

DEMINING NATIONAL STANDARD 10.50

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Storage, transportation & handling of explosives - Mozambique

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Introduction

The need to reduce risk and to provide a safe working environment are fundamental principles of mine action management (see NS 07.10). Risk reduction involves a combination of safe working practices and operating procedures, effective supervision and control, appropriate education and training, equipment of inherently safe design, and the provision of effective personal protective equipment and clothing.

The provision of a safe working environment includes the safe storage, transportation and handling of explosives and explosive materials. This requires appropriate storage facilities, equipment and vehicles to be made available, and for national mine action authorities and demining agencies to develop and maintain appropriate policy and procedures.

This standard provides national mine action authorities and demining agencies with guidance on the safe storage, transportation and handling of explosives and explosive materials. Specifications for the storage of explosives and safety distances are those provided by the US Institute of Makers of Explosives (IME) and are consistent with the United Nations' Ammunition and Explosives Regulations. These specifications should not normally be reduced without the advice of a professionally qualified explosives engineer.

Safety and Occupational health Storage, transport and handling of explosives

1. Scope

This standard provides specifications and guidelines for the safe storage, transportation and handling of explosives used by demining agencies in Mozambique.

In this standard, the term 'explosives' is used to refer to both explosives and explosive materials, unless stated otherwise in the text. (See Clause 3 below.)

This standard does not apply to bombs, rockets, projectiles, UXO or any other heavily encased explosives.

NS 09.30 – EOD operations provides specifications and guidelines for the storage and handling of ammunition and UXO. However, the national mine action authority should seek the advice of a suitably qualified ammunition technical expert or EOD technical expert for guidance on the storage, transport and handling of these types of ordnance.

2. References

A list of normative references is given in Annex A. Normative references are important documents to which reference is made in this standard and which form part of the provisions of this standard.

3. Terms and definitions

A list of terms and definitions used in this standard is given in Annex B. Further terms and definitions may be found in IMAS 04.10 and NS 04.10.

The term 'national mine action authority or authorities' refers to the government department(s), agency(s) or institution(s) in each mine-affected country charged with the regulation, management and co-ordination of mine action if in existence. For Mozambique IND is the 'national mine action authority'.

The term 'demining agency' refers to any agency (government, NGO or commercial entity) responsible for implementing demining projects or tasks. The demining agency may be a prime contractor, subcontractor, consultant or agent.

The term 'explosives' is used to refer to a substance or mixture of substances which, under external influences, is capable of rapidly releasing energy in the form of gases and heat.

The term 'explosive materials' is used to refer to components or ancillary items used by demining agencies which contain some explosives, or behave in an explosive manner, such as detonators, fuzes and primers.

4. General requirements

Modern explosives are safe if they are stored, transported and handled in accordance with the manufacturers' instructions. Demining agencies should not use explosives of uncertain origin or age, or when the environmental storage conditions have not met the manufacturers' requirements. IND and or the national mine action authority may impose additional requirements based on local experience and conditions.

5. Environmental requirements

The environmental requirements (temperature, humidity and vibration) of explosives vary, and are dependent on their intended storage conditions (including shelf life), transportation, handling and use. The performance of explosives will be unpredictable and the safety will be reduced if the manufacturers' environmental conditions are not met. In general, explosives should be:

- a) kept dry and well ventilated;
- b) kept as cool as possible and free from excessive or frequent changes of temperature;
- c) protected from direct sunlight; and
- d) Kept free from excessive and constant vibration.

Note 1: Some substances used in explosives attract and hold moisture, which will result in the loss of explosive properties, and may cause them to become dangerous to handle. Rain, dampness and humidity can cause enormous damage to explosives in a very short time. Every effort shall be made to ensure dry conditions prevail in storage and transportation.

Note 2: Good ventilation of explosives will keep them cool and prevent condensation.

Note 3: Non-explosive materials, fabric including felt, paper and other materials which absorb water create the conditions which may cause the corrosion and decay of other materials in the same container.

Note 4: Agencies storing explosives should ensure that they follow the manufactures' specifications and guidelines for storage.

6. Storage requirements

6.1. Storage design

General requirements for the design of magazines and containers used for the storage and transport of explosives used in the demining process are given in Annex D.

6.2. Warning signs and symbols

Nationally approved explosive signs shall be used on explosive storage sites and or facilities.

6.3. Fire prevention

Demining agencies shall establish and maintain fire prevention policies and SOP, which should be based on the general principles given in Annex E.

6.4. Table of safety distances

Demining agencies shall apply the safety distances for the storage of explosives given in Annex F, unless instructed otherwise by IND.

6.5. Indoor storage

No indoor storage magazine shall be located in a residence or dwelling or office building.

7. Transportation requirements

7.1. General

Demining agencies shall establish and maintain SOP that give procedures for the safe transportation of explosives. Demining agency SOP shall conform to the Mozambique transportation laws. (See Note 5 & 6 at the end of this paragraph) The procedures should include the following requirements:

- a) ensure the security of explosives;
- b) transport explosives in accordance with the manufacturers' instructions and specifications, and other relevant national law and regulations; and
- c) Avoid accidents.

Note 5: At the time of writing this NS there is no law in Mozambique that permits demining agencies to carry small amounts of explosive for daily use at tasks. Nor is there a law to permit transportation of explosive training aids (mines) for MDD. In the interim this NS will act as authority until IND has addressed the issue of implementation of suitable regulations to reflect the demining agency needs. Demining agencies are permitted to carry up to 20kg of explosive and a small number of explosive MDD training aids in order to conduct daily tasks. This excludes bulk transportation of explosive, where demining agencies shall conform to Mozambique law and shall have Police escort for such re-supply and all other bulk movement requirements.

Note 6: When IND obtains the relevant regulations and references a summary of relevant information will in future be inserted into this NS in order to demining agencies to gain easier access. In the interim IND recommends that the Police are consulted and utilized for bulk transportation that includes convoy escort services, and advice on the pertinent explosive transportation regulations. IND is not responsible for any resulting infringements and or penalties as a result of traffic non-conformance in regard bulk transportation infringements.

7.2. Passengers

Demining agencies should not transport passengers with explosives. If it is necessary that passengers be carried in the same vehicle as explosives, a supervisor shall be appointed. The supervisor shall ensure the safety of passengers and enforce all fire hazard precautions.

7.3. Transporting detonators and explosives

Detonators and explosives shall not be carried on the same vehicle unless the storage container for the detonators meets the minimum design requirements given in Annex D.

7.4. Special Equipment

The following additional equipment shall be carried on all vehicles transporting explosive:

- a) two 9 litre water extinguishers or equivalent; and
- b) a container for storing smoking materials, matches, lighters, cigarettes etc.

8. Handling

Demining agencies shall establish and maintain SOP that give procedures for the safe handling of explosives. The procedures should include the following requirements.

- a) access to explosives shall be tightly controlled;
- b) explosives shall be handled in accordance with the manufactures instructions and specifications and other relevant standards and regulations (this NS) provided by IND; and
- c) only suitably qualified demining personnel, or personnel supervised by a qualified supervisor shall handle or use explosives.

9. Responsibilities and obligations

9.1. IND

IND shall use this NS document and the procedures there in for the storage, transportation and handling of explosives in Mozambique, which include:

- a) standards for storage of explosives on mine clearance sites;

- b) standards for the carriage of explosives, including warning signs and symbols to be used on vehicles; and
- c) safety distances for the storage and handling of explosives.

9.2. Demining agency

The demining agency shall establish and maintain SOP that comply with the provisions of this NS, established international standards, and IND standards and other relevant standards or regulations.

The demining agency responsibilities are not restricted to:

- a) issue, maintain and update their own regulations, codes of practice, SOP and other suitable provisions on the storage, transportation and handling of explosives;
- b) co-operate with other demining agencies in Mozambique to ensure consistency of standards for the storage, transportation and handling of explosives; and
- c) assist in framing national regulations and codes of practice for the storage, transportation and handling of explosives.

9.3. Deminers

Demining workers shall;

- a) comply with instructions given for their own conduct and safety when carrying out the storage, transportation and handling of explosives; and
- b) report forthwith to their immediate superior any situation associated with the storage, transportation and handling of explosives which they have reason to believe could present a hazard which they cannot themselves correct.

Annex A (Normative) References

The following documents when referred to in the text of this standard, form part of the provisions of this standard.

- a) Institute of Makers of Explosives; Safety Library Publication No. 22 – 'Recommendations for the safe transportation of detonators in a vehicle with certain other explosive materials'
- b) United Nations; UN ammunition and explosives regulations manual, 'Ammunition and explosives regulations – For use by the United Nations field missions'
- c) NS 10.10 S&OH – General requirements
- d) NS 09.30 – EOD Operations

The latest version/edition of these references should be used. IND Mozambique hold copies of all references used in this standard. A register of the latest version/edition of the NS standards and references is maintained by IND in Maputo. Demining agencies, employers and other interested bodies and agencies should obtain copies before commencing mine action programmes.

Annex B

(Informative)

Terms and definitions

1.1. explosives

a substance or mixture of substances which, under external influences, is capable of rapidly releasing energy in the form of gases and heat.

1.2. explosive materials

components or ancillary items used by demining agencies which contain some explosives, or behave in an explosive manner, such as detonators, fuses and primers.

1.3. magazine

any building, structure or container approved for the storage of explosive materials.

1.4. nonsparking material

material that will not produce a spark when struck with other tools, rocks, or hard surfaces

1.5. particle board

a composition board made of small pieces of wood, bonded together

1.6. steel

general purpose (hot or cold rolled) low-carbon such as ASTM A366b or equivalent

1.7. theft resistant

construction designed to deter illegal entry into facilities used for the storage of explosives

1.8. weather resistance

construction designed to provide reasonable protection against weather

Annex C **(Informative)** **Bibliography**

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Institute of Makers of Explosives (1993). *Safety Library Publication No. 3 – "Suggested code of regulations for manufacture, transportation, storage, sale, possession and use of explosive materials"*. Institute of Makers of Explosives, Washington D.C.,

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Institute of Makers of Explosives (1993). *Safety Library Publication No. 17 – "Safety in the transportation, storage, handling and use of explosive materials"*. Institute of Makers of Explosives, Washington D.C.

Institute of Makers of Explosives (1993). *Safety Library Publication No. 20 – "Safety guide for the prevention of radio frequency radiation hazards in the use of commercial electric detonators"*; Institute of Makers of Explosives, Washington D.C.

Institute of Makers of Explosives (1993). *Safety Library Publication No. 22 – "Recommendations for the safe transportation of detonators in a vehicle with certain other explosive materials"*. Institute of Makers of Explosives, Washington D.C.

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United States Army (1973). *Technical manual TM 9-1300-206, "Ammunition and explosives standards"*. Headquarters of the Department of the Army; Washington D.C.

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Annex D **(Normative)**

General requirements for the construction of Magazines

1. Permanent or Semi-Permanent structure (Task site / Field Camps)

A permanent semi-permanent structure magazine may be a building, igloo, tunnel or dugout. It shall be bullet resistant, fire-resistance, theft resistant and ventilated.

Footings for concrete, concrete blocks, stone or brick construction shall be designed and constructed in accordance national building standards. If piers or posts are used the area under the building should be enclosed with metal.

Walls shall be constructed of a combination of steel, wood, masonry or other materials, which are fire resistance and structurally sound.

Note 1: Any wood on the exterior of the building shall be covered with fire resistance material.

Note 2: Voids in concrete blocks clay blocks should be filled with well tamped dry sand or gypsum mixture.

Note 3: Interior walls should be clean with nothing on them.

Floors should be constructed of wood or be covered with wood or other suitable non-sparking material.

The roof shall be constructed of structurally sound materials, which are or have been made fire resistant. The roof or ceiling should include a thermal shield designed to assist in maintaining interior temperatures below 40 Celsius. (Soil layer)

Doors shall fit tightly. Hinges and locking-ware shall be rigidly attached by welding riveting or bolting which cannot be removed when the door is locked.

Adequate ventilation shall be provided to prevent dampening and heating of stored explosives. Climatic conditions, size of magazine and location will determine the amount of ventilation required.

Note 1: The recommended minimum is 60 cm² 1.0 m³ of space in the magazine.

The site shall have adequate drainage to prevent water damage to the contents of the magazine

The magazine shall be equipped with at least a steel padlock that has a casehardened shackle.

2. Portable or mobile magazine

A portable magazine is a portable structure such as a skid-mounted container, trailer or semi-trailer.

A portable or mobile magazine shall be theft-resistant, fire-resistant, weather-resistant and bullet resistant. The magazine should be constructed of steel with an interior lining of timber

Note 1: 15.9mm steel with an interior lining of any spark-proof material
12.7 mm steel with an interior lining of not less than 9.5mm plywood or particleboard
9.5mm steel with an interior lining of 57mm of plywood or particle board

The magazine should be supported in a manner that will prevent the magazine from being in contact with the ground. Magazines of less than one cubic metre in size should be fastened to a fixed object to prevent theft of the entire magazine.

Doors shall fit tightly. Hinges and locking-ware shall be rigidly attached by welding riveting or bolting which cannot be removed when the door is locked.

Adequate ventilation shall be provided to prevent dampening and heating of stored explosives. Climatic conditions, size of magazine and location will determine the amount of ventilation required.

Note 1: The recommended minimum is 60 square centimetres cm^2 per 1.0 cubic metre of space in the magazine.

The magazine shall be equipped with at least a steel padlock have at least a casehardened shackle. Trailers or semi-trailers use as portable magazines should be immobilized by removing the wheels of or locking with a wheel locking device approved by the national mine action authority.

3. Day box

A day box or other portable magazine shall be theft-resistant and weather-resistant. It need not be bullet resistant.

The day box shall be constructed of wood.

The door of the day box shall overlap the door opening by not less than 25mm. Hinges and locking-ware shall be rigidly attached by riveting or bolting which cannot be removed when the door is locked.

The magazine shall be equipped with at least a padlock that has a casehardened shackle. Explosive materials shall not be left unattended in a day box and shall be removed to a portable or mobile magazine or permanent magazine.

4. Detonator transport container

Detonators and other explosives may be carried together on a vehicle using the detonator transport container or compartments that meet the specifications included in appendix 1 to this annex and only under the following conditions:

- a) Explosives that are transported on the same vehicle are limited to:
- Detonators
 - detonators, electric; 1.4B and 1.4S
 - detonators electric 1.1B that contain no more than 1gm of explosive (excluding ignition and delay charges and are electric detonators with leg wires 1.2m or longer or
 - detonators, non-electric 1.4B or 1.4S and
 - Class 1 explosive materials (explosives A,B and C) excluding 1.1A materials

Note 1: NS 04.10 includes detailed guidance on the hazard classification and compatibility codes 1.1A, 1.1B, 1.4B and 1.4S

- b) Packaging for detonators described in sub-clause 4.1 a) above are as follows:
- detonators electric 1.4B, 1.4S and 1.1B that contain no more than 1gm of explosive and are transported in quantities of less than 1000 shall be packed in inner packing or cartons that meet the manufactures specifications before loading into the container.
 - detonators non-electric 1.4B and 1.4S shall be loaded into the container in the manufacturers original outer packing.
- c) no material is loaded on top of the portable detonator container

- d) the detonator container shall be secured to the vehicle to prevent movement during transport
- e) the container is clearly labeled "contains explosive, handle with care" in the official languages commonly use in the demining agency.

Appendix 1 to Annex D **(Normative)** **Construction of a detonator transport container**

The container or compartment shall provide for total enclosure of its contents.

The top, lid or door, sides and bottom surfaces of the container shall provide for total enclosure of the contents.

The top, lid or door, sides and bottom surfaces of the container or compartment shall be constructed of wood.

The wood shall be securely bound together by waterproof adhesive or other equally effective means.

All interior surfaces of the container shall be constructed so as to prevent contact of the contents with any sparking metal. The exterior surface of the container that may contact other explosives carried on the vehicle shall be constructed of non-sparking material.

There shall be direct access to the container from the exterior of the vehicle.

The container shall have a snug fitting lid or door and equipped with means to provide for locking or sealing if required.

The exterior of the container shall be weather resistant. Weather resistance may be provided by methods such as fiberglass, epoxy coatings, weather resistant paints or comparable coverings.

Annex E **(Normative)** **Fire prevention**

Demining agencies responsible for storing explosives and explosive materials shall establish and maintain documented fire prevention policies and SOP. The policies and SOP should include the following.

- a) No smoking within 20m of the magazine. NO SMOKING / NO NAKED LIGHTS signs shall be prominently displayed around the magazine.
- b) Grass and undergrowth shall cut down and kept short in the area around the magazine.
- c) Flame or spark producing equipment shall not be used within 20 m of a magazine. Where such equipment is required to carry out repairs to the magazine, all explosives shall be removed.
- d) Paints, oils, petrol or any other flammable materials shall not be stored with explosives. Authorized cleaning materials may be used in the magazine for maintenance but are to be removed when not in use.
- e) Empty containers of any type are not to be stored with explosives.
- f) A minimum of two extinguishers shall be in a prominent position outside each explosive store.
- g) All fire fighting equipment is to be maintained in a fully serviceable condition.
- h) Some form of lightning protection should be used.
- i) A board listing articles that are not permitted into the magazine shall be prominently displayed at the entrance to the magazine. Details of the information to be shown on the board are as follows.
 - Lanterns, oil lamps and stoves and all flame or fire producing appliances.
 - Matches, cigarette lighters or other portable means of producing a spark or flame.
 - Tobacco in any form and any article used for the purpose of smoking.
 - Inflammable liquids and solvents other than those authorized for maintenance work on containers or contained in the tank of a vehicle.
 - Food and drink.
 - Radio equipment (all types) including mobile phones.
 - Firearms with the exception of armed guards.
 - Drugs and medicines other than those forming part of an authorized first aid kit.
 - Ammunition not authorized to be stored.
 - Any unprotected power source.

Annex F
(Normative)
Table of distances for the storage of explosive materials

Qty of explosive Kg		Distance m							
		Inhabited buildings distance in m		Public roads Traffic volume				Separation of magazines	
				Less than 3000 veh/day		more than 3000 veh/day			
over	less than	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
0	2	32	64	14	27	23	46	3	5
2	5	41	82	16	32	29	58	4	7
5	9	50	100	20	41	37	74	5	9
9	14	57	114	23	45	42	84	5	10
14	18	64	127	25	50	47	94	5	11
18	23	68	136	27	54	50	100	6	13
23	34	77	154	32	64	58	115	7	14
34	45	86	173	34	68	63	126	7	15
45	57	91	182	36	73	68	136	8	16
57	68	98	195	39	77	72	144	9	17
68	91	107	213	43	86	79	159	10	19
91	114	116	232	48	95	86	172	10	21
114	136	123	245	50	100	91	183	11	22
136	182	134	268	54	109	100	201	12	25
182	227	145	291	59	118	108	216	13	26
227	272	109	218	61	123	115	230	14	28
272	318	161	322	66	132	103	205	15	29
318	363	170	341	68	136	126	252	15	30
363	409	177	354	70	141	131	262	16	32
409	454	182	363	73	145	136	272	16	33
454	545	193	386	75	150	144	289	18	35
545	636	204	409	77	154	153	305	19	37
636	726	213	427	79	159	159	319	20	39

Qty of explosive Kg		Distance m							
		Inhabited buildings distance in m		Public roads Traffic volume				Separation of magazines	
				Less than 3000 veh/day		more than 3000 veh/day			
over	less than	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
726	817	222	445	82	163	166	332	20	40
817	908	229	459	84	168	172	343	20	41
908	1135	247	495	86	173	185	370	22	44
1135	1362	263	527	89	177	196	392	24	47
1362	1816	288	577	95	191	215	430	26	53
1816	2270	311	622	102	204	233	466	28	55
2270	2724	331	663	107	213	248	496	30	59

- Note 1: Weights and distances are converted from the imperial weights and distances used in the American table of distances (IME safety library publication No2)
- Note 2: Barricaded means the effective screening of the magazine containing explosives from a building containing explosives, or other building or railway or roadway by a natural or by an artificial barrier. A straight line from the top wall of a building or magazine containing explosives to the eaves line of any other building or a point 3.5m above the centre line of any roadway or railway shall pass through such a barrier.
- Note 3: Artificial barricade is an artificial mound or reveted earth wall not less than 90cm thick.
- Note 4: Natural barricade means natural feature of the ground such as hills or timber with sufficient density that the magazine cannot be seen from the building of features requiring protection when the trees are bare of leaves.
- Note 5: Storage of quantities in excess of 2724 kg should be limited to a permanent storage facility which should be regulated by the host nation or the national mine action authority.