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Storage, transportation and handling of explosives

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Foreword

International standards for humanitarian demining programmes were first proposed by working groups at an international technical conference in Denmark, in July 1996. Criteria were prescribed for all aspects of demining, standards were recommended and a new universal definition of 'clearance' was agreed. In late 1996, the principles proposed in Denmark were developed by a UN-led working group and the International Standards for Humanitarian Mine Clearance Operations were developed. A first edition was issued by the UN Mine Action Service (UNMAS) in March 1997.

The scope of these original standards has since been expanded to include the other components of mine action and to reflect changes to operational procedures, practices and norms. The standards were re-developed and renamed as International Mine Action Standards (IMAS) with the first edition produced in October 2001.

The United Nations has a general responsibility for enabling and encouraging the effective management of mine action programmes, including the development and maintenance of standards. UNMAS, therefore, is the office within the United Nations responsible for the development and maintenance of IMAS. IMAS are produced with the assistance of the Geneva International Centre for Humanitarian Demining (GICHD).

The work of preparing, reviewing and revising IMAS is conducted by technical committees, with the support of international, governmental and non-governmental organisations. The latest version of each standard, together with information on the work of the technical committees, can be found at <http://www.mineactionstandards.org/>. Individual IMAS are reviewed at least every three years to reflect developing mine action norms and practices and to incorporate changes to international regulations and requirements.

Introduction

The need to reduce risk and to provide a safe working environment is a fundamental principle of mine action management. 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 when applicable provision of effective Personal Protective Equipment (PPE) 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 (NMAA) and demining organisations engaged in demining and Explosive Ordnance Disposal (EOD) operations to develop and maintain appropriate policy and procedures. Where existing national government regulations differ from those contained in IMAS, the more stringent requirement should be met.

This standard provides NMAA and demining organisations with guidance on the safe storage, transportation and handling of explosives and explosive materials both in the operators' main base and also in the field or temporary base. Specifications for the storage of explosives and safety distances when storing bulk explosives are those provided by the International Ammunition Technical Guidelines (IATG). These specifications should not normally be reduced without the advice of a professionally qualified explosives engineer in the form of an explosion consequence analysis (ECA).

Storage, transportation and handling of explosives

1. Scope

This standard provides references, specifications and guidelines for the safe storage, transportation and handling of explosives used by demining organisations. It complements the more detailed International Ammunition Technical Guidelines (IATG) to which it refers (see clause 5.2 below).

The regulations regarding storage of EOD demolition boxes whilst 'in use' have been developed from various Government and demining organisation' SOPs. Due to the Institute of Makers of Explosives; Safety Library Publication No 2 (IME Pub 2) now calculating Quantity Distances (QD) only for items with no/very little fragmentation risk the safety distances contained therein have been reduced. It is these distances that should be used when storing an EOD demolition, box where appropriate (an EOD Demolition box is regarded as 'in use' throughout the whole time it is with a team away from the organisation's explosives stores). These distances shall not be used for ERW or other ammunition items which may produce fragments. IATG should be used when deciding where these are to be stored.

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

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, definitions and abbreviations

A complete glossary of all the terms, definitions and abbreviations used in the IMAS series of standards is given in IMAS 04.10. In the IMAS series of standards, the words 'shall', 'should' and 'may' are used to indicate the intended degree of compliance.

- a) 'shall' is used to indicate requirements, methods or specifications that are to be applied in order to conform to the standard;
- b) 'should' is used to indicate the preferred requirements, methods or specifications; and
- c) 'may' is used to indicate a possible method or course of action.

The term 'National Mine Action Authority' (NMAA) refers to the government entity, often an interministerial committee, in an EO-affected country charged with the responsibility for broad strategic, policy and regulatory decisions related to mine action.

Note: In the absence of an NMAA, it may be necessary and appropriate for the UN, or some other body, to assume some or all of the responsibilities of an NMAA.

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

The term EOD refers to Explosive Ordnance Disposal, the detection, identification, evaluation, render safe, recovery and disposal of Explosive Ordnance. EOD may be undertaken:

- a) as a routine part of clearance operations, upon discovery of ERW;
- b) to dispose of ERW discovered outside hazardous areas, (this may be a single item of ERW, or a larger number inside a specific area); or

- c) to dispose of EO which has become hazardous by deterioration, damage or attempted destruction.

The term “EOD Demolition Box” refers to any container used by demining organizations in the field to temporarily store and transport explosives to the work site. The box can be of varying size and would typically contain demolition explosive used for the demolition of mine/ERW found during the task.

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 organizations that contain some explosives, such as detonators, fuzes and primers.

The term “magazine” refers to any building, structure, or container approved for the storage of explosive materials, c.f. explosive storehouse.

4. General requirements

Modern explosives are safe if they are stored, transported and handled in accordance with the manufacturers' instructions. Demining organisations should not use explosives of uncertain origin or age, or when the environmental storage conditions have not met the manufacturers' requirements. The NMAA or demining/EOD organisation may impose additional requirements based on local experience and conditions.

5. International legislation

5.1. Movement of explosives by road

The movement by road of explosives is a complex issue dependent on what area of the world the demining operations are to take place. The rules contained in IATG 08.10 Transport of Ammunition are to be followed in conjunction with any applicable national rules in the location where the transport is to take place.

Although the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) applicable as from 1 January 2013 is designed for Europe it should be used as a guide when writing SOPs on movement of ammunition by road. The ADR can be found at <http://www.unece.org/trans/danger/publi/adr/adr2013/13contentse.html>.

5.2. Storage of ammunition and explosives

Although the safe storage of ammunition and explosives is a national responsibility, in 2011 the UN General Assembly encouraged States to adopt the technical guidance contained within the International Ammunition Technical Guidelines (IATG).

Demining organisations should therefore adopt IATG for the storage, transport and handling of ammunition and explosives where appropriate. This IMAS will provide information as to the specific elements of IATG that should be adopted.

Note: The IATG are primarily aimed at the management of military stockpiles of ammunition. The rules contained therein apply to ALL organisations when they are storing ammunition and explosives in bulk (i.e. the organisation's main explosive stores). For QD purposes 'in bulk' is anything over 500kg net explosive quantity – any amount below this can be stored using the IME Pub 2 table (at Annex D) as long as there is little or no fragmentation hazard from the explosives stored. Due to differing circumstances in operational areas, these regulations cannot always be applied to 'in use' EOD Demolition boxes which are being used and stored in the field.

6. Environmental requirements

The environmental requirements (temperature, humidity and impact) of ammunition and 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) properly stacked and secured from impact as a result of an accident

Note: Some substances used in ammunition and explosives attract and hold moisture, which may result in the degradation of explosive performance. Degradation may make certain explosive components more sensitive to external influence and thereby may cause them to become dangerous to handle, often due to the potential for the formation of sensitive explosive crystals between the fuze and main body of the munition. Rain, dampness and humidity can cause enormous damage to ammunition and explosives in a very short time – conditions of storage and age of the ammunition may cause dangerous degradation of some stabilising chemicals in propellant and explosives. Every effort shall be made to ensure dry conditions prevail in storage and transportation.

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

Note: 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.

Condensation occurs during sudden changes in temperature and transfer of moisture can also occur through water resistant packaging materials such as plastic containers.

7. Storage requirements

7.1. Storage design

General requirements for the design of magazines and containers used for the storage and transport of explosives used in the demining/EOD process are given in Annex B. Detailed guidance on the design of permanent ammunition storage facilities is provided in IATG 05.20 'Types of buildings for explosive storage'.

7.2. Warning signs and symbols

The NMAA shall specify the warning signs and symbols to be used on explosive storage facilities in local languages in their countries. All warning signs and symbols shall be in accordance with the guidance provided in IATG 01.50 UN Hazard classification system and codes.

7.3. Fire prevention

NMAA oversight and established minimum safety standards. Demining organisations shall establish and maintain fire prevention policies and Standard Operating Procedures (SOPs), which should be based on the general principles given in Annex C. Further guidance on fire prevention, which should also be complied with, is contained within IATG 02.50 'Fire safety'.

7.4. Table of safety distances

For the storage of their main explosive stocks demining organisations should apply the safety distances given in Annex D where practicable as long as the NEQ is less than 500kg and the explosives have no fragmentation risk, unless instructed otherwise by the NMAA. For guidance on the storage of Hazard Division 1.1 explosives over 500kg or posing a fragmentation hazard, or for the storage of explosives in Hazard Divisions 1.2 to 1.6, IATG 02.20 should be used.

7.5. Indoor storage

No indoor storage magazine shall be located in a residence or dwelling or office building, unless it is for the storage of Hazard Division 1.4S items only.

7.6. In-use storage

When a demining team or EOD unit is working in a location where it is not practicable to return the EOD Demolition box to the main store at the close of the day's work the box can be kept at the team's location in accordance with the following rules, where these are practicable:

- a. Detonators shall be stored in a separate box from the rest of the ready use explosives.
- b. Detonators shall be kept in their original packaging, i.e. plastic inner containers within an approved metal box or equivalent protective packaging. They shall be packaged in such a way that they cannot move around within the box.
- c. Detonators shall be stored in a structure a minimum of 30 metres from the team's living accommodation unless a dedicated magazine is provided. They shall be contained in a detonator bay built of sandbags which must completely surround the box and be higher than the box by at least 15cm.
- d. The maximum Net Explosive Quantity (NEQ) to be held in the EOD Demolition box shall be 10kg.
- e. The EOD Demolition box shall be an authorised metal ammunition box of sufficient size to hold all the demolition explosives. Items shall be packed in such a way that they cannot move around inside the box.
- f. The IME Pub 2 table at Annex D should be used when calculating safety distances for the storage of the EOD Demolition box where practicable. It can be stored closer if a dedicated magazine is provided.
- g. The EOD Demolition box may be kept within the same structure as the detonator box as long as the detonator box is kept separate and within a detonator bay as described in Para 7c above.
- h. Fuels, oils, and lubricants and any other flammable materials shall not be stored within 30m of EOD explosive stores. It is permissible for explosives to be stored on a worksite in a vehicle provided the vehicle is not used for routine administrative tasks or is not the dedicated safety vehicle. Where applicable, the requirements of the remainder of this section above still apply.
- i. EOD explosive stores shall be sited so that they are able to be kept under observation at all times. EOD explosive stores established at temporary operations bases are to be suitably guarded during the hours of darkness.
- j. Fire prevention. Fire beater, buckets filled with sand and two 6 kg ABE fire extinguishers are to be available in case of fire.

7.7. UXO and AXO Storage

Recovered UXO and AXO shall not be stored in the same magazine/store as serviceable explosives. UXO and AXO shall be stored separately. Any UXO or AXO store will adhere to the safety distances contained in IATG 02.20. National regulations in regard to removal and destruction of UXO found during demining operations shall be strictly followed.

8. Transportation requirements

8.1. General

Demining organisations shall establish and maintain SOPs that give procedures for the safe transportation of explosives. The procedures should be based on IATG 09.10 Security Principles and Systems, and IATG 08.10 Transport of Ammunition, as well as any national and international regulations in force at that time. The SOPs should include the following requirements:

- a) measures to ensure the security of explosives (e.g. tarpaulin, secured to the vehicle using fibre straps, clearing of inflammable materials from vehicle) ;
- b) explosives to be transported in accordance with the manufacturers' instructions and specifications; and
- c) personnel involved have the required EOD competency level. See CWA EOD competency standards.

8.2. Passengers

Demining organisations should not normally transport passengers with explosives. If it is necessary that passengers are carried in the same vehicle as explosives, a team member shall be appointed as the responsible person in charge. The responsible person shall then ensure the safety of passengers and enforce all fire hazard precautions.

8.3. Transporting detonators and explosives

Detonators and explosives shall not be carried on the same vehicle unless the detonators are stored in their original packaging or in a storage container which meets the minimum design requirements in Annex B.

8.4. Equipment for personal and general protection

Protective and prevention equipment are required in order to:

- carry out general actions and hazard specific emergency actions; and
- be carried on board the vehicle in accordance with section 8.1.5 of ADR.

The following equipment shall be carried on board the transport unit:

- a. for each vehicle:
 - a wheel chock of a size suited to the maximum mass of the vehicle and to the diameter of the wheel;
 - two self-standing warning signs (triangles);
 - eye rinsing liquid; and
 - a container for storing smoking materials, matches, lighters, cigarettes etc..
- b. for each member of the vehicle crew:
 - a warning vest (e.g. as described in the EN 471 standard);
 - portable lighting apparatus;

- a pair of protective gloves; and
 - eye protection (e.g. protective goggles).
- c. Additional equipment required for certain classes:
- a shovel.

Note: This is the minimum amount of equipment that shall be carried as required by European ADR; local or National rules may list additional equipment which should also be carried when working in the area where those regulations apply.

9. Handling

Demining organisations shall establish and maintain SOPs 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 manufacturers' instructions and specifications and other relevant standards and regulations provided by the NMAA; and
- c) only suitably qualified EOD personnel, or personnel supervised by a qualified supervisor, shall handle or use explosives.

10. Inert, drill, instructional or replica mines and ammunition

Only training aids which are Certified Free From Explosives (CFFE) shall be used in training, in displays or as examples during presentations and lectures. Mines and ammunition are inherently dangerous and it is essential that everyone involved in the handling and movement of ammunition should exercise extreme care. It is obviously safer to use inert or drill mines and ammunition for training or display purposes, but this requirement also carries its own specific risks. It is therefore a fundamental principle of ammunition and explosive safety that live ammunition and explosives are never mixed with inert, drill, instructional or replica ammunition and explosives. This is a proven principle designed to ensure that the risk of accidents during training and instruction is reduced to the minimum. The consequences of live mines and ammunition being inadvertently used during training could result in fatalities or injuries.

There is no specific international legislation that refers to the use of inert, drill, instructional and replica mines and ammunition, therefore this part of the IMAS has been derived from 'best practice'.

Demining organisation shall establish and maintain SOPs that give procedures for the storage and handling of inert, drill, instructional or replica mines and ammunition. The procedures shall include the requirements contained at Annex F.

11. Physical security

Demining organizations shall provide for appropriate levels of physical security for explosives in their possession during storage, transportation and use. Consideration should be given not only to the immediate physical security provided by the storage facility - strict accounting procedures and control of access shall be implemented. There may be occasions when additional measures such as appropriately equipped guards are necessary. The national standard should be the minimum level provided. The security measures required depend on the situation of the area where operations are taking place and should be decided on in consultation with the local authorities.

12. Responsibilities

12.1. National Mine Action Authority (NMAA)

The NMAA shall develop documented regulations for the storage, transportation and handling of explosives, which include:

- a) an accreditation system for demining organisations. The system should ensure that demining organisations are competent and equipped to store explosives
- b) standards for storage of explosives, including storage of ERW, including when on unexploded sub-munitions clearance sites;
- c) standards for the carriage of explosives, including warning signs and symbols to be used on vehicles;
- d) safety distances for the storage and handling of explosives; and
- e) minimum requirements for fire prevention.

12.2. Demining organisations

The demining organisations shall establish and maintain SOPs that comply with the provisions of this IMAS, established international standards, the NMAA standards and other relevant standards or regulations.

In the absence of a NMAA or authorities, the operator should assume additional responsibilities. These include, but are not restricted to:

- a) issue, maintaining and updating of their own regulations, codes of practice, SOPs and other suitable provisions on the storage, transportation and handling of explosives;
- b) co-operating with other organisations in the same country to ensure consistency of standards for the storage, transportation and handling of explosives; and
- c) assisting in framing national regulations and codes of practice for the storage, transportation and handling of explosives.

12.3. Demining Organisation' employees

Demining organisations' employees 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. This includes any explosive or explosive items which are found to be missing.

Annex A (Normative) References

The following normative documents contain provisions, which, through reference in this text, constitute provisions of this part of the standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid ISO or EN:

- a) IATG 01.50 UN Explosive classification system and codes;
- b) IATG 02.20 Quantity and separation distances;
- c) IATG 02.50 Fire safety;
- d) IATG 04.10 Field and temporary storage;
- e) IATG 05.20 Types of buildings for explosive facilities;
- f) IATG 08.10 Transport of ammunition;
- g) IATG 09.10 Security principles and systems;
- h) 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' dated February 2007;
- i) Institute of Makers of Explosives; Safety Library Publication No 2 – 'The American Table of Distances' with changes up to October 2011 – further information is available at <http://www.ime.org>;
- j) IMAS 04.10 Glossary of mine action terms, definitions and abbreviations; and
- k) IMAS 09.30 Explosive ordnance disposal.

The latest version/edition of these references should be used. GICHD hold copies of all references used in this standard. A register of the latest version/edition of the IMAS standards, guides and references is maintained by GICHD, and can be read on the IMAS website (www.mineactionstandards.org). National employers, mine action authorities, and other interested bodies and organisations should obtain copies before commencing mine action programmes.

Annex B (Informative) **General requirements for the construction of Magazines**

B.1. Permanent structure

Permanent structures should be designed and constructed in accordance with the guidance at IATG 05.20 Types of buildings used for explosive facilities.

B.2. Portable or mobile magazine

A portable magazine is a portable structure such as a skid-mounted container, trailer or semi-trailer. Other types of field or temporary storage arrangements may be used in accordance with IATG 04.10 Field and temporary storage.

A portable or mobile magazine shall be theft-resistant, fire-resistant and weather-resistant. The magazine should be constructed of steel with an interior lining of timber. Where possible the following criteria should be applied.

Note: 15.9 mm steel with an interior lining of any spark-proof material.

12.7 mm steel with an interior lining of not less than 9.5 mm plywood or particleboard.

9.5 mm steel with an interior lining of 57 mm 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: Ventilation openings in walls of magazines should have as a minimum a total surface area of 60 cm² per 1.0 m³ of volume inside the magazine.

The magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5 mm diameter casehardened shackle. Hardware used with the padlock should be of a comparable quality.

Trailers or semi-trailers used as portable magazines should be immobilised by removing the wheel, or by locking with a wheel locking device approved by the NMAA.

B.3. Day box

A day box is a portable EOD Demolition box that shall be theft-resistant, fire-resistant and weather-resistant. It need not be bullet resistant.

The day box should be constructed of not less than 2.6 mm steel with an interior lining of not less than 12.7 mm plywood or particleboard.

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

The magazine should be equipped with at least a five tumbler steel padlock that has at least a 9.5 mm diameter casehardened shackle. Hardware used with the padlock should be of a comparable quality.

Explosive materials shall not be left unattended in a day box and shall be removed to a portable or mobile magazine or permanent magazine.

B.4. Detonator transport container

Detonators and other explosives may be carried together on a vehicle providing the detonators are carried in a detonator transport container or compartments designed and constructed specifically for that purpose. This does not apply to ready use detonators – these can be carried as long as they are in their original packaging and kept as far away from the EOD Demolition box as possible. Use of detonator transport containers shall be under the following conditions:

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

Note: Annex E to this IMAS provides detailed guidance on hazard classification and compatibility codes.

- b) packaging for detonators described in sub-clause C.4 a) (1) above are as follows;
 - (1) detonators electric 1.4B, 1.4S and 1.1B that contain no more than 1 gm of explosive and are transported in quantities of less than 1000 shall be packed in inner packing or cartons that meet the manufacturers' specifications before loading into the container; and
 - (2) detonators non-electric 1.4B and 1.4S shall be loaded into the container in the manufacturers' original outer packing;
- c) no other material shall be loaded on top of the portable detonator container;
- d) the detonator container shall be secured to the vehicle to prevent movement during transport; and
- e) the detonator container shall be clearly labelled 'contains explosive, handle with care' in the official languages commonly used in the demining organisation.

Annex C

(Informative)

Fire prevention

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

- a) no smoking within 20 m of the magazine. NO SMOKING / NO NAKED LIGHTS signs shall be prominently displayed around the magazine;
- b) grass and undergrowth shall be 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. Authorised 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 9.0 litre water 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 notice board listing articles that are not permitted into the magazine shall be prominently displayed at the entrance to the magazine. Details of the prohibited articles to be shown on the board are as follows:
 - (1) lanterns, oil lamps and stoves and all flame or fire producing appliances;
 - (2) matches, cigarette lighters or other portable means of producing a spark or flame;
 - (3) tobacco in any form and any article used for the purpose of smoking;
 - (4) inflammable liquids and solvents other than those authorised for maintenance work on containers or contained in the tank of a vehicle;
 - (5) food and drink;
 - (6) radio equipment (all types) including mobile phones;
 - (7) firearms with the exception of those carried by guards;
 - (8) drugs and medicines other than those forming part of an authorised first aid kit;
 - (9) ammunition not authorised to be stored; and
 - (10) any unprotected power source.

- j) an external sign on storage facilities shall give details of emergency point of contact to obtain access to the facility, and shall list hazard divisions of the contents;
- k) All metallic enclosures for electrical wiring and fittings shall be effectively bonded throughout and grounded;
- l) Some method of sounding an alarm in the event of fire shall be in place; and
- m) The correct Fire Symbol shall be displayed outside each building containing ammunition to alert personnel to the hazards associated with the ammunition in the event of fire.

Annex D (Informative)

Table of distances for the storage of explosive materials

Net Explosive Quantity (NEQ) (kg)		Distance (m)							
		Inhabited Building Distance (IBD)		Public Traffic Routes (PTR) (Traffic Volume)				Inter Magazine Distance (IMD)	
				Less than 3000 veh/day		More than 3000 veh/day			
Over	Less Than	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
0	3	21.3	46.6	9.1	19.3	15.5	33.6	1.8	4.1
3	5	29.4	56.1	11.7	23.3	21.2	42.4	2.6	5.3
5	10	34	68.9	13.9	27.7	25.1	50.1	3.7	6.2
10	15	39	79	15.6	31.1	29.0	57.9	3.4	6.5
15	20	43.6	87.8	17.2	34.5	32.0	64.1	3.8	7.7
20	25	48.2	93.9	19.5	39.1	35.6	71.3	4.4	8.8
25	35	53.1	105	21.6	43.3	39.5	78.9	4.6	9.3
35	50	58.2	118	23.0	46.0	42.7	85.3	4.9	9.9
50	65	62.8	129	25.0	50.0	46.8	93.7	5.6	11.2
65	80	70	138	28.1	56.3	52.0	104	6.2	12.5
80	100	74.8	148	30.6	61.1	55.6	111	6.7	13.4
100	120	79.6	158	32.6	65.3	59.1	118	7.1	14.3
120	150	84.5	169	34.4	68.8	63.0	126	7.6	15.2
150	200	92.3	186	37.5	75.0	69.0	138	8.4	16.8
200	250	100	201	40.2	80.5	74.4	149	9.1	18.2
250	300	106	213	42.7	85.4	79.1	158	9.6	19.2
300	350	112	225	45.1	90.3	83.3	167	9.9	19.9
350	400	118	236	46.8	93.6	87.1	174	10.5	21.0
400	450	121	243	48.5	97.0	90.8	182	10.9	21.8
450	500	129	252	50.2	100	96.5	193	11.8	23.6

Note: 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 centreline of any roadway or railway shall pass through such a barrier. It is also often referred to as traversing.

-
- Note: Artificial barricade is an artificial mound or revetted earth wall not less than 90 cm thick.
- Note: For small quantities (up to 18 Kg NEQ) a 68cm thick brick wall situated 1m from the ammunition/explosives and extending to 2° (but a minimum of 60cm) above the top of the ammunition/explosive (see IATG 05.30 for details).
- Note: 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 or features requiring protection when the trees are bare of leaves.
- Note: The table now included has lower quantity distances for explosives held than the original version in IMAS 10.50 Editions 1 and 2. This is due to the fragmentation effect being ignored as it is intended for blasting explosives and the like. This table is therefore only for use with demolition stores where there is very little fragmentation hazard. This table shall not be used for APM, ERW, stockpiles or similar where military ammunition may be involved.
- Note: When an operational EOD Demolition Box is being used away from the team's HQ location, it is regarded as being 'in use' at all times. The distances in this table apply between the 'in use' box and areas/facilities which are not connected with the team, e.g. houses, roads etc. **where practicable**. The distances at Para 7.6 should be applied between the 'in use' box and the team's temporary accommodation, garaging etc. where these distances are possible given the security climate of the area they are in.
- Note: This table can be used to calculate safety distances for an organisation's main bulk holdings of demolition explosives and accessories up to 500kg NEQ as long as there are no fragmentation hazards from any of the items. Above 500kg NEQ IATG 02.20 is to be used.
- Note: When storing APM, ERW, CM and stockpiles which include military ammunition, and therefore carry the risk of fragmentation, the quantity distance tables in IATG 02.20 are to be used.

Annex E

(Normative)

Hazard classification codes

E.1. Hazard divisions

Explosive items are allocated one of six Hazard Divisions (HDs); dependent on the hazard it presents when initiated. The HDs are identified by a two number code as follows: 1.1, 1.2, 1.3, 1.4, 1.5 and 1.6.

The description and definition of each of the HDs are included in Appendix 1 to this Annex.

E.2. Compatibility groups

In addition to HDs all ammunition has been allocated to one of thirteen Compatibility Groups (CGs) indicated by the letters A to H, J, K, L, N and S in order to ensure correct segregation during storage and transportation.

The description and definition of each of the CGs is included as Appendix 2 to this Annex.

E.3. Hazard Classification Code

Hazard Classification Codes (HCC) are formed by combining the HD and CG of an item of ammunition to produce a two/three number, one letter code. For example '1.1 D' or '1.21 C'.

Appendix 1 to Annex E (Normative) Ammunition hazard divisions

Ammunition is divided into six Hazard Divisions (HD) according to the hazard it presents when initiated.

HD 1.1 - Ammunition which has a mass explosion hazard

The explosion will produce severe structural damage to surrounding buildings in the immediate neighbourhood, the severity being determined by the amount of explosives involved and the distance of the buildings from the explosion site. Blast and high speed fragments are the major hazards although there may be a danger from heavy debris propelled from the structure in which the explosion occurs.

HD 1.2 - Ammunition which has a projection hazard but not a mass explosion hazard

The explosion will result in items burning and exploding progressively a few at a time. Fragments, fire brands and unexploded items may be projected in considerable numbers; some of these may explode on impact and propagate fire or explosion. Blast effects will be limited to the immediate vicinity of the explosion site.

For the purpose of determining the quantity distance this hazard division is subdivided, namely:

- a) Subdivision 1.21 - Ammunition which will produce large fragments with a considerable range.
- b) Subdivision 1.22 - Ammunition which will produce small fragments with a limited range.

HD 1.3 - Ammunition which has a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

For the purposes of determining the quantity distance this hazard is subdivided, namely:

- a) Subdivision 1.3.1 - Ammunition which will burn with great violence and intense heat emitting considerable thermal radiation.
- b) Subdivision 1.3.2 - Ammunition which will burn sporadically. Items may explode producing minor fragments. Firebrands and burning containers may also be projected.

HD 1.4 - Ammunition which presents no significant hazard.

Ammunition included in this division is primarily a moderate fire hazard. It will not contribute excessively to the fire. The effects are largely confined to the package; however the external fire may cause a package to be degraded such that it cannot contain the effects of the ammunition. No fragments of appreciable size or range are to be expected. An external fire will not cause a mass explosion of the total contents of the package when there are a number of items in the package.

HD 1.5 - Ammunition which although mass exploding is very insensitive.

Ammunition in this division is confined to certain bulk explosives that are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of storage and transport. For the purposes of determining quantity distances, ammunition belonging to Hazard Division 1.5 is to be deemed to belong to HD 1.1.

HD 1.6 – Ammunition which is extremely insensitive and does not have a mass explosion hazard.

This division comprises articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

Appendix 2 to Annex E (Normative) **Ammunition compatibility groups**

Ammunition and explosives have been grouped into thirteen Compatibility Groups (CGs) A to H, J, K, L, N and S. Group I is omitted to avoid possible confusion between the letter I and the Roman numeral 1. Group S is given a distinctive letter since it corresponds to a unique possibility for mixing in storage and transport.

2.E.1 Definitions of compatibility groupings:

Group A

Primary explosive.

Group B

Ammunition containing primary explosive.

Group C

Propellant, explosive or other secondary deflagrating explosive or ammunition containing such explosive.

Group D

Secondary detonating explosive or black powder or ammunition containing secondary detonating explosive, in each case without its own means of initiation and without a propulsive charge.

Group E

Ammunition containing secondary detonating explosive, without its own means of initiation, with a propulsive charge.

Group F

Ammunition containing secondary detonating explosive, with its own means of initiation, with or without a propulsive charge.

Group G

Pyrotechnic substance, or ammunition containing pyrotechnic substance, or ammunition containing both an explosive and an illuminating, incendiary, lachrymatory or smoke producing substance (other than a water-activated article or one containing WP, phosphide or flammable liquid or gel).

Group H

Ammunition containing both an explosive and WP.

Group J

Ammunition containing both an explosive and a flammable liquid or gel.

Group K

Ammunition containing both an explosive and a toxic chemical agent.

Group L

Ammunition containing explosive and presenting a special risk needing isolation of each type.

Group N

Ammunition which contains only extremely insensitive detonating substances.

Group S

Ammunition so packaged or designed that any explosive effect during storage or transport is confined within the package except when an external fire has degraded the packaging.

- Note: CG D applies only when secondary detonating explosive (high explosive) or black powder is properly packed in a dust-tight container. OTHERWISE, CG L applies.
- Note: CG D or E may apply to ammunition that is fuzed or packed together with fuzes.
- Note: CG F does not necessarily apply to ammunition that is fuzed or packed together with fuzes.
- Note: The HD and CG given to an item apply when that item is packed in its full standard packaging. When unpackaged, or contained in different packaging, the operator shall assess whether it still retains its packaged code. If not it must be stored in accordance with the newly assessed code. An example would be; if HE hand grenades, normally packed with their fuzes within the same outer pack but with a protective inner pack which prevented functioning of the fuzes propagating to the grenades (classed as 1.2E), were stored with the fuzes in different packaging without the protective inner pack, they would exhibit the features of items in 1.1F, meaning that the contents would mass explode and would have the method of initiation 'attached'. It would be stored as CG 'F' using the CG mixing rules and would be classed as HD 1.1 when calculating the NEQ in a store.

Appendix 3 to Annex E (Normative) Ammunition Compatibility Group Mixing Rules

Compatibility Group	A	B	C	D	E	F	G	H	J	K	L	N	S
A													
B			(8)	(1,8)	(1,8)	(1,8)	(3,8)						
C		(8)				(2)	(3)					(4)	
D		(1,8)				(2)	(3)					(4)	
E		(1,8)				(2)	(3)					(4)	
F		(1,8)	(2)	(2)	(2)		(3)						
G		(3,8)	(3)	(3)	(3)	(3)							
H													
J													
K													
L											(5)		
N			(4)	(4)	(4)							(6)	(7)
S												(7)	

Table 4: Compatibility Group Mixing Rules

When using the table please refer to the following key to the colour codes and the note numbers within each box and what they mean.



Items within these two compatibility groups **cannot** be stored together under any circumstances. Where there is a note number then additional restrictions apply as below.



Items within these two compatibility groups **can** be mixed in storage. Where there is a note number the rules in the appropriate note apply.



Items within these two compatibility groups **can** be mixed in storage **only if** they meet the criteria specified below for the note number in the box.

Note 1: Compatibility Group B fuzes may be stored with the articles to which they will be assembled, but the Net Explosive Quantity (NEQ) shall be aggregated and treated as Compatibility Group F.

Note 2: Storage in the same building may be permitted if effectively segregated to prevent propagation.

Note 3: Mixing of articles of Compatibility Group G with articles of other compatibility groups is at the discretion of the National Competent Authority. This only applies to articles in CG 'G' – substances in CG 'G' must be stored separately.

- Note 4: Articles of Compatibility Group N should not in general be stored with articles in other compatibility groups except S. However, if such articles are stored with articles of Compatibility Group C, D and E, the articles of Compatibility Group N should be considered as having the characteristics of Compatibility Group D and the compatibility groups mixing rules apply accordingly.
- Note 5: Compatibility Group L articles shall always be stored separately from all articles of other compatibility groups as well as from all other articles of different types of Compatibility Group L.
- Note 6: It is allowed to mix 1.6N munitions. The Compatibility Group of the mixed set remains N if the munitions belong to the same family or if it has been demonstrated that, in case of a detonation of one munition, there is no instant transmission to the munitions of another family (the families are then called 'compatible'). If it is not the case the whole set of munitions should be considered as having the characteristics of Compatibility Group D.
- Note 7: A mixed set of munitions 1.6N and 1.4S may be considered as having the characteristics of Compatibility Group N.
- Note 8: Detonators in CG 'B' can be stored with these CGs if the detonators are contained within a brick or sandbag built detonator bay.

The Mixing Rules in this Appendix only apply to serviceable ammunition.

Annex F **(Normative)**

Inert, drill, instructional or replica mines and ammunition

F.1. General

The purpose of this Annex is to ensure that inert, drill, instructional or replicas of mines and ammunition are handled, stored and accounted for accurately, in order to:

- a) avoid accidents;
- b) avoid incidents of mistaken identification leading to unnecessary clearance operations or render safe procedures;
- c) ensure the security of drill and inert mines and ammunition; and
- d) ensure that drill and inert mines and ammunition are not subjected to unnecessary damage, which can be expensive.

All authorised breakdown or modification of live mines and ammunition into inert, drill, instructional or replica items shall only be carried out by appropriately qualified and authorised EOD personnel. As such operations carry a high degree of inherent risk the authorisation for such activities shall be the responsibility of the national programme manager, or equivalent, of the demining/EOD organisation. Such operations should only be carried out by a Level 3+ EOD technician who has experience and knowledge of the item being broken down, who has been granted authority based on qualifications and experience by the technical operations manager and the technical authority in the NMAA/MAC. The organisation must have full technical documentation for the item involved from either the manufacturers or the military of the items country of origin. A full technical breakdown instruction including a diagram or x-ray of all the component parts of the item must be produced and approved by the technical operations manager and the technical authority in the MAC before the national programme manager gives his/her permission. A letter authorising the activity must be written by the country manager specifying who is authorised to carry out the procedure, what the ammunition involved is and how long the permit lasts. It must certify that the procedure has been checked and that the area where the procedure is to be performed has been inspected and confirmed as fulfilling all requirements for the dismantling of the item (e.g. protective shields, earthing procedures, conducting surfaces, correct standard of electrical installation and so on). The letter must be signed by the country manager, the technical manager, the MAC technical authority and the person carrying out the task.

Note: Drill and replica mines and ammunition are readily available on the commercial market. They are made up from empty components, either obtained direct from the original manufacturer or specifically made for the purpose. These should be used as the first choice. Locally manufactured drill and instructional mines and ammunition should only be used as a last resort. The cost of inert replica items should not be a reason to engage in potentially lethal break downs of ammunition. It should be borne in mind what the cost of the item is compared to the cost of a life.

NMAA and demining organisations should never produce Free From Explosives (FFE) ammunition as souvenirs.

F.2. Storage

Inert, drill, instructional and other replicas of mines and ammunition shall not be stored with live ammunition. They shall be stored in a separate location outside the explosive storage area.

Mines and ammunition that have been subjected to render safe procedures, have had all explosives removed, and have been certified as FFE, shall be stored in the same manner as drill and inert ammunition. Technical Operations managers should check all FFE items in their area of responsibility to confirm they are FFE as close to the start of their appointment as possible.

Inert, drill, instructional and other replicas of mines and ammunition shall not be stored in the same containers as live ammunition. They shall be stored in a separate container, which shall be clearly marked INERT or DRILL in the local language. It should also appear in one of the six recognised languages of the United Nations, (Arabic, Chinese, English, French, Russian and Spanish). All other markings shall be eradicated from the container to ensure that there is no possibility that it could mistakenly be identified as containing live ammunition.

F.3. Movement

Inert, drill, instructional and inert replicas of mines and ammunition shall not be moved in the same containers as live ammunition. They shall be moved in a separate container, which shall be clearly marked INERT or DRILL in the local language. It should also appear in one of the six recognised languages of the United Nations, (Arabic, Chinese, English, French, Russian and Spanish). All other markings shall be eradicated from the container to ensure that there is no possibility that it could be mistakenly identified as containing live ammunition.

It is recommended that inert, drill, instructional and other replicas of mines and ammunition are not moved on the same vehicle as live ammunition wherever possible, but it is accepted that local circumstances may not allow for this.

F.4. Breakdown of mines and ammunition

Demining organisations should not breakdown, modify or tamper with mines and ammunition, unless it is done in the course of inspection, modification or disposal in accordance with the appropriate technical procedures.

All authorised breakdown or modification of live mines and ammunition into inert, drill, instructional or replica items shall only be carried out by appropriately qualified and authorised EOD personnel. As such operations carry a high degree of inherent risk the authorisation for such activities shall be the responsibility of the national programme manager, or equivalent, of the demining/EOD organisation. Such operations should only be carried out by a Level 3 + EOD technician who has experience and knowledge of the item being broken down, who has been granted authority based on qualifications and experience by the technical operations manager and the technical authority in the MAC. The organisation must have full technical documentation for the item involved from either the manufacturers or the military of the items country of origin. A full technical breakdown instruction including a diagram or x-ray of all the component parts of the item must be produced and approved by the technical operations manager and the technical authority in the MAC before the national programme manager gives his/her permission.

A letter authorising the activity must be written by the country manager specifying who is authorised to carry out the procedure, what the ammunition involved is and how long the permit lasts. It must certify that the procedure has been checked and that the area where the procedure is to be performed has been inspected and confirmed as fulfilling all requirements for the dismantling of the item (e.g. protective shields, earthing procedures, conducting surfaces, correct standard of electrical installation and so on). The letter must be signed by the country manager, the technical manager, the MAC technical authority and the person carrying out the task.

F.5. Marking of inert or drill mines and ammunition

All inert, drill, instructional or other replicas of mines and ammunition shall be clearly marked on all sides as either '**INERT**' or '**DRILL**' as appropriate in the local language. It should also appear in one of the six recognised languages of the United Nations, (Arabic, Chinese, English, French, Russian and Spanish). This ensures that they can be clearly identified from all angles, and therefore do not inadvertently or accidentally become the focus of a clearance operation or render safe procedure.

All inert, drill, instructional or other replicas of mines and ammunition shall also be marked with a unique serial number. This unique serial number should be in the following format:

ABC / 1234 / 01

(Demining organisation trigram/Serial Number/Year of manufacture or purchase)

There are no commonly accepted international standard for the body colour marking of ammunition and explosives, although international alliances have made standard agreements (STANAG) for standardisation within their alliance. Inert, drill, instructional or replica mines and ammunition should be coloured dark blue for uniformity throughout Mine Action organisations to avoid confusion.

If an individual is in any doubt as to the explosive status of a mine or item of ordnance, then it shall be treated as live, and technical demining or EOD advice as appropriate shall be immediately requested.

F.6. Registration and accounting for inert or drill mines and ammunition

The demining organisation shall maintain a master register of all inert, drill, instructional or other replica mines and ammunition that it has responsibility for. This register shall include the following information:

- a) serial number;
- b) type of APM or munition;
- c) current location;
- d) FFE certificate serial number;
- e) photographs of the item from several angles, showing the markings and, where possible, showing the parts of the item where explosives have been removed from; and
- f) where possible an x-ray of the item should be taken and a positive image kept with the FFE documents for each item.

The demining organisation shall operate an appropriate accounting system to ensure accountability and traceability for all inert, drill, instructional or replica mines and ammunition in its possession. It is recommended that this is based on their live ammunition accounting system. All documents should be kept with the register for easy confirmation of an item's status as FFE.

F.7. Free From Explosive (FFE) certification

On initial acquisition, all supposedly inert, drill, instructional or replica mines and ammunition shall be visually inspected and physically examined by an appropriately qualified EOD technician to ensure that the item contains no explosive, pyrotechnic, lachrymatory, radioactive, chemical, biological or other toxic components or substances. The EOD technician shall also ensure that all ammunition markings, (designation, hazard division, hazard compatibility code, previous serial numbers, UN symbols etc.), that refer to the previous live condition of the item have been removed or obliterated.

The EOD technician shall then issue a FFE certificate for the item. This certificate shall contain the following information:

- a) unique serial number. (It is recommended that for ease of administration that this is the same as the serial number at clause F.5);
- b) date;
- c) name of inspecting EOD technician;
- d) brief description of item;
- e) an FFE certification statement;
- f) signature of inspecting EOD technician.

Note: It is recommended that the following statement is used in the local language for (e) above:

I certify that I have visually inspected and physically examined the item referred to on this FFE certificate and confirm that this item contains no explosive, pyrotechnic, lachrymatory, radioactive, chemical, biological or other toxic components or substances. I also certify that I have ensured that all previous ammunition markings have been removed or obliterated and that the item has been remarked as either DRILL or INERT. I am satisfied that it is safe to use for drill, display or instructional purposes.

The demining organisation shall maintain a register of all FFE certificates issued, together with the items detailed in F6 above.

WARNING

If an individual is in any doubt as to the explosive status of a mine or item of ordnance, then it shall be treated as live, and technical demining or EOD advice as appropriate shall be immediately requested. If there are still any doubts then the item is to be destroyed.

Amendment record

Management of IMAS amendments

The IMAS series of standards are subject to formal review on a three-yearly basis, however this does not preclude amendments being made within these three-year periods for reasons of operational safety and efficiency or for editorial purposes.

As amendments are made to this IMAS they will be given a number, and the date and general details of the amendment shown in the table below. The amendment will also be shown on the cover page of the IMAS by the inclusion under the edition date of the phrase '*incorporating amendment number(s) 1 etc.*'

As the formal reviews of each IMAS are completed new editions may be issued. Amendments up to the date of the new edition will be incorporated into the new edition and the amendment record table cleared. Recording of amendments will then start again until a further review is carried out.

The most recently amended IMAS will be the versions that are posted on the IMAS website at www.mineactionstandards.org.

Number	Date	Amendment Details