20 December 99

TARGET STANDARDIZATION FOR DEMINING TESTING

1. SCOPE.

a. This document provides guidance on targets to be used in the testing of demining detection, clearing, and marking systems. Demining targets are landmines or Unmanned Target Activated Weapons (UTAWs) or surrogates (see 1.1.3a) or simulants (see 1.1.3b) of landmines and UTAWs. In the text of this document, landmines and UTAWs are called mines.

b. There are numerous types of actual mine models that have been produced with different fuzes, sensors, boosters and explosive fills available. Actual mine targets are often hazardous to work with, difficult to obtain and when used in testing can create physical security, test data classification and other issues. The many different types of technologies (see document “General Test Requirements for Demining testing,” Appendix A) used in demining equipment also has made the selection and use of standard mine targets difficult.

c. The use of non-standard targets, targets selected solely because of availability, various mine replicas, and targets with poorly understood or documented characteristics and features, leads to non-repeatable test data, test data that is difficult to share, compare or analyze and test data that cannot be used in modeling or simulation of demining system performance. Therefore, it is critical that when testing demining equipment that the guidance provided herein for target standardization be followed.

d. It is intended that this document will be updated in the future to address simulant mine targets used in testing of clearing equipment (Appendix C). Additionally, as detection technologies improve or become available in other sensor areas such as Optical, Vapor, or Nuclear, simulant mine targets may be added to Appendix A to encompass these unique areas.

e. Notwithstanding anything within this or other documents, the storage, transport or use in testing of any targets containing any explosive material shall be approved by the appropriate safety authority for the nation on whose territory the storage, transport or test will take place.

1.1 Terms/Definitions.

1.1.1 Target. Live mine, surrogate or simulant mine.

1.1.2 Live Mine Target (LMT); Type 1 Target. Tactical, live, completely and fully functional production mine. A tactical mine with fully functional explosive train and kill mechanism. The mine may be in any arming status, but is normally fully armed. Use only where absolutely necessary and no suitable alternative is possible, practical or available.

A Type 1A Target is a Type 1 Target without the main explosive, yet with an active/live fuze.

1.1.3 Standard Test Target (STT). A simulant or surrogate mine used in the test of demining systems. Intended to interact with demining systems in a way representative of, or identical to, that of a real mine or mine category. STTs are used to make testing of demining systems safer, quicker, less costly and more repeatable. STTs facilitate the interchange of consistent demining test data between organizations and countries.

a. Surrogate Mine (SUM) - A STT that lacks some (one or more) features or characteristics of an actual mine type or model. May be a modified LMT or a target specifically fabricated with the desired features of an actual mine type or model. SUM STT's are further classified and defined into the following Type Targets:

(1) Type 2 Target - A production mine rendered safe. A Type 1 LMT that has been rendered safe by disabling all or part of the initiation mechanism so that the fuze cannot operate. The main explosive charge is unchanged. If the original detonator or other components are

removed, they will be replaced by replicas which are as close to the original as possible, consistent with the initiation mechanism being disabled.

(2) Type 3 Target - A production mine free from explosive (FFE). A Type 1 LMT that has been rendered safe by having all explosive removed. In a Type 3A Target, the explosive is removed and not replaced with anything. Detonators and other components removed while removing explosives should be placed back in the target or replaced by replicas which are as close to the original as possible. In a Type 3B Target, the removed explosive is replaced with an inert material.

(3) Type 4 Target - A reproduction mine. Type 4 Targets are usually FFE. Type 4 Targets are fabricated with the intention of replicating one, few, many or nearly all of the characteristics and features of a specific production mine model. They are usually fabricated by an organization other than the original manufacturer(s). The design of reproduction mines is usually derived from reverse engineering. A Type 4A Target has air in lieu of explosive. A Type 4B Target has an inert material in lieu of explosive. A Type 4C Target has explosive. Usually Type 4C Targets will be rendered safe so that the fuze cannot operate.

b. Simulant Mine (SIM) - A STT that has features or characteristics representative of a category of mine types, but does not replicate any specific mine type or model. SIM STTs are further classified and defined into the following Type Targets:

(1) Type 5 Target - A SIM that contains some explosives. The explosive may be in significant or trace quantities. A Type 5A Target has a significant amount of explosive. It may have a fuze. A Type 5B Target contains an explosive fuze. It also may contain a small booster charge, but does not have a main explosive charge. A Type 5C target has only trace amounts of explosive, not in a fuze configuration.

(2) Type 6 Target - A SIM that is fully Inert/FFE.

c. Instrumented Mine, Type 7 Target - Usually used in clearing equipment testing. A SIM or SUM that has been instrumented to determine if a disturbance would have initiated or detonated the target. Use a combined Target Type nomenclature to indicate what type of SIM or SUM is used as an Instrumented Mine (e.g. Type 7-3B or Type 7-6).

1.1.4 Calibration Target; Type 8 Target - May be a target, as defined above in 1.1.2 and 1.1.3, or a special non-mine target; especially for detection equipment testing. A calibration target may be used for multiple purposes to include training, reference, diagnostics, confidence check, false alarms or as test control. Use combined Target Type nomenclature when a SIM or SUM is used as a calibration Target (e.g. Type 8-3B or Type 8-6). If the calibration target is a non-mine target just refer to the Target as Type 8.

1.1.5 Target Array - A minefield or array of UTAWs. Target arrays may consist of LMTs, STTs or a mix.

1.1.6 Recommended Target Types – Recommended target types are as shown in Table 1.

1.2 Alternate Terms/Definitions.

Alternate terms/definitions for target types are found in Appendix E.

Table 1. Recommended Target Type Table.

Target Type	Description	FFE	LMT	SUM	SIM
Type 1	Production Mine	N	Y		
Type 1A	- main explosive removed, active fuze	N	Y		
Type 2	Production Mine Rendered Safe	N		Y	
Type 3	Production Mine - FFE	Y		Y	
Type 3A	- explosive removed and not replaced (air)	Y		Y	
Type 3B	- explosive replaced with inert material	Y		Y	
Type 4	Reproduction Mine	Y/N		Y	
Type 4A	- FFE (air)	Y		Y	
Type 4B	FFE (inert material)	Y		Y	
Type 4C	- Explosive	N		Y	
Type 5	Simulant Mine w/explosive	N			Y
Type 5A	significant amount of explosive				
Type 5B	explosive fuze, no main explosive charge				
Type 5C	only trace amounts of explosive, no fuze				
Type 6	Simulant Mine - FFE	Y			Y
Type 7	Instrumented Mine	Y/N		?	?
Type 8	Calibration Target	Y/N		?	?

2. FACILITIES AND INSTRUMENTATION.

a. Facilities and instrumentation should comply with guidance given for the demining equipment being tested. See document "General test requirements for demining testing" and related documents for demining detection, clearing, and marking equipment.

b. Live mines, surrogate or simulant mines that contain explosive material generally have special physical security requirements that must be addressed. These include requirements when targets are being transported, are in storage and when targets are being used in testing. Special facilities, shipping containers and provisions, and surveillance instrumentation may be required.

c. Live mines or surrogate mines that contain classified or sensitive components or hardware will also have special physical security requirements that must be addressed.

d. Fully inert surrogate or simulant mines should be properly marked, colored or labeled to indicate that they are inert. This may eliminate the need for any special physical security requirements.

3. REQUIRED TEST CONDITIONS.

3.1 Test Conditions.

Test conditions should comply with guidance given for the demining equipment being tested. See document "General test requirements for demining testing" and related documents for demining detection, clearing, and marking equipment.

3.2 Targets.

3.2.1 Target Identification. Prior to initiation of the test, assign each target a unique target identification number and document its location and characteristics or features. Also document target's depth, orientation, weathering, the emplacement technique used, and any other information which may aid in assessing or comparing test data or results.

3.2.2 Target Selection.

3.2.2.1 Selection Considerations. Targets should be selected based on what characteristics of the demining equipment are being tested. Different tests and different test objectives for the demining equipment will require different test targets. Targets should be selected in the following order of preference:

a. SIM STT

b. SUM STT, FFE

c. SUM STT, not FFE

d. LMT

For final development or operational type testing the use of less preferred targets may be necessary to achieve the very high confidence levels required for final design assessment and approval. Individuals with expert knowledge about mines, technical performance of the equipment under test, the environment, the demining testing process and overall program objectives are required when selecting targets for test.

When selecting targets consider the following:

a. The different types of mines that the equipment is expected to encounter performing detection, clearing, or marking operations. The expected probability and criticality of these encounters.

b. Type of demining equipment being tested. The performance method and technical characteristics of the equipment. The equipment capability in different environments.

c. Specific test objectives.

d. Expected interaction between demining equipment being tested, the environment and the planned targets.

e. Special considerations or test data desired at the edge of the demining equipment's performance envelope.

f. How to determine the edge of the demining equipment's performance envelope.

g. Target selection in previous testing of the demining equipment and any comparison required between that data and data to be generated in current testing.

3.2.2.2 SIM Selection. The use of SIMs will not be possible for all testing since SIMs have not yet been developed to interact with all types of demining equipment in a way representative of LMTs. Initial SIMs (Appendix A) were developed to interact with induction, radar and IR detection sensors. SIMs to interact with other type detection sensors and clearing equipment will not be developed until a later date. In addition the SIMs available are not representative of all target categories or types. For instance, SIMs for side or top attack mines, claymore mines and other nonconventional type landmines are not available. Use SUMs if SIMs are not available for

the mine target category or type required, or if the SIM, although of the correct type, does not interact appropriately with the equipment under test.

3.2.2.3 SUM Selection. The SUM STTs in Appendix's to this document are a subset of the world's mines. The SUMs identified have a wide range of features; size, weight, metallic content, explosive type and weight, source or origin, fuze type, air gaps, etc. While some are uncommon and were selected due to the small number of mines in that category, or to provide a difficult target due to a particular feature, most are very common and are mines that are very likely to be encountered in demining operations today and for many years.

The more SUM target models identified in the Appendix's (or selected for use in testing), the more thoroughly the full spectrum of mines is covered. The SUMs identified in the Appendix's are a tradeoff between:

a. A very large sample population representative of the complete variety and spectrum of features found in all the mines of the world.

b. Ensuring all the numerous types of possible interaction (physical, electromagnetic, explosive, etc.) phenomena with the many different types of demining equipment with the mines is considered.

c. Keeping the number of recommended priority SUMs to a relatively small amount in order to obtain the benefits resulting from target standardization.

d. Selecting the mines most likely to be encountered during demining operations.

e. Selecting mines that are difficult or challenging targets for demining detection, clearing, and marking equipment.

Due to practical constraints, demining equipment cannot be tested against all the SUMs identified. Often equipment can only be tested against a very small number of SUMs, which become defacto representatives of the world population of mines.

The SUMs selected for testing should be analyzed to ensure they are good representatives of the world population of mines that the demining equipment is intended to perform against. That they contain the necessary spectrum of features to represent a wide range of possible interactions. This is easier to do if many SUMs can be used but becomes an increasingly more difficult and risky task if only a few SUMs represent the world set. The number of mine model types (minimum) that are needed to be confident that test results can be confidently extrapolated to the complete world set for the equipment that is being evaluated needs to be carefully assessed.

First priority, second priority and third priority SUMs are identified to provide a general indication of which mines are most important, difficult or likely to be encountered and to provide alternatives if for whatever reasons higher priority SUMs are not available for testing.

3.2.3 Target Emplacement.

3.2.3.1 Emplacement Considerations. When emplacing targets consider the following:

a. Military doctrine for emplacement of that type mine or mine category. The expected probability and criticality of different possible emplacements (burial depth, orientation, weathering, hole vs. trench, etc.).

b. Type of demining equipment being tested. The performance method and technical characteristics of the equipment. The equipment capability in different environments.

c. Specific test objectives.

d. Expected interaction between demining equipment being tested, the environment and the planned targets.

e. Special considerations or test data desired at the edge of the demining equipment's performance envelope.

f. How to determine the edge of the demining equipment's performance envelope.

g. Target emplacement in previous testing of the demining equipment and any comparison required between that data and data to be generated in current testing.

3.2.3.2 Burial. Based on the above considerations (3.2.3.1) surface emplace or bury targets using nominal burial depths selected from the following:

a. 1 cm (flush buried)

b. 5 cm

c. 10 cm

d. 15 cm

e. 20 cm

f. 30 cm

All depths are the distance from the highest point on the target to the ground surface. Selection of these standard burial depths will help facilitate data interchange, analysis and test repeatability. When there are instances where targets need to be placed at depths other than those above the specific rationale as to why should be documented. While target emplacement at 30 cm depth is not in accordance with usual military doctrine this extreme condition is included to standardize deep buried conditions that might require testing. This extreme condition might be encountered through soil and/or mine movement by wind, water or mechanical equipment after initial mine emplacement.

3.2.3.3 Emplacement. When burying targets, the depth, type and size of the hole used should consider military doctrine for emplacement of that type target and the manual or mechanical equipment and procedures normally used for emplacement. Overburden backfill techniques and overburden compaction should also be considered. Hole depth and dimensions for the emplaced targets should consider real world interaction between variations in the emplacement technique/equipment selected or being simulated and the soil. For example an actual threat emplacement may place targets varying from 4 to 7 cm deep rather than exactly 5 cm. Both manual and mechanical emplacement techniques will rarely bury targets deeper than an underlying very hard subsoil layer. This would be time consuming and the mine might not initiate properly. Mines, particularly those at large burial depths, cannot function properly without realistic type holes and backfill. Targets should be emplaced in a manner in which they can be realistically be expected to be employed. As an extreme example, do not emplace in Anti-personnel mine targets through a hard subsoil to 30 cm depth with straight sided holes. For ground penetrating radar and thermal infrared detection equipment tests pay particular attention to emplacement considerations since these technologies may detect disturbances to the soil caused by target emplacement rather than the target itself. For certain types of detection, clearing equipment it also may be necessary to consider the different orientations of the mine targets possible rotating about the vertical axis. For surface emplaced targets consider that scatterable mine type delivery systems mounted on trucks, helicopters or fixed wing aircraft and rocket or artillery delivered mines may result in mine targets emplaced at varying orientations on the ground with respect to level or horizontal.

3.2.3.4 Weathering. When test planning consider that targets may have to be emplaced for a specified minimum (or maximum) period of time prior to test conduct in order to provide test results representative of the performance of a piece of demining equipment against real world targets. Provisions may have to be made in some cases to eliminate visual cues to target location such as using vegetation as camouflage, plowing up or disturbing an area so it all looks alike, watering down the target area, etc. When using equipment in post-conflict for demining purposes, weathering may include significant overgrowth of native vegetation. Therefore, weathering should reflect a specified minimum (or maximum) weathering period appropriate to the purpose; doctrinally correct elimination of visual cues; and consideration of natural or deliberate re-vegetation of the area.

3.2.3.5 Target Array Emplacement. The pattern and density of the emplaced targets should reflect military doctrine for operational testing. The pattern and density of the emplaced targets should consider real world interaction between variations in the emplacement technique/equipment selected or being simulated and the environment. For example an actual threat emplacement may place targets or rows 4-6 meters apart rather than exactly 5 meters. Pattern and density may be varied to optimize the number of encounters or increase test efficiencies provided that the objectives of tests of clearing equipment are not compromised through unplanned fratricide, interference with mine or equipment function, or accelerated wear of equipment. Where appropriate to doctrine, complex combat obstacles may be included to determine the compounding effects of wire, ablatis, dragons teeth, ditches, etc. on system performance.

4. TEST PROCEDURES/TEST TARGETS.

4.1 Minefield Marking Equipment Test Targets.

Select targets for test of minefield marking equipment from guidance that follows for either mine detection equipment test targets or demining clearing test targets, as appropriate. Minefield marking is usually conducted in conjunction with mine or minefield detection operations but may also be conducted with area clearing operations.

4.2 Mine Detection Equipment Test Targets.

4.2.1 SIM STTs. Select SIM STTs from Appendix A. Fabricate in accordance with specifications referenced therein. If SIM STTs from Appendix A are not used, document fabrication procedures and techniques. Document features, characteristics and properties of importance to the detection equipment under test. Document any data verifying the SIM STT provides the desired characteristics of the actual mine target category it is intended to replicate.

4.2.2 SUM STTs. If SUM STTs are used:

a. Select SUM STTs to be representative of one of the mine models/types listed in Appendix B, if possible. If not possible, document specific rationale as to why not.

b. Fabricate SUM STTs by modifying an actual LMT or by fabricating surrogates specifically with the desired features of selected LMT type or model. Document detailed procedures and techniques used in modifying an actual LMT or fabricating SUM STTs.

c. Document features and characteristics of SUM STTs. Document properties (metal type, content, fill type, materials, air gap, etc.) of the SUM STT that are of particular importance to the mine detection equipment that is being tested. Provide any data used in verifying that the SUM STT provides the desired characteristics of the actual LMT it is intended to replicate.

4.3 Mine Clearing Equipment Test Targets.

4.3.1 SIM STTs. Select SIM STTs from Appendix C. Fabricate in accordance with specifications referenced therein. If SIM STTs from Appendix C are not used, document fabrication procedures and techniques. Document features, characteristics and properties of importance to the demining clearing equipment that is being tested. Document any data verifying the SIM STT provides the desired characteristics of the actual mine target category it is intended to replicate.

4.3.2 SUM STTs. If SUM STTs are used:

a. Select SUM STTs to be representative of one of the mine models/types listed in Appendix D, if possible. If not possible document specific rationale as to why not.

b. Fabricate SUM STTs by modifying an actual LMT or by fabricating surrogates specifically with the desired features of selected LMT type or model. Document detailed procedures and techniques used in modifying an actual LMT or fabricating SUM STTs.

c. Document features and characteristics of SUM STTs. Document properties (size, shape, explosive type and amount, fuze type, etc.) of the SUM STT that are of particular importance to the demining clearing equipment that is being tested. Provide any data used in verifying that the SUM STT provides the desired characteristics of the actual LMT it is intended to replicate.

5. DATA REQUIRED.

The following information should be documented for test targets:

a. Identification number and Target Type

b. Location (pattern and density if applicable)

c. Burial depth

d. Rationale why targets were not placed at standard burial depths of paragraph 3.2.3.2 (if applicable).

e. Orientation

f. Weathering

g. Emplacement technique (include information on hole depth and diameter or trench dimensions, hole/trenching techniques, backfill/overburden material and methods).

h. Description of any combat obstacles used with the target array

i. Characteristics and features including:

(1) SIM or SUM STT Model Number (from Appendices A through D).

(2) Rationale as to why SIM or SUM STTs referenced in paragraph 4.2 or 4.3 were not used (if applicable).

(3) STT properties (metal type, content, materials, air gap, size, shape, weight, fuze type, explosive type and amount, etc.) that are of importance to the demining equipment being tested.

(4) Detailed procedures and techniques used in modifying an actual LMT or fabricating a STT.

(5) Any data used in verifying the STT provides the desired characteristics of the actual LMT or LMT category it is intended to replicate.

j. Any other information which may aid in assessing or comparing test data or results.

6. PRESENTATION OF DATA.

Presentation of data should comply with guidance given for demining equipment being tested. See document "General test requirements for demining testing" and related documents for demining detection, clearing, and marking equipment. Presentation of results of demining equipment testing should provide a clear and definitive audit trail of targets selected, target characteristics and features, target emplacement and any other data required to be documented in this document.

20 December 1999

APPENDIX A. SIM STTs FOR MINE DETECTION EQUIPMENT.

See internet website located at http://www.denix.osd.mil/denix/Public/News/UXOCOE/Sigdata/Mine/mine.html. An overview and technical data on SIMs developed for Induction, Radar and IR detection sensors is provided.

APPENDIX B. SUM STTs - DETECTION.

Table B-1. Recommended SUM STTs for Mine Detection Equipment.

30 cm	25 cm	20 cm	12 cm	9 cm	6 cm	SIZE
Large Conventional AT	Medium Conventional AT	Small Conventional AT	Large AP	Medium AP	Small AP	CATEGORY
TM-62M TM-57 TM-46 TM-89 PT-Mi-K	**Type 72 (M)** TM-72 TM-41	Mark 5 (UK) CVP-1 (Hungary)	**PMN Series (plastic)**	**VS-50 (plastic)** PMM-3	No.7 (UK) DH-3 (Viet)	Metallic (M)
TM-62P TMA-1 TMA-4 PT-Mi-Ba PT-Mi-Ba-III	**Type 72 (NM)** VS-2.2 VS-3.6 TMA-3	**VS-1.6** TC 2.4/M80 MAT-87	**PMA-3**	**Type 72A** **TS-50**	**PMA-2**	Low Metallic (LM)

Notes:

a. 1st priority targets for each size/category are highlighted in **bold** and are at the top of each cell.

b. 2nd priority targets are listed below 1st priority targets.

c. Primary (1st and 2nd priority) detection targets are **recommended Surrogate Mine (SUM) targets**.

d. Note that categories highlighted in gray contain no 1st priority detection targets. Although the 2nd priority SUMs identified in these are not common mines, testing against them may be appropriate in certain cases to determine the limitations and capabilities of the equipment under test.

e. Note that Large and Medium AP Metallic category 1st targets are plastic bodies mines containing significant amounts of metal.

Table B-2. Alternate SUM STTs for Mine Detection Equipment.

30 cm	25 cm	20 cm	12 cm	9 cm	6 cm	SIZE
Large Conventional AT	Medium Conventional AT	Small Conventional AT	Large AP	Medium AP	Small AP	CATEGORY
		M1A1 (US)				Metallic (M)
M19 (US) 1A (India) MAT-76 (RO) MAT-62B (RO) DM-11 (GE)	No. 8 (SA) P2 Mk2 (PK) PRB M3 (BG)			DM-11 (GE) MAI-75 (RO) NR 409 (BG)	M14 (US) M-59 (FR) P4 Mk1 (PK) R2M1/2 (SA) PRB M35 (BG)	Low Metallic (LM)

Notes:
a. Alternate or 3rd priority SUM targets are identified here in the event recommended primary SUMs are not available.
b. Also consider targets from Appendix D as possible alternate targets to address special test issues.

20 December 1999

APPENDIX C. SIM STTs FOR MINE CLEARING EQUIPMENT.

(To be provided at a later date.)

APPENDIX D. SUM STTs FOR MINE CLEARING EQUIPMENT.

- Use same SUM STTs from Appendix B (SUM STTs for mine detection equipment).
- Also consider the following table of targets whose different shapes, emplacements, fuze types etc. should be considered when testing various types of explosive, mechanical and electromagnetic clearing equipment.

Mine Target Type	Country	Notes
Barmine (AT)	UK, India	Large Rectangular shape (11 x 120 cm)
PGMDM/PTM-1 (AT)	Russia	Small rectangular shape (6.5 x 30 cm)
PFM-1 (AP)	Russia	"Butterfly" mine
ADAM/PDM (AP)	US	Scatterable, small, "wedge" shape, Trip "wires," metallic
SB-33	Italy	Scatterable, irregular shape (8.8 cm dia.)
Scatterable "can" type (AT, AM) (AT-2, HB 876, etc.)	Germany, other	High metallic content, spring "feet"
Bounding Fragment (AP) (OZM-72, VAL-69, Type 69, etc.)	Numerous	High metallic content, similar shape to scatterable "can" type target
Scatterable "disk" type (AT) RAAM	US	High metallic content

Mine Target Type	Country	Notes
Stake mine (AP)	Russia, many other	Fragmentation, trip wire, etc.
Roller Targets (AT) - Large pressure plate - Small pressure plate - Prong pressure fuze - Screen/Spider plate fuze	 - Numerous - Numerous - Yugo, other - Czech, Sweden, China, other	 - Common - Common - TMA-4 - PT-Mi-K
Rectangular (AP), plastic; PMA1	Yugo, other similar	7 x 14 cm
Scatterable "can" type (AP) POM-2S	Russia	6.3 cm (dia.) x 18 cm (height) high metal, spring feet, trip wire
Off-route	Many	
"Claymore" or directional fragmentation type	Many	
"Carrot" mine (AP) buried ZAP No. 1 & 2	Zimbabwe	3.6 cm (dia.) x 19.5 cm (height) low metal, similar to UK No. 6
Small rectangular (AT), metal; M7A2	US	11.4 x 17.8 cm, 6.4 cm height 1.62 kg explosive, only .58 kg metal low (60 - 110 kg) fuze pressure

20 December 1999

APPENDIX E. UK TARGET CLASSIFICATIONS.

The definitions, key features, and envisaged applicability of the UK target classifications are given below.

1. PRODUCTION MINE.

A Production Mine is a live, fully armed, mine, that is identical in every respect to the threat against which a countermeasure is to be deployed.

Key Features. The question of correctness of representation of the real target does not arise.

Applicability. Only where absolutely necessary, either where target recognition is critical (e.g. UWB radar) or where no suitable alternative common to all sensors of multi-sensor system is available.

2. PRODUCTION MINE RENDERED SAFE.

A Production Mine (Rendered Safe) is a Production Mine that has had some part of the initiation mechanism disabled so that the fuze cannot operate. It will contain the original main explosive charge unchanged, and, if the original detonator or other components are removed, they will be replaced by replicas which are as close to the original as possible consistent with the initiation mechanism being disabled.

Key Features. Much safer than a production mine with minimal loss of correctness of representation.

Applicability. Wherever it can be established that they are sufficiently representative to avoid the need to use Type 1, and it is hoped that this would be almost always.

3. PRODUCTION MINE (FREE FROM EXPLOSIVES).

Production Mines (FFE) are as category 2 (above), but with all explosives removed and replaced with inert materials.

Key Features. Completely safe, with the inert fill likely to be sufficiently representative in many situations.

Applicability. Whenever an inert fill can be used without compromising real target representation.

4. REPRODUCTION MINE.

Reproduction Mines are targets which have been manufactured with the intention of replicating the characteristics of a specific production mine, usually by an organization other than any of the original manufacturer(s). The design of Reproduction Mines will usually have to be derived from reverse engineering. Reproduction Mines will be Free From Explosives.

Key Features. Completely safe and readily manufacturable, probably with reasonably good representation.

Applicability. Will often be the most representative target possible.

5. SUBSTITUTE MINES.

Substitute Mines are targets that are to be generally representative of a class of mine, but not representative of any specific mine type. They will contain explosive, but no means of initiation.

Key Features. Readily manufacturable, and allow tests where the presence of explosives is necessary for adequate representation.

Applicability. Wherever explosive detecting sensors are to be tested, but replication of a specific mine type is not required.

6. SUBSTITUTE MINES (FFE).

Substitute Mines (FFE) are as Category 5 (above), but are Free From Explosives.

Key Features. Readily manufacturable, and completely safe.

Applicability. Where explosive detecting sensors are not involved, nor is representation of a specific mine type necessary.

7. SUBSTITUTE MINES (LF).

Substitute Mines (LF) are as Category 5 (above), are Free from Main Explosive Charge but contain a Live Fuze.

Key Features. Readily manufacturable, and allow tests where the presence of a Live Fuze is necessary for adequate representation.

Applicability. Where reaction of the mine fuze is to be assessed during the operation of mine clearance equipment.

8. MODEL MINE (INSTRUMENTED).

Model Mines (Instrumented) are targets that are representative of either a specific mine type or class of mines, in size and weight, and also incorporate instrumentation that will determine if, in the course of neutralisation trials, a disturbance would have detonated the mine represented.

Key Features. Readily manufacturable, intended specifically for neutralizationclearance tests.

Applicability. Neutralisation/clearance trials where the question of detonation of the target is a significant issue.

9. MODEL MINES.

Model Mines are as Category 8 (above), but have no instrumentation.

Key Features. Easy and relatively cheap to make.

Applicability. Neutralisationclearance trials where the question of detonation of the target is not a significant issue.

10. CALIBRATION TARGET.

A Calibration Target is a reference target for confidence checks and calibration. A calibration target is likely to be used to check that specific signals internal to a detection system are present. It need not be representative of a mine.

Key Features. Specific to detection sensor type under test.

Applicability. Confidence checks, diagnostic aids, and calibration facilities. Principally for use on R & D trials. Must contain explosives for some sensors.

Table E-1 gives the nearest correspondence between the target types recommended in this document and the UK list.

Table E-1. Target Type Cross-Reference.

Part. 1: document to UK

Recommended	UK (Best correspondence)
1	1
1A (Reproduction live fuze)	7
2	2
3A	3
3B	3
4A	4
4B	4
4C	5
5A	5
5B	7
5C	6
6	6
7	8
8	10

Part 2: UK to document

UK Target type	Nearest equivalent Recommended Target Type
1	1
2	2
3	3A, 3B
4	4A, 4B
5	5A
6	5C, 6
7	1A, 5B
8	7
9	(-)
10	8

APPENDIX F. REFERENCES.

1. document, “General Test Requirements for Demining testing”.