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Storage, transportation and handling of explosives in mine action

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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.

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

Introduction

Managing risk is fundamental to every aspect of mine action. The aim of risk management is to identify, assess, control and review risk wherever it may arise, so that mine action programmes, projects and activities are safe, efficient and effective in achieving their objectives. Within mine action, the provision of a safe working environment includes the safe storage, transportation and handling of explosive ordnance (EO).

This requires:

- appropriate storage facilities;
- equipment and vehicles to be made available; and
- national mine action authorities (NMAA) and demining organizations which are engaged in land release and explosive ordnance disposal (EOD) operations to develop and maintain appropriate policy and procedures.

In the mine action sector, the requirement to store, transport and handle explosives is intrinsically linked to the disposal processes that culminate with land release.

Determining safety best practice is directly linked to:

- IMAS 07.11, Land release
- IMAS 07.14, Risk management in mine action
- IMAS 09.30, Explosive ordnance disposal.
- IMAS 09.31, Improvised explosive device disposal.
- T&EP 09.31/01/2019, IEDD competency standards
- IMAS 10.10, Safety and occupational health – general requirements.
- IMAS 10.20, Demining worksite safety
- IATG 04.10, Temporary storage
- IATG 08.10, Transport of ammunition

The International Ammunition Technical Guidelines (IATG) provide guidance on conventional ammunition stockpile management. The term ‘stockpile management’ refers to those procedures and activities regarding the safe and secure accounting, storage, transportation, handling, and disposal of conventional ammunition.

The objectives of conventional ammunition stockpile management are to reduce and mitigate the risk to personnel and communities from unplanned explosive events and the risk of diversion to illicit markets as well as to ensure optimum usage of scarce resources. The guidance provided in the IATG is relevant to the mine action sector and shall be integrated as much as possible; particularly in the topics listed above.

The aim of this standard is to provide specifications and guidance for the conduct and management of the safe storage, transport and handling of explosives used in mine action, and the EO located as part of mine action. It details general principles and management responsibilities, but it does not provide specific technical guidance for the disposal of particular EO.

Storage, transportation and handling of explosives in mine action

1 Scope

This standard provides guidance to national mine action authorities (NMAAs) and mine action organizations for the temporary storage, transportation and handling of explosives used for mine action and the explosive ordnance (EO) associated with the disposal or demolition of unexploded ordnance (UXO), abandoned ordnance (AXO), propellants and improvised explosive devices (IED), components including home-made explosives, that derive from land release operations and explosive ordnance disposal tasks.

This document does not apply to the storage, transportation and handling of conventional ammunition stockpiles, which is covered by the International Ammunition Technical Guidelines (IATG).

This document does not cover explosive ordnance disposal (EOD) and IED disposal render safe procedures (RSP), which are addressed in other IMAS.

2 Normative 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 complete glossary of all the terms, definitions and abbreviations used in the International Mine Action Standards (IMAS) series is given in IMAS 04.10.

In the IMAS series, the words “shall”, “should” and “may” are used to indicate the intended degree of compliance:

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

3.1

demolition explosives

serviceable stocks of ammunition and explosives used by mine action organizations to dispose of explosive ordnance

3.2

explosive ordnance

EO

mine action’s response to the following munitions:

- mines;
- cluster munitions;
- unexploded ordnance;
- abandoned ordnance;
- Booby traps;
- other devices (as defined by CCW APII);

- improvised explosive devices

Note to entry: Improvised explosive devices (IEDs) meeting the definition of mines, booby traps or other devices fall under the scope of mine action when their clearance is undertaken for humanitarian purposes and in areas where active hostilities have ceased.

3.3

explosive materials

components or ancillary items used by demining organizations that contain some explosives, such as detonators, fuzes and primers

3.4

explosive ordnance disposal

EOD

detection, identification, evaluation, render safe, recovery and disposal of explosive ordnance

Note to entry: EOD may be undertaken:

- as a routine part of mine clearance operations, upon discovery of EO;
- 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
- to dispose of EO which has become hazardous by deterioration, damage or attempted destruction.

3.5

explosive ordnance disposal demolition box

EOD demolition box

suitable container used by demining organizations in the field to temporarily store and transport explosives to the work site

Note to entry: The box can be of varying size and typically contains demolition explosives and materials used for the demolition of EO found during the task.

3.6

explosives

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

3.7

exposed site

ES

magazine, cell, stack, truck or trailer loaded with ammunition, ammunition process building (APB), inhabited building, assembly place or public traffic route, which is exposed to the effects of an explosion (or fire) at the potential explosion site (PES) under consideration

3.8

Improvised explosive device

IED

a device placed or fabricated in an improvised manner incorporating explosive material, destructive, lethal, noxious, incendiary, pyrotechnic materials or chemicals designed to destroy, disfigure, distract or harass. They may incorporate military stores but are normally devised from non-military components.

3.9

improvised explosive device disposal

IEDD

location, identification, rendering safe and final disposal of improvised explosive devices

3.10

inhabited building

building or structure occupied in whole or in part by people (usually civilian)

3.11

inhabited building distance

IBD

minimum permissible distance between potential explosion sites (PES) and non-associated exposed sites (ES) that requires a high degree of protection from an explosion

Note to entry: The IBD is a form of outside quantity distance (OQD).

3.12

inside quantity distance

IQD

minimum permissible distance between a potential explosion site (PES) and an exposed site (ES) inside the explosives area

3.13

inter-magazine distance

IMD

minimum permissible distance between a building or stack containing explosives to other such buildings or stacks, which will prevent the immediate propagation of explosions or fire from one to the other by missile, flame or blast

3.14

magazine

<mine action> any building, structure or container approved for the storage of explosive materials (also explosive storehouse)

[SOURCE: IATG 01.40]

3.15

mine action organization

any organization (government, military, commercial or non-governmental organization/civil society) responsible for implementing mine action projects or tasks

Note to entry: The mine action organization may be a prime contractor, subcontractor, consultant or agent.

3.16

national mine action authority

NMAA

government entity, often an inter-ministerial committee, in an EO-affected country charged with the responsibility for broad strategic, policy and regulatory decisions related to mine action

Note to entry: 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.

3.17

outside quantity distance

OQD

minimum permissible distance between a potential explosion site (PES) and an exposed site (ES) outside the explosives area

3.18

potential explosion site

PES

location of a quantity of explosives that will create a blast, fragment, thermal or debris hazard in the event of an explosion

3.19

public traffic route

PTR

road used for general public traffic; a railway outside the explosives area that is used for public passenger traffic; a waterway, such as a river having tidal water and a canal, used by passenger vessels

3.20

public traffic route distance

PTRD

minimum permissible distance between a potential explosion site (PES) and public traffic routes, which is such that the ignition or explosion of explosives at the PES will not cause intolerable danger to the occupants of vehicles at an exposed site (ES)

3.21

safe to move

a technical assessment, by an appropriately qualified technician or technical officer, of the physical condition and stability of ammunition and explosives prior to any proposed move. Note: Should the ammunition and explosives fail a 'Safe to Move' inspection, then they must be destroyed in situ, or as close as is practically possible, by a qualified EOD team acting under the advice and control of the qualified technician or technical officer who conducted the initial Safe to Move inspection.

4 General requirements

4.1 Demolition explosives and explosive ordnance

4.1.1 General

This IMAS covers the:

- Use of demolition explosives for demolition purposes, including EOD demolition boxes;
- Disposal of EO.

4.1.2 Demolition explosives

Demolition explosives and explosive material for demolition purposes are generally manufactured and packed under conditions that guarantee their stability when stored, transported and handled in accordance with the manufacturers' instructions. The NMAA and mine action organizations shall ensure that these procured items conform with applicable legislation and regulations. They shall also assess if the local conditions under which these items are to be stored, transported and handled would generate additional risks.

4.1.3 Explosive ordnance

The condition of EO encountered in the course of disposal tasks can have been affected by factors such as firing forces or other handling and environmental forces. This is why the preferred option is to always consider disposal in place rather than moving EO items to a disposal site. Storage, transportation and handling of EO items will likely increase risks compared to procured demolition explosives and explosive materials. In most cases, there is no national legislation or regulation covering the storage, transportation and handling of EO items. The NMAA and mine action organizations shall then develop standards and procedures reflecting the local conditions.

4.2 Legislation

The storage, transportation and handling of explosives shall comply with applicable legal, regulatory and normative requirements (for example, national law).

Throughout this document, where any applicable regulations differ from the requirements contained in this standard, the more stringent requirement shall be followed.

4.3 Management of risks

The management of risks (see IMAS 07.14) applies to the storage, transportation and handling of explosives.

Regarding the storage, transportation and handling of explosives necessary to proceed with the demolition of EO recovered during mine action, the management of risks shall include:

- the procurement of demolition explosive and explosive material conforming to applicable regulatory texts;
- the compliance with instructions given by the supplier and any applicable regulatory text.

No EO encountered during mine action shall be stored, transported or handled without a prior formal and documented risk assessment completed by an EOD level 2 or EOD level 3 (see IMAS 09.30) operator and declaring the EO item as safe to move.

For EO assessed as safe to move, the management of risks in the local environment, including the population, shall include:

- the risk of unintended detonation;
- the risk of diversion of the explosives.

Other relevant risks shall be identified and assessed through the risk assessment process.

To bring these risks as low as reasonably practicable (ALARP), the treatment of risks shall include:

- avoiding the risk: this consists of limiting the storage, transportation and handling of explosives to absolute necessities;
- changing the likelihood: this consists of taking action to make it less likely that an unintended detonation will occur;
- changing the consequences by assuming that the likelihood can be reduced but not entirely removed: this consists of taking action to reduce the impact of an unintended detonation on people, assets or property;
- providing appropriate training;
- using effective personal protective equipment (PPE);
- implementing correct supervision.

When disposing of EO, the safest and preferred option is to “destroy in-situ”. However, this may not always be possible. Therefore, in extreme cases, when it is safe to do so and in compliance with EOD competencies, it may be necessary to move EO to a disposal site, such as a central demolition site (CDS). The storage, transportation and handling of explosives shall be limited to strict necessities.

The NMAA shall specify under which circumstances and conditions, EO may be stored, transported or handled, including:

- the justification for storage, transportation and handling;
- the duration;
- the quantity;
- the qualifications;
- the documentation and reporting.

Before storing, transporting or handling EO, a qualified EOD operator (see 4.4) shall conduct a formal assessment to decide if it is safe to move to a demolition range.

4.4 Qualifications

Within a mine action programme, personnel providing the technical understanding for the storage, transportation and handling of explosives shall hold qualifications in accordance with T&EP 09.30/01/2022 and T&EP 09.31/01/2019. The storage, transportation and handling of explosives may include other functions such as accounting or store keeping.

4.5 Accounting of explosives

There shall be an inventory of demolition explosives and EO. The ability to maintain an accurate record of stock holdings is essential for efficiency in mine action organizations. Stock control is required to ensure that:

- older stock of demolitions explosives is used first;
- re-ordering of fresh supplies is conducted in a timely fashion; and
- theft of stock can be identified at the earliest opportunity.

Ineffective stock accounting systems significantly increase the risk of proliferation.

The mine action organization shall maintain accurate lists of stock held, including:

- where it is held;
- how much is held;
- ledgers for signing in and out of storage or handing over EO from sites
- what condition it is in;
- any use-by dates associated with the explosives;
- set usage against the mine action task;
- re-ordering of stock levels;
- lists of staff that are authorized to account, manage, draw and use the explosives.

4.6 Safety distances

The guidance in this clause only applies to mine action organizations required to store and transport their main stocks of demolition explosives (not containing primary fragmentation hazards) for use with demolitions. For quantities of less than 500 kg NEQ, the safety distances given in Annex D are to be used where practicable, unless instructed otherwise by the NMAA.

For guidance on the storage of HD 1.1 demolition explosives for over 500 kg NEQ, IATG 02.20 shall be used.

For the storage of items, such as EO, that pose a fragmentation hazard (across HD 1.1 to HD 1.6), the temporary distance (TD) tables in D.2 shall be used.

5 Storage

5.1 General

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

This IMAS provides guidance where the IATG do not reflect the requirements for the storage, transportation and handling of demining EO.

The IATG are primarily aimed at the management of military stockpiles of ammunition. The guidance in IATG apply to all organizations that store ammunition and explosives in large quantities, that is, the organization's main demolition explosive stores. Compliance with ammunition storage, transport and handling regulations may require additional specialist technical advice. This advice may be sought from the UN SaferGuard Programme (<https://unsafeguard.org/>).

5.2 Types of Storage

Storage of explosives and EO is required under the following circumstances:

- 1) storage of non-primary fragmentation producing demolition explosives for demolition purposes in permanent explosive storage facilities as part of their main explosives stocks;
- 2) temporary storage of EO that cannot be disposed of in situ, and which has been declared safe to move;
- 3) in-use storage of detonators and explosives – usually within “demolition boxes” in the field;
- 4) storage during transportation.

If necessary, EO can be moved to a secure storage area to await destruction at a later date. This shall only be for short periods of time. It is essential that ammunition storage by hazard divisions and compatibility groups follows the requirements, good best practice and guidance in IATG, IMAS, national mine action standards (NMAS) and organizational Standing Operating Procedures (SOP).

Although the United Nations Hazard Classification Classes (UN HCCs) pertain to conventional ammunition stocks which have been classified in accordance with national safety organizations criteria, the UN HCCs should be used as a guide when transporting EO which has been declared safe to move. If there is any doubt as to the precise type of explosive filling, EO items are to be treated as HD 1.1.

EO recovered or loose propellants and IED explosive components, including home-made explosives, shall only be stored for temporary and specified periods within a defined disposal process and only if safe to do so. Mine action organizations shall have in place a formal risk assessment for the movement and storage of EO. The risk assessment shall be agreed with the NMAA.

5.3 Storage of demolition explosives for demolition purposes

The distance tables in Annex D have been designed so that distances are shorter when no primary fragmentation hazard exists. Demolition stores shall only contain explosives that do not produce primary fragmentation to conduct demolitions.

Compatibility group storage regulations shall be complied with in accordance with Annex E.

When considering the design of permanent ammunition storage facilities and in the absence of national regulations, IATG 05.20, Types of buildings for explosive storage should be considered (for example, in an ammunition management programme)

5.4 Temporary storage of EO for disposal

Within a defined disposal plan (or SOP for general EOD spot tasks), recovered EO which has been declared safe to move may be stored for temporary periods in terms of time/days that the items are to be stored. The temporary distance tables for inside and outside quantity are given in D.2.

A formalized risk assessment shall be conducted prior to any temporary storage, and an explosive safety case shall be produced (see IATG 02.10, Annex G). EO shall not be stored in the same store as demolition explosives.

UXO and AXO shall be stored separately. National regulations regarding removal and destruction of EO found during demining operations shall be strictly followed.

General requirements for the design of magazines used for the storage and transport of explosives used in the demining/EOD process are given in Annex C. Barricading/traversing shall be constructed in accordance with IATG 04.10.2015, 7.7.

5.5 In-use storage of explosives (including demolition boxes)

When a clearance 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 daily cessation of work, the box may be kept at the team's location following the requirements in C.5. The single greatest hazard that could cause an unintended explosion in these circumstances is fire. Control of fire hazards shall be the highest priority for the storage of explosives in these circumstances.

5.6 Receipts and issues

All demolition explosives and EO shall be accurately accounted for using a system of office-held main accounts and ammunition storehouse stack tally cards. A process which records the issue, and receipts of ammunition shall also be employed. Separate accounts should be held for demolition explosives and recovered EO, such as UXO and AXO. IATG 03.10 provides guidance on how to maintain ammunition accounts and stack tally cards.

An effective management-led auditing and stock-checking process shall be established for all ammunition accounts (see IATG 03.10).

5.7 Physical security measures

Mine action organizations shall provide appropriate levels of physical security for explosives in their possession during storage (permanent, temporary or field storage), transportation and use. Strict accounting procedures and control of access should be implemented.

The security measures required depend on the area where operations are taking place. They should be selected in consultation with the local authorities. It is highly recommended that risk assessments be used as part of the implementation of physical security measures. Full guidance is provided in IATG 09.10.

5.8 Fire prevention

Fire is the most significant hazard associated with storage, transportation and handling of explosives. Control of the threat from fire is the most important factor associated with reducing the risk of an unintended explosion.

Demining organizations shall establish and maintain fire prevention policies and standard operating procedures (SOPs), which shall be based on the general principles given in Annex B.

IATG 02.50, Fire safety, provides further guidance on fire prevention, which should also be complied with.

5.9 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 the UN hazard classification system and codes. Examples of these can be found in IATG 01.50.

5.10 Indoor storage

No indoor storage magazine shall be located in a residence, dwelling or office building, unless it is for the storage of HD 1.4S items. In this case, HD 1.4S items shall only be stored in quantities sufficient for use by guard forces.

5.11 Environmental requirements

The environmental requirements (temperature, humidity and impact) of explosives vary and are dependent on their intended storage conditions (including shelf life), transportation, handling and use. Where the manufacturer's environmental or shelf-life conditions are not met, the performance of explosives may be unpredictable, and the safety is likely to be reduced. In general, explosives shall be:

- 1) kept dry, off the floor, not directly against walls and well ventilated;
- 2) kept as cool as possible and free from excessive or frequent changes of temperature (temperature cycling);
- 3) protected from direct sunlight;
- 4) properly stacked and secured from impact as a result of an accident.

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 cause them to become dangerous to handle. Rain, dampness and humidity may cause damage to explosives in a very short time.

Condensation occurs during sudden changes in temperature and transfer of moisture can also occur through water-resistant packaging materials, such as plastic containers. Good ventilation of explosives keeps them cool and prevents condensation.

5.12 Propellant storage

When dealing with EO, it is important to understand that the conditions of storage and age of the items may have dangerously degraded some stabilizing chemicals in the explosives. This is especially the case for high energy propellants containing nitroglycerin or nitrocellulose, such as those used in medium-to-long range or high-velocity rockets and missiles.

These high energy propellants are unstable even under the manufacturer's approved storage conditions because nitrate esters decompose over time. To prevent a runaway autocatalysis chain reaction, the propellants contain inhibitors which have a specific shelf life. Once expired, these high energy propellants may therefore be highly unstable and present a significant explosive hazard.

Storage in high temperature environments (above 25 degrees C) may seriously reduce the shelf-life of propellants.

Liquid propellants can be particularly dangerous and require special handling considerations during storage and disposal. See TNMA 09.30/03 for further guidance.

Precautions to avoid propellants being subjected to autocatalysis include:

- maintaining stock control accounting and inspection procedures;
- avoiding temperature extremes during storage;
- storing in original containers;
- disposing of propellants/ammunition with expired shelf life;
- not storing propellants of unknown provenance (to be destroyed instead).

6 Transportation

6.1 General

Guidelines for the transport of dangerous goods by air, sea and road are contained in their own specific international regulations. In mine action, IATG 08.10, Transport of ammunition, shall be referred to for all aspects of moving ammunition and demolition explosives. When EO is declared safe to move, the guidelines contained in clause 4.3 should be used.

Where there is no national regulation for the movement of explosives by road, the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) may be used by NMAAs as additional guidance in order to produce national directives for the transportation of ammunition and demolition explosives. While the ADR does not specifically cover the transport of EO, the ADR is useful as a framework for mine action organizations when writing NMAS and SOPs on movement of ammunition and explosives by road.

6.2 Hazard classification code (HCC)

In order to meet the UN hazard classification criteria, thus ensuring, as far as possible, that ammunition and demolition explosives are safe to transport, Class 1 items shall be packaged in their full-service pack (FSP). Once outside their FSP, their UN hazard classification code (HCC) no longer exists. HCCs are allocated after a series of stringent tests. The HCC is only applicable to the specific item packed in the packing configuration in which it was tested.

6.3 Compatibility group mixing rules for explosives transported by road

Compatibility group mixing rules for the transport of ammunition and explosives shall be adhered to. They are different from those for storage (see C.5). Importantly, ammunition containing white phosphorus shall always be transported separately from all other ammunition other than HCC 1.4S.

Detonators shall be carried in approved metal or wooden boxes. Ideally, these boxes should be carried in a separate vehicle from other ammunition and explosives. If not feasible, they should be carried in the cab of the vehicle away from other ammunition and explosives. Radio transmitters should not be used in these vehicles unless in an emergency.

6.4 Safety distance rules for explosives transported by road

Ammunition quantity distances (QD) do not generally apply while in movement. However, appropriate QD shall be applied to all surrounding exposures, or risk management principles shall be applied, when ammunition in transit stops for more than a temporary halt; or is loaded to, unloaded from or between transportation conveyances (handling).

When the QD requirements of IATG 02.20 cannot be met, appropriate risk assessments, risk analyses and explosives safety cases shall be conducted, and risk decisions obtained from appropriate decision-makers.

When ammunition is moved by road, it should be in convoy, whether with other vehicles carrying ammunition or with escort vehicles. A minimum distance of 50m should be observed between each transport unit.

6.5 Loading of vehicles

The vehicle used to transport explosives shall be fit for purpose and roadworthy. Only fuel carried in the vehicle's fuel tank or in specific external storage compartments shall be permitted. No fuel in any other type of container shall not be transported on the same vehicle. The same applies to oils and lubricants.

Mine action organizations shall establish and maintain SOPs that give procedures for the safe transportation of explosives. The procedures shall be based on the guidance provided in 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 shall include the following requirements:

- 1) measures to ensure the security of explosives (for example, tarpaulin, secured to the vehicle using fibre straps, clearing of inflammable materials from vehicle);
- 2) explosives to be transported in accordance with the manufacturers' instructions and specifications;
- 3) personnel involved have the required EOD competency level;
- 4) use of packing materials.

6.6 Maximum loads by net explosive quantity (NEQ)

For maximum loads by NEQ for different types of vehicle and different HDs, refer to IATG 08.10, Annex D Transport of Ammunition by Road, paragraph 16.

6.7 Fire prevention during movement

Fire is a principal hazard to the transportation of explosives. The following precautions shall be followed when transporting ammunition and explosives by road:

- a serviceable CO2 fire extinguisher shall be carried in the cab. To balance effectiveness (capacity) against ease of extraction and use, a 10 kg extinguisher is recommended (ADR Vol. 2.8);
- smoking is not permitted in the vehicle or within 30 m of the vehicle (ADR. 7.5.9);
- fuel shall not be carried anywhere other than in the fuel tank or in specific external storage compartments;
- no fire-making materials, matches, lighters or similar shall be carried in ammunition and explosives carrying vehicles unless contained in a fireproof container;
- vehicles transporting ammunition and explosives shall be fitted with a grounding strap to permit the release of any build-up of static electricity.

The full list of vehicle requirements and safety precautions is given in IATG 08.10:2021, Annex D.

6.8 Route planning

Transport routes should generally be planned in advance and information concerning these routes should be treated as confidential. Procedures for regular traffic between the same two locations should be varied and reviewed regularly. For emergency planning purposes, ensure local authorities understand the routine activities and areas where your regular movement of explosives takes place.

A general security principle is that ammunition and weapons should be transported separately while the vehicle moves.

A risk assessment shall be conducted during the planning of the movement of explosives and EO to minimize the risk related to unplanned explosions. The risk assessment should include:

- time of day
- routes to minimize exposure to population
- maximum permitted NEQ
- type of vehicle(s)
- carriage of emergency equipment
- the consignee is ready to accept the delivery

- notification of the movement to the NMAA and Police - security situation dependent.

6.9 Driver and passengers

The minimum age of drivers for vehicles carrying ammunition and explosives shall comply with the legislation of the host country. A co-driver shall be present at all times. Both the driver and the co-driver shall be trained in the handling and transport of ammunition and explosives.

Mine action organizations 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.

6.10 Equipment for personal and general protection

In relation to IATG 08.10:2021, Annex D, the following minimum equipment shall be carried on board the transport unit.

For each vehicle:

- a container for storing smoking materials such as matches, lighters, cigarettes;
- 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), to be displayed front and rear if a breakdown occurs;
- a shovel and pickaxe;
- eye rinsing liquid;
- torches;
- two red warning flags;
- signage/placards in compliance with host country national regulations.

For each member of the vehicle crew:

- a warning vest (dayglow style);
- a pair of protective gloves;
- eye protection (for example, protective goggles).

6.11 Breakdowns and accidents

When transporting ammunition and explosives, all drivers and co-drivers shall be briefed on the emergency “actions-on” for breakdowns and accidents (IATG 08.10:2021, Annex D).

7 Handling

7.1 Standard operating procedures

Mine action organizations shall establish and maintain SOPs that give procedures for the safe handling of explosives. The procedures shall include, as a minimum, the following requirements.

- 1) Access to explosives shall be tightly controlled.

- 2) Explosives shall be handled in accordance with the manufacturers' instructions and specifications, and other relevant standards and regulations provided by the NMAA.
- 3) Only suitably qualified and competent personnel, or personnel supervised by a qualified supervisor, shall handle explosives. Only staff with an EOD qualification shall be allowed to use explosives. Staff conducting EOD training shall be supervised by qualified EOD personnel.

7.2 Abandoned ordnance (AXO)

EOD operators may be required to examine abandoned ammunition or stockpiles of conventional ammunition to declare them safe to be moved either to disposal sites or to storage facilities. Only EOD operators with the appropriate competencies outlined in T&EP 09.30 and recorded in writing, are authorized to do so. Note that IATG 07.20, Inspection of ammunition, lists regulations for the safe moving of munition arising from storehouse explosions.

7.3 Certified free from explosives (CFFE) Declaration

This does not apply to the demilitarization of EO which is a separate and highly hazardous process undertaken only by authorized and trained personnel. It does apply only to the Certification of FFE EO. CFFE is a declaration process to ensure live explosives, ammunition and EO have not been inadvertently mixed with fired (spent) explosives, ammunition and EO and which has been previously declared as safe for disposal, display or for drill purposes. It shall only be carried out by EOD 2 or 3 staff who have been authorized in writing as being competent to do so. For aerial bombs, guided weapons, chemical ordnance, or IEDs, the staff shall in addition be respectively qualified as EOD 3+ aerial bombs, guided weapons, chemical ordnance or IEDD. CFFE applies to:

- 1) packages, articles or equipment;
- 2) scrap from demolitions and breakdown of explosive ordnance;
- 3) Inert explosive ordnance including:
 - a) Explosive ordnance to which a Free From Explosive process has already been applied;
 - b) Drill explosive ordnance;
- 4) training aids;
- 5) scrap items sent for disposal.

7.4 Inert, including drill, explosive ordnance

Only training aids certified free from explosives (CFFE) shall be used in training, displays or as examples during presentations and lectures. Live explosive ordnance and explosives shall never be mixed with inert, drill, instructional or replica explosive ordnance and explosives. The consequences of live munitions being inadvertently used during training are likely to result in fatalities or injuries.

There is no specific international legislation that refers to the use of inert, including drill, instructional and replica mines and ammunition. Therefore, this sub-clause has been derived from good practice. The requirements in Annex F shall be applied.

In addition to the requirements in Annex F, mine action organizations shall establish and maintain SOPs that give procedures and cataloging arrangements for the storage and handling of inert, drill, instructional or replica mines and ammunition. All CFFE EO items shall have a serial number on the item and the serial number is to be cross-referenced to a database. All CFFE EO is to be stored separately from live ammunition and explosive items.

8 Responsibilities

8.1 National mine action authority

The NMAA or the organization acting on its behalf shall:

- 1) Liaise with relevant authorities concerning the storage, transportation and handling of explosives;
- 2) Develop, documented instructions for the storage, transportation and handling of explosives((for example, NMAS and/or any instruction from the competent authorities), including:
 - a) safety distances for the storage and handling of explosives;
 - b) minimum requirements for fire prevention.
 - c) accredit organizations as capable of undertaking storage, transportation and handling of explosive;

8.2 Mine action organizations

The mine action organizations shall:

- 1) Establish and maintain SOPs for the storage, transportation and handling of explosives that comply with national mine action standards or any other applicable legal, regulatory and normative requirements..
- 2) Gain accreditation from the NMAA

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

- 3) issuing, maintaining and updating their own regulations, codes of practice, SOPs and other suitable provisions on the storage, transportation and handling of explosives;
- 4) cooperating with other organizations in the same country to ensure consistency of standards for the storage, transportation and handling of explosives; and
- 5) assisting in framing national regulations and mine action standards for the storage, transportation and handling of explosives.

8.3 Mine action organization employees

Mine action organizations' employees shall:

- 1) comply with instructions given for their own conduct and safety when carrying out the storage, transportation and handling of explosives; and
- 2) immediately report to their direct superior any situation associated with the storage, transportation and handling of explosives which they have reason to believe may present a hazard which they cannot correct themselves. 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 standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this 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.

- [1] IMAS 04.10, Glossary of mine action terms, definitions and abbreviations
- [2] IMAS 07.11, Land release
- [3] IMAS 07.14, Risk management in mine action
- [4] IMAS 09.30, Explosive ordnance disposal
- [5] IMAS 09.31, Improvised explosive device disposal
- [6] IMAS 10.10, Safety and occupational health – general requirements
- [7] IMAS 10.20, Demining worksite safety
- [8] IATG 01.40, Glossary of terms, definitions and abbreviations
- [9] IATG 01.50, UN explosive classification system and codes
- [10] IATG 02.10, Introduction of risk management principals
- [11] IATG 02.20, Quantity and separation distances
- [12] IATG 02.50, Fire safety
- [13] IATG 03.10, Inventory Management
- [14] IATG 04.10, Field and temporary storage
- [15] IATG 05.20, Types of buildings for explosive facilities
- [16] IATG 07.20 Inspection of Ammunition
- [17] IATG 08.10, Transport of ammunition
- [18] IATG 09.10, Security principles and systems
- [19] T&EP 09.30/01/2022, Conventional explosive ordnance disposal competency standards
- [20] T&EP 09.31/01/2019, Improvised explosive device disposal competency standards
- [21] ADR Vol 1 The International Carriage of Dangerous Goods by Road
- [22] ADR Vol 2. Agreement concerning the International Carriage of Dangerous Goods by Road

[23] Institute of Makers of Explosives, Safety Library Publication No. 2 – The American Table of Distances (October 2011), see <http://www.ime.org>

[24] United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (The orange book)

Annex B (informative)

Fire prevention

Fire represents the first cause of unintended explosions globally, occurring in military, industrial and governmental storage sites and during transportation of explosives. Prevention of fire is critical to the safe storage and transportation of explosives. Equally important is the ability to control and mitigate fire outbreaks before they can impact explosives stored or transported.

Mine action organizations responsible for storing explosives and explosive materials shall establish and maintain documented fire prevention policies and SOPs. The hazard posed by fire for all explosive storage and transportation activities shall be incorporated into organizational risk registers. The policies and SOPs should include the following requirements.

- 1) The requirement for a formalized risk assessment for all storage sites and transportation activities. These risk assessments should be reviewed every time there is significant change to the storage facility or the quantities stored, and on an annual basis.
- 2) The requirement for trained, qualified and competent staff to assess the needs of firefighting equipment associated with each storage facility and transportation task.
- 3) The requirement for regular staff training and practice tests on equipment relating to and dealing with fire outbreaks.
- 4) Firefighting equipment shall be positioned such that people responding to a fire can access it quickly and easily.
- 5) No smoking shall be permitted within 20 m of any magazine or within the designated storage area, if this is fenced off. NO SMOKING/NO NAKED LIGHTS signs shall be prominently displayed around the magazine.
- 6) The grass and undergrowth shall be cut down and kept short in the area around the magazine. All cut down undergrowth shall be removed, and the build-up of dry detritus shall be prevented.
- 7) 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.
- 8) 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 shall be removed when not in use.
- 9) Empty containers of any type shall not be stored with explosives.
- 10) A minimum of two 9.0-litre water extinguishers shall be in a prominent position outside each explosive store.
- 11) All firefighting equipment shall be maintained in a fully serviceable condition.
- 12) A form of lightning protection shall be used.
- 13) A noticeboard listing articles that are not permitted into the magazine area shall be prominently displayed at the entrance to the magazine. The notices shall be displayed in languages so that they can be read and understood by all employees. Details of the prohibited articles to be shown on the board are as follows:
 - a) lanterns, oil lamps and stoves and all flame or fire producing appliances;
 - b) matches, cigarette lighters or other portable means of producing a spark or flame;

- c) tobacco in any form and any article used for the purpose of smoking;
 - d) inflammable liquids and solvents other than those authorized for maintenance work on containers or contained in the tank of a vehicle;
 - e) food and drink;
 - f) radio equipment (all types), including mobile phones;
 - g) firearms, with the exception of those carried by guards;
 - h) drugs and medicines other than those forming part of an authorized first aid kit;
 - i) ammunition not authorized to be stored;
 - j) any unprotected power sources.
- 14) 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.
- 15) All metallic enclosures for electrical wiring and fittings shall be effectively bonded throughout and grounded.
- 16) A method of sounding an alarm in the event of fire shall be in place.
- 17) 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 C (normative)

General requirements for the construction of magazines

C.1 Permanent structure

For the design and construction of permanent structures, IATG 05.20 offers general guidance that should be followed by demining organizations. IATG 02.20 offers guidance on risk reduction associated with magazine design and should be considered for the construction of any permanent structure.

C.2 Portable or mobile magazine

IATG 04.10 provides the design for a generic portable or mobile magazine, such as a skid-mounted container, trailer or semi-trailer. The most widely used mobile magazine is the ISO container, rather than bespoke magazines.

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. Wood is a good thermal insulator and lining any metal container either plywood or particle board significantly reduces the contact temperature of the internal wall of the magazine.¹ The lining for mobile magazines should use the following lining materials:

- 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 shall 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 reduce the effects of temperature cycling and the ingress of damp air. The amount of ventilation required depends on local climatic conditions, size of magazine and location.

Ventilation openings in walls of magazines should have as a minimum a total surface area of 60 cm² per cubic metre of volume inside the magazine.

The magazine should be equipped with a minimum of three steel padlocks that has at least a 9.5 mm diameter case hardened shackle. The fixtures and fittings used with the padlock should be of a comparable quality.

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

C.3 EOD Demolition box

An EOD demolition box is a portable box that shall be theft-resistant, fire-resistant and weather-resistant.

Ideally, 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 lid of the day box should overlap the edges of the box and hinges and

¹ This is the minimum amount of equipment that shall be carried as required by ADR or an NMAA.

locking-ware shall be rigidly attached by welding, riveting or bolting which cannot be removed when the lid is locked.

Explosive materials shall not be left unattended in a day box.

C.4 Detonator transport container

Detonators and other explosives may be carried together on the same vehicle providing the detonators are carried in a detonator transport container or compartments designed and constructed specifically for that purpose. Some manufacturers package their detonators such that they are designated 1.4S, which allows for greater flexibility in their requirements for transportation. Most detonators used in humanitarian mine action are not likely to be packaged as 1.4S and these can still be carried as long as they are in their original packaging and kept as far away from the EOD demolition box as possible. The design and use of detonator transport containers shall comply with the following criteria and conditions:

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

NOTE: Annex E provides detailed guidance on hazard classification and compatibility codes.

- 2) packaging for detonators described in list item 1) a) are as follows:
 - a) detonators electric 1.4B, 1.4S and 1.1B that contain no more than 1 g of explosive and are transported in quantities of less than 1,000 shall be packed in inner packing or cartons that meet the manufacturers' specifications before loading into the container; and
 - b) detonators non-electric 1.4B and 1.4S shall be loaded into the container in the manufacturers' original outer packing;
- 3) no other material shall be loaded on top of the portable detonator container;
- 4) the detonator container shall be secured to the vehicle to prevent movement during transport; and
- 5) the detonator container shall be clearly labelled "contains explosive, handle with care" in the official languages commonly used in the demining organization.

C.5 Requirements for use of EOD demolition boxes

- 1) Detonators shall be stored in a separate box from the remaining demolition explosives and explosive materials.
- 2) Detonators shall be kept in their original packaging, if it is a bespoke design consisting of plastic inner containers within an approved metal box or equivalent protective packaging. Other packaging designs may be entirely of a plastic construct. The principle to be observed is that a single detonator functioning will not cause other detonators to function, and the effects of the detonation being contained entirely within the primary packaging. Many commercial detonators are not packaged in this way, but it is acceptable for the detonators to be repackaged into containers that will contain and prevent propagation as described above. The detonators shall be packaged in such a way that they cannot move around within the box.

- 3) Detonators shall be stored in a structure a minimum of 30 m from the team's living accommodation and other hazards and occupied housing, unless a dedicated magazine is provided. The structure designed for their storage shall be in the form of a detonator bay built of sandbags which shall completely surround the box and be higher than the box by at least 15 cm.
- 4) The EOD demolition box shall be stored 30 m from the team's living accommodation and other hazards and occupied housing. The maximum NEQ to be held in the EOD demolition box shall be 10 kg. The structure designed for the storage shall be the form of either a pit providing a depth of 60 cm above the level of the explosives container or sandbags to this effect or even a combination of the two. If a pit is used, this will provide sufficient wall depth and if sandbags are used. Then, 30 cm walling is the minimum to be used.
- 5) The EOD demolition box shall be an authorized container box of sufficient size to hold all the demolition explosives. The container may be made of either light steel or wood but shall not overtly add to the fragmentation hazard. Items shall be packed in such a way that they cannot move around inside the box.
- 6) 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 list item 3).
- 7) Fuels, oils, lubricants and any other flammable materials shall not be stored within 30 m 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 and is not the dedicated safety vehicle.
- 8) EOD explosive stores shall be sited so that they can be kept under observation at all times. EOD explosive stores established at temporary operations bases shall be suitably guarded during the hours of darkness.
- 9) Fire prevention. Fire beaters, buckets filled with sand and two 6 kg ABE fire extinguishers shall be available in case of fire. These are to be placed such that they are immediately available to those responding to a fire that may affect the explosives store. It is vital however that, once fire engulfs the explosive store, evacuation becomes the priority.
- 10) For the storage of explosive items that do not have primary fragmentation, Annex D shall be used for the storage of explosives under 500 kg.

Annex D (informative)

Table of distances for the storage of main stocks of demolition explosives not containing primary fragmentation

D.1 General

Table D1: Distances for storage

| Net explosive quantity (NEQ) (kg) | | Distance (m) | | | | | | | |
|--------------------------------------|-----------|-----------------------------------|------|--|------|----------------------------------|------|-------------------------------|------|
| | | Inhabited building distance (IBD) | | Public traffic routes (PTR) (traffic volume) | | | | Inter-magazine distance (IMD) | |
| | | | | Less than 3,000 vehicles per day | | More than 3,000 vehicles per day | | | |
| Over | Less than | B | U | B | U | B | U | B | U |
| 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 |
| B Barricaded. U Unbarricaded. | | | | | | | | | |

Notes on table D1

- 1) The table includes lower quantity distances than those specified in IATG for explosives. This is because the fragmentation effect has been ignored. Therefore, this table is 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. See Normative in Annex A: "Institute of Makers of Explosives, Safety Library Publication No. 2".

- 2) This table may be used to calculate safety distances for an organization's main holdings of demolition explosives and accessories up to 500 kg NEQ as long as there are no fragmentation hazards from any of the items. Above 500 kg NEQ, IATG 02.20 shall be used.
- 3) 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 3.5 m above the centreline of any roadway or railway shall pass through such a barrier. It is also often referred to as traversing.
- 4) Artificial barricade is an artificial mound or revetted earth wall not less than 90 cm thick.
- 5) Natural barricade means natural features 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.
- 6) When an operational EOD demolition box is used away from the team's headquarters' 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, for example, houses, roads, etc., where practicable. The distances in C.5 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.
- 7) 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 shall be used

D.2 Temporary storage structures and quantity distances – for use with storage of recovered EO

D.2.1 Outside quantity distances (OQD)

Table D2: OQD Temporary Distance (TD) for Temporary Storage Areas

| Exposed Site (not containing explosives) | Potential Explosion Sites (PES) | | | | |
|--|---------------------------------|-------------------|-------------------|-------------------|-------------------|
| | Hardened | Semi-hardened | | Open / Light | |
| | | Barricaded | Un-barricaded | Barricaded | Un-barricaded |
| Hardened | TD4 | TD4 | TD4 | TD4 | TD4 |
| Semi-Hardened Barricaded | TD4 | TD4 | TD4 | TD4 | TD4 |
| Semi-Hardened Un-Barricaded | TD5 | TD5 | TD6 | TD5 | TD6 |
| Open / Light Barricaded | TD8 TD7 Note 1 | TD8 TD7 Note 1 | TD8 TD7 Note 1 | TD8 TD7 Note 1 | TD8 TD7 Note 1 |
| Open / Light Un-Barricaded | TD8 TD7 Note 1 | TD8 TD7 Note 1 | TD9 | TD8 TD7 Note 1 | TD9 |
| Open Mission related personnel | TD8 TD7 Note 2 | TD8 TD7 Note 2 | TD9 | TD8 TD7 Note 2 | TD9 |
| Unprotected Civilian Population | TD8 | TD9 TD8 Note 3 | TD9 | TD9 TD8 Note 3 | TD9 |
| TD = Temporary Distance | | | | | |

Notes on table D2

Note 1: If an Overhead Protection protects against falling fragments then TD7 may be applied.

Note 2: Reduced distances may be implemented if the national authority has approved the storage structure.

Note 3: TD9 shall be applied except for heavy calibre artillery shells stored in a vertical position where TD8 may be applied.

Table D3: Outside Quantity Distances (OQD) Temporary Distance (TD) (Metres) for Temporary Storage Areas

| NEQ | OQD (TD's) (M) | | | | | |
|------|----------------|-----|-----|-----|-----|-----|
| | TD4 | TD5 | TD6 | TD7 | TD8 | TD9 |
| 25 | 12 | 18 | 23 | 23 | 100 | 130 |
| 50 | 15 | 22 | 30 | 33 | 100 | 212 |
| 75 | 17 | 25 | 34 | 40 | 100 | 260 |
| 100 | 19 | 28 | 37 | 46 | 100 | 294 |
| 150 | 21 | 32 | 43 | 56 | 100 | 342 |
| 250 | 25 | 38 | 51 | 73 | 100 | 400 |
| 500 | 32 | 48 | 64 | 103 | 155 | 400 |
| 750 | 37 | 55 | 73 | 118 | 203 | 400 |
| 1000 | 40 | 60 | 80 | 130 | 235 | 400 |
| 1500 | 46 | 69 | 92 | 149 | 283 | 400 |
| 2000 | 51 | 76 | 101 | 164 | 320 | 400 |
| 2500 | 54 | 82 | 109 | 177 | 352 | 400 |
| 3000 | 58 | 87 | 116 | 188 | 381 | 400 |
| 4000 | 64 | 95 | 127 | 207 | 400 | 400 |

D.2.2 Inside quantity distances (IQD)

Table D4. IQD (TD) for Temporary Storage Areas

| Exposed Site (structures containing explosives) | Potential Explosion Sites <small>Note1 / Note 2</small> | | | | |
|--|---|---------------|---------------|------------|---------------|
| | Hardened | Semi-hardened | | Hardened | |
| | | Barricaded | Un-barricaded | Barricaded | Un-barricaded |
| Hardened | Not applicable (NA) | (NA) | (NA) | TD1 | TD1 |
| Semi-Hardened Barricaded | (NA) | (NA) | (NA) | TD1 | TD1 |
| Semi-Hardened Un-Barricaded | (NA) | (NA) | (NA) | TD1 | TD2 |
| Open / Light Barricaded | (NA) | (NA) | (NA) | TD1 | TD1 |
| Open / Light Un-Barricaded | (NA) | (NA) | (NA) | TD1 | TD3 |

| | | | | | |
|---|------|------|------|-----|-----|
| Ammunition Process Area ^{Note 4} Barricaded | (NA) | (NA) | (NA) | TD1 | TD1 |
| Ammunition Process Area Un-Barricaded | (NA) | (NA) | (NA) | TD1 | TD3 |
| TD = Temporary Distance | | | | | |

Note 1: Non-earth covered buildings that can generate debris like structures of concrete or bricks shall NOT be used as PES, unless constructed in accordance with Clause 7.5.

Note 2: Reduced distances may be implemented if authorized by the national authority.

Note 3: Hardened structures are by definition barricaded.

Note 4: Only for ammunition related personnel. For an ammunition process area as a PES use the appropriate PES structure type column.

Table D5: Inside Quantity Distance (IQD) Temporary Distance (TD) (metres) for Temporary Storage Areas

| NEQ | IQD (TD)'s (m) | | |
|------|----------------|-----|-----|
| | TD1 | TD2 | TD3 |
| 25 | 4 | 7 | 14 |
| 50 | 4 | 9 | 18 |
| 75 | 4 | 10 | 20 |
| 100 | 4 | 11 | 22 |
| 150 | 4 | 13 | 26 |
| 250 | 4 | 15 | 30 |
| 500 | 4 | 19 | 38 |
| 750 | 4 | 22 | 44 |
| 1000 | 4 | 24 | 48 |
| 1500 | 7 | 28 | 55 |
| 2000 | 8 | 30 | 61 |
| 2500 | 8 | 33 | 65 |
| 3000 | 9 | 35 | 69 |
| 4000 | 10 | 38 | 76 |

Annex E (normative)

Hazard classification codes (see IATG 01.50)

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 E.4.

E.2 Compatibility groups

Additionally, all ammunition has been allocated to one of 13 compatibility groups (CGs), indicated by the letters A to H, J to N and S, that specifies compatibility during storage and transportation.

The description and definition of each of the CGs is included as E.5.

E.3 Hazard classification codes

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.

EXAMPLE: 1.1 D or 1.21 C.

E.4 Ammunition hazard divisions

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

HD 1.1: Explosives which have a mass explosion hazard

The explosion will produce severe damage to surrounding structures, the severity being determined by the amount of explosives involved and their proximity. 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: Explosives which have 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.

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

- subdivision 1.2.1: Ammunition which will produce large fragments with a considerable range.
- subdivision 1.2.2: Ammunition which will produce small fragments with a limited range.

HD 1.3: Explosives that have 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:

- subdivision 1.3.1: Explosives which will burn with great violence and intense heat emitting considerable thermal radiation.
- subdivision 1.3.2: Explosives which will burn sporadically. Items may explode producing minor fragments. Firebrands and burning containers may also be projected.

HD 1.4: Explosives which present no significant hazard

This division is primarily a moderate fire hazard. It will not contribute excessively to the fire and the effects are largely confined to the package. An external fire may cause a package to be degraded. No fragments of appreciable size or range are to be expected and fire will not cause a mass explosion.

HD 1.5: Explosives which although mass exploding is very insensitive

This division relates to explosives where there is very little probability of initiation or of transition to detonation under normal conditions of storage and transport.

HD 1.6: Explosives which are extremely insensitive and do 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.

E.5 Ammunition compatibility groups

Ammunition and explosives are grouped into 13 compatibility groups (CGs) A to H, J to N and S. Group I is omitted to avoid possible confusion between the letter I and the Roman numeral 1. Group S is distinctive, since it provides a unique possibility for mixing in storage and transport.

- **Group A:** Primary explosive.
- **Group B:** Ammunition containing primary explosive.
- **Group C:** Propellant or other secondary deflagrating explosive or ammunition containing such explosive.
- **Group D:** Secondary detonating explosive or black powder or ammunition containing secondary detonating explosive, 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 either pyrotechnic substance, or containing both an explosive and an illuminating, incendiary, lachrymatory or smoke producing substance.
- **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:** Explosives 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.

E.6 Ammunition compatibility group mixing rules²

The mixing rules in this clause only apply to ammunition and demolition explosives and do not apply to EO. These rules may apply to AXO but only after a technical assessment has been conducted by a suitably qualified and competent individual.

It is likely that the guidance in this clause will not apply to the majority of humanitarian mine action activities, mainly when HCCs is not applied by the originating country. The full UN explosive hazard classification system and codes can be found in IATG 01.50. Even without HCCs, conventional ammunition should be stored by compatibility group in accordance with the mixing rules in Table E.1.

Table E.1 – Compatibility group mixing rules

| Compatibility group | A | B | C | D | E | F | G | H | J | K | L | N | S |
|---------------------|---|------|------|------|------|--------|--------|---|---|---|----|------|------|
| A | X | | | | | | | | | | | | |
| B | | X | X 1) | X 1) | X 1) | X 1) | X 1) | | | | | | X |
| C | | X 1) | X | X | X | X 2) | X 3) | | | | | X 4) | X |
| D | | X 1) | X | X | X | X 2) | X 3) | | | | | X 4) | X |
| E | | X 1) | X | X | X | X 2) | X 3) | | | | | X 4) | X |
| F | | X 1) | X 2) | X 2) | X 2) | X | X 2,3) | | | | | | X |
| G | | X 1) | X 3) | X 3) | X 3) | X 2,3) | X | | | | | | X |
| H | | | | | | | | X | | | | | X |
| J | | | | | | | | | X | | | | X |
| K | | | | | | | | | | X | | | |
| L | | | | | | | | | | | 5) | | |
| N | | | X 4) | X 4) | X 4) | | | | | | | X 6) | X 7) |
| S | | X | X | X | X | X | X | X | X | | | X 7) | X |

- 1) Compatibility group B fuzes may be stored with the articles to which they will be assembled, but the NEQ shall be aggregated and treated as compatibility group F.
- 2) Storage in the same building may be permitted if effectively segregated to prevent propagation.

² IATG 01.50: 2015, Clause 7.

- 3) Mixing of articles of compatibility group G with articles of other compatibility groups is at the discretion of the national competent authority.
- 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.
- 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.
- 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.
- 7) A mixed set of munitions 1.6N and 1.4S may be considered as having the characteristics of compatibility group N.

In addition to the mixing rules, certain types of conventional ammunition should always be stored separately (or under specific conditions) from other types of ammunition.

- Detonators and blasting caps (separated from compatibility groups C, D, E, and F by a dividing wall capable of preventing sympathetic detonation of other items).
- Damaged ammunition (if considered unsafe for storage, damaged munitions should be destroyed at the earliest convenience).
- Ammunition in an unknown condition (this shall be stored at such a distance that detonation of this ammunition will not jeopardize other stocks).
- Ammunition that has deteriorated and become hazardous (this shall be stored in isolation and destroyed at the earliest convenience).

E.7 Compatibility group mixing rules for explosives transported by road³

Table E.2 – Compatibility group mixing rules

| Compatibility group | A | B | C | D | E | F | G | H | J | L | N | S |
|---------------------|---|---|------|------|------|---|---|---|---|---|------|---|
| A | X | | | | | | | | | | | |
| B | | X | | a | | | | | | | | X |
| C | | | X | X | X | | X | | | | b, c | X |
| D | | a | X | X | X | | X | | | | b, c | X |
| E | | | X | X | X | | X | | | | b, c | X |
| F | | | | | | X | | | | | | X |
| G | | | X | X | X | | X | | | | | X |
| H | | | | | | | | X | | | | X |
| J | | | | | | | | | X | | | X |
| L | | | | | | | | | | d | | |
| N | | | b, c | b, c | b, c | | | | | | b | X |
| S | | X | X | X | X | X | X | X | X | | X | X |

X Mixed loading permitted.

a Packages containing articles of CG B and those containing articles or substances of CG D may be loaded together provided they are effectively segregated such that there is no danger of transmission of detonation from the articles of CG B to the articles or substances of CG D.

b Different types of articles of HCC 1.6N may be carried together as 1.6N only when it is proven by testing or analogy that there is no additional hazard of sympathetic detonation between the articles. Otherwise, they should be treated as HD 1.1.

c When articles of CG N are carried with articles or substances of CG C, D or E, the articles of CG N should be considered as having the characteristics of CG D.

d Packages containing substances or articles of CG L may be loaded together on one vehicle or in one container with packages containing the same type of substances or articles of CG L.

NOTE: Definitions and explanations of compatibility groups are in the United Nations Recommendations on the Transport of Dangerous Goods Model Regulations (colloquially known as the Orange Book or the UN Model Regulations): para. 2.1.2.1.1, ADR, Vol. 1, 2.2.1.1.6, and in IATG 01.50, para. 6.2).

³ IATG 08.10:2021, Annex D.

Annex F (normative)

Items certified free from explosives (CFFE) including inert, drill, instructional or replica mines and ammunition

F.1 General

The title of this annex specifically covers items that are CFFE. Historically, items containing explosives have been used for instructional purposes but this has led to accidents and is therefore not advised. If a mine action organization requires items that contain explosives, either for training or equipment testing, then that organization shall produce a formal risk assessment for each individual set of circumstances.

The purpose of this annex is to ensure that inert and drill, explosive ordnance are handled, stored and accounted for accurately, in order to:

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

F.2 Rendering items FFE, including breakdown of mines and ammunition

Mine action organizations should not breakdown, modify or tamper with mines and ammunition, except during inspection, modification or disposal in accordance with the appropriate technical procedures.

All EOD L3 qualified staff can conduct RSPs on items and declare items, within the RSP process of component separation as being FFE. The EOD L3 qualification does not confer any competency for the breakdown or modification of items of ammunition.

All authorized breakdown or modification of live mines and ammunition into inert items shall only be carried out by appropriately qualified EOD personnel recorded as being authorized by the mine action organization.

As such operations carry a high degree of inherent risk, the authorization for such activities shall, as a minimum, be the responsibility of the national programme manager, or equivalent, of the mine action/EOD organization.

Such operations shall only be carried out by an EOD operator who holds the appropriate Level 3+ qualification for the specific item, has experience and knowledge of the item being broken down and who has been granted authority by the national programme manager in line with already established NMAA frameworks for that programme/country.

A letter (or other formalized process) authorizing the activity shall be produced by the country manager, specifying who is authorized to carry out the procedure, what the munition involved is and how long the permit lasts. It shall certify that the procedure has been checked by the appropriate technical authority in the mine action organization 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.

The mine action organization shall have full technical documentation for the item involved from either the manufacturers or the military of the item's country of origin where obtainable. A full technical breakdown instruction, including a diagram or X-ray of all the component parts of the item, shall be produced and approved

by the appropriate technical authority in the mine action organization before the national programme manager grants permission. The letter shall be signed by the country manager, the technical manager and the person carrying out the task.

Upon completion of the process, the certification as FFE shall be carried by a staff other than those conducting the process.

Drill explosive ordnance are readily available on the commercial market. They are often made up from empty non explosive components, either obtained direct from the original manufacturer or specifically made for the purpose. The cost of drill explosive ordnance including their import should not be a reason to engage in potentially lethal breakdowns of ammunition. The cost of the item should be borne in mind compared to the cost of a life.

NMAAs and demining organizations should never produce free from explosives (FFE) ammunition as souvenirs.

F.3 Marking of inert or drill mines and ammunition

All drill explosive ordnance shall be clearly marked as “**DRILL**” in the local language. All other inert explosive ordnance shall be clearly marked on all sides as “**INERT**” in the local language. It should also appear in one of the six recognized 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, including drill, explosive ordnance shall also be marked with a unique serial number. As a suggestion, this unique serial number may be in the following format:

ABC / 1234 / 01

(mine action organization trigram / serial number / year of manufacture or purchase)

There are no commonly accepted international standards for the body colour marking of ammunition and explosives, although international alliances have made standard agreements (STANAG). Other than items for displays and training where original body colours and markings may be used, inert, drill, instructional or replica mines and ammunition may be coloured dark blue for uniformity throughout mine action organizations to avoid confusion especially where such items are reserved for the calibration of detection equipment and for use within training area minefields.

If an individual has 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.4 Storage

Inert, including drill, explosive ordnance shall not be stored with live explosive ordnance and demolition explosives. 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 inert, including drill, ammunition. Technical operations managers shall check all FFE items in their area of responsibility to confirm they are FFE as close to the start of their appointment as possible.

F.5 Movement

Inert, including drill, explosive ordnance shall not be moved in the same containers as live explosive ordnance. It is recommended that inert, including drill, explosive ordnance not be moved on the same vehicle as live explosive wherever possible.

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

The mine action organization shall maintain a primary register of all inert, including drill and explosive ordnance that it has responsibility for. This register shall include the following information:

- serial number;
- type of munition;
- current location;
- FFE certificate serial number.

Photographs of the item from several angles, showing the markings and, where possible, the parts of the item from which explosives have been removed.

The mine action organization shall operate an appropriate accounting system to ensure accountability and traceability for all inert, including drill, explosive ordnance in its possession. It is recommended that this be based on their live ammunition accounting system. All documents should be kept with the register for easy confirmation of an item's status as CFFE.

F.7 Certified free from explosive (FFE) certification

On initial acquisition, all supposedly inert, including drill, explosive ordnance shall be visually inspected and physically examined by an appropriately competent EOD L3-qualified operator to ensure that the item contains no explosive, pyrotechnic, lachrymatory, radioactive, chemical, biological or other toxic components or substances. This process shall be completed for all items of EO, including those recovered from IEDs. The IMAS EOD L3-qualified operator 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 L3-qualified operator shall then issue a CFFE certificate for the item, containing the following information:

- unique serial number (for ease of administration, it is recommended that it be the same as in F.3);
- date;
- name of inspecting EOD technician.;
- brief description of item.;
- a CFFE certification statement.;
- signature of inspecting EOD operator. It is recommended that the following statement be used in the local language :

I certify that I have visually inspected and physically examined the item referred to on this CFFE 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 mine action organization shall maintain a register of all CFFE certificates issued, together with the items detailed in F.6 .

While EOD L2 and 3 qualified operators can certify an item as CFFE, this does not authorize them to conduct actions for which they are not qualified. The recovered items shall only be completed by suitably

competent, qualified and authorized (by the mine action organization) staff. By way of example, the render safe procedures (RSP) for IEDs and GW shall only be conducted by qualified staff.

Designating an item as CFFE is not the same as conducting an RSP or inerting.

F.8 Inerting munitions

Certifying an item as CFFE is different from the process of inerting an item. Examples of inerting include the removal of explosives from within a fuze or breaking down items such as improvised detonators.

This process shall only be conducted in exceptional circumstances and shall require the authorization of the most senior staff within a mine action organization.

WARNING

If an individual has 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 shall be destroyed.

Amendment record

Management of IMAS amendments

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

As amendments are made to this IMAS they are given a number. The date and general details of the amendment shown in the table below. The amendment is also shown on the cover page of the IMAS by the inclusion under the edition date of the phrase “*incorporating amendment #.*”

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

The most recently amended IMAS are posted on the IMAS website at www.mineactionstandards.org.

| Number | Date | Amendment details |
|--------|------|-------------------|
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