- f) Stability of settings test (6.5),



- g) Vibration test (6.6),
- h) Shock test (6.7), and
- i) Drop test (6.8).

## 6.2 Alarm Indication Tests

### 6.2.1 Audible Alarm Indication Test

**6.2.1.1** *Equipment - Sound level meter* - The sound pressure level meter shall be according to IEC 61672-1.

#### 6.2.1.2 Sound Pressure Level Test

Perform the test in an anechoic chamber or at an outdoor location, at least 6 m from any large object, where the ambient sound pressure level at the time of the test is not more than 53 decibels. Hold the detector in the normal manner in the right hand at waist level with that arm extended in front of the body. Direct the metal sensing area of the detector to the left, with the detector's major axis horizontal. Position the sound pressure level meter microphone 0.80 m from the centre of the palm of the hand holding the detector. Place the microphone adjacent to the right ear of the tester approximately, 15 cm from the head. Measure the sound pressure level with the detector power applied and the alarm indicator in the non-alarm state. Then, position test object 1M, described in Fig. 2 at a separation distance of 5 cm to produce an alarm, and again measure the sound pressure level.

### 6.2.2 Vibratory Alarm Indication Test

**6.2.2.1** *Equipment - Accelerometer*

**6.2.2.2** *Test Procedure* - Attach the accelerometer to the detector at the approximate location of the test subject's palm. Turn on the detector and move a metal object near the detector to cause an alarm. Measure and record the output from the accelerometer. The accelerometer shall detect vibration as per requirement 5.3.4.

**6.3 Detection Performance Tests** - The detection performance shall be evaluated by bringing a test object to the detector, each at a test separation distance specified in Table 2. The detector and any nearby metal shall be kept stationary to ensure that the change in the detector's response is due to a change in the test signal or the position of a test object.

**Table 2: Test separation distances**

**(Clauses 6.3 and 6.3.2)**

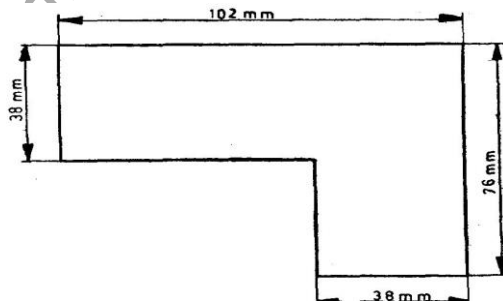
	MINIMUM SEPARATION DISTANCE FOR ALL ORIENTATION cm
Test object 1M	10
Test object 1N	10
Test object 2N	4
Test object 3M and 3N	2
Test object 4M and 4N	2 and 10

### 6.3.1 Equipment

**6.3.1.1 Test objects** - Test objects 1M, 1N, 2N, 3M, 3N, 4M and 4N shall be of the sizes and materials shown in Fig. 1, 2, 3 and 4 respectively.

**6.3.1.2 Detector, test object supports** - The detector and test object shall be firmly supported by non-metallic materials such that the test separation distance between them is positively established. The position and orientation of the test object shall be adjustable for maximum detector response at the specified test separation distances. The test object shall be removable without changing the position of the detector.

**6.3.2 Procedure** - Set up the detector and the test object support at the test location and adjust them for the appropriate test separation distance listed in Table 2.



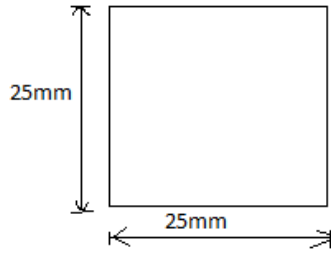
#### Materials

1M- Sheet carbon steel, cold finished, 1.6 mm thick as per ASTM A568/A568M

Tolerance on all dimensions except material thickness & 1 mm.

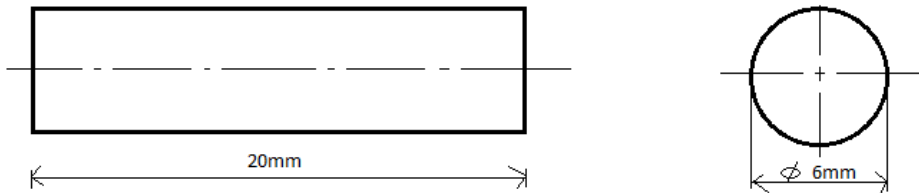
1N - Leaded brass sheet, copper alloy, half hard, 1.6 mm thick as per ASTM B121/B121M

**Fig.1 Test objects 1M and 1N simulating 0.25 semi-automatic pistol**



Material - Non-magnetic stainless steel, 1.6 mm, Grade 04 Cr 19 Ni 9 as per ISO 16143-1.

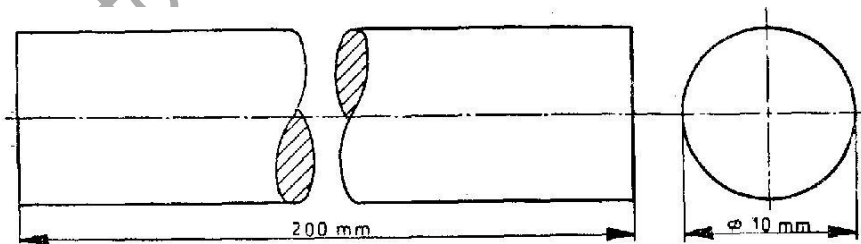
**Fig.2 Test object 2N**



3M – Mild Steel as per ASTM A510 / A510M

3N - Brass as per ASTM B927/B927M

**Fig.3 Test objects 3M and 3N**



4M – Mild Steel as per ASTM A510 / A510M

4N - Brass as per ASTM B927/B927M

**Fig.4 Test objects 4M and 4N**

Remove the test object. Turn on the detector, permit it to warm up, and adjust its controls as specified in the operator's manual. An alarm indicator should be in the non-alarm state.

Position and orient the test object for maximum detector response, or an alarm, at the test separation distance. Occasionally, remove the test object and readjust the detector setting while positioning the test object. After the position of maximum detector response has been located, remove the test object without moving the detector. Turn off the detector for one minute. Then turn on the detector and readjust any controls (without moving the detector) within 10 seconds. Do not make further adjustments to any control. Reposition the test object for maximum detector response or an alarm, 45s after the detector is turned on, note the alarm indicator response and then remove the test object. Immediately note the new alarm indicator response. The test object shall be considered to have been detected only if the alarm indicator with the test object removed is in the non-alarm state and the change in alarm indicator response corresponds to a positive alarm indication.

#### **6.4 Test for Operation Near a Metal Wall**

**6.4.1 Metal Test Panel** - The metal test panel shall be cold-finished sheet of carbon steel in accordance with ASTM A568 / A568M, 1 m<sup>2</sup> and 0.75 ± 0.13 mm thick. The panel shall be mounted or supported in a manner which keeps the panel flat.

**6.4.2 Procedure** - Position the detector with its sensor plane parallel to, centered with respect to, 0.90 m from the plane of the test panel. Turn on the detector and adjust its controls as specified in the operator's manual. Note the alarm indicator response. Then rapidly (within 1s), change the separation distance to 0.60 m and immediately note the new alarm indicator response.

**6.5 Stability of Settings Test** - This shall be carried out as per 6.3 for objects 1M and 1N and detection shall be done at interval of 10 minutes. During 1-hour period, the sensitivity shall not be altered.

#### **6.6 Vibration Test**

**6.6.1** The metal detector shall be mounted and tested in accordance with IEC 60068-2-6:2007 and an equal number of samples shall be subjected to vibration test in each of the three principal axes. The vibration severity should be 10 to 55 Hz within a duration of 6 hours.

**6.6.2** After this test, the metal detectors shall be visually examined and there shall not be any damage or deterioration. The performance of metal detector shall be checked and it shall meet the requirement of 5.4.

## **6.7 Shock Test**

**6.7.1** The metal detector shall be mounted and tested in accordance with IEC 60068-2-27 at an acceleration of 1 000 m/s<sup>2</sup> and for 6 ms.

**6.7.2** After this test, the metal detectors shall be visually examined and there shall not be any damage or deterioration. The performance of metal detector shall be checked and it shall meet the requirement of 5.4.

## **6.8 Drop and Topple**

**6.8.1** The metal detector shall be subjected to this test according to IEC 60068-2-31. The height of fall shall be 1 000 mm.

**6.8.2** After this test, the metal detectors shall be visually examined and there shall not be any damage or deterioration. The performance of metal detectors shall be checked and it shall meet the requirement of 5.4.