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Storage space requirements

Warning

The International Ammunition Technical Guidelines (IATG) are subject to regular review and revision. This document is current with effect from the date shown on the cover page. To verify its status, users should consult www.un.org/disarmament/ammunition

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Foreword

Ageing, unstable and excess conventional ammunition stockpiles pose the dual risks of **accidental explosions at munition sites** and **diversion to illicit markets**.

The humanitarian impact of ammunition-storage-area explosions, particularly in populated areas, has resulted in death, injury, environmental damage, displacement and disruption of livelihoods in over 100 countries. Accidental ammunition warehouse detonations count among the heaviest explosions ever recorded.

Diversion from ammunition stockpiles has fuelled armed conflict, terrorism, organized crime and violence, and contributes to the manufacture of improvised explosive devices. Much of the ammunition circulating among armed non-State actors has been illicitly diverted from government forces.¹ In recognition of these dual threats of explosion and diversion, the General Assembly requested the United Nations to develop **guidelines for adequate ammunition management**.² Finalized in 2011, the International Ammunition Technical Guidelines (IATG) provide voluntary, practical, modular guidance to support national authorities (and other stakeholders) in safely and securely managing conventional ammunition stockpiles. The UN SaferGuard Programme was simultaneously established as the corresponding knowledge-management platform to oversee and disseminate the IATG.

The IATG also ensure that the United Nations entities consistently deliver high-quality advice and support – from mine action to counter-terrorism, from child protection to disarmament, from crime reduction to development.

The IATG consist of 12 volumes that provide practical guidance for ‘through-life management’ approach to ammunition management. The IATG can be applied at the guidelines’ **basic, intermediate, or advanced levels**, making the IATG relevant for all situations by taking into account the diversity in capacities and resources available. Interested States and other stakeholders can **utilize the IATG for the development of national standards and standing operating procedures**.

The IATG are reviewed and updated at a minimum every five years, to reflect evolving ammunition stockpile-management norms and practices, and to incorporate changes due to changing international regulations and requirements. The review is undertaken by the UN SaferGuard Technical Review Board composed of national technical experts with the support of a corresponding Strategic Coordination Group comprised of expert organizations applying the IATG in practice.

The latest version of each IATG module can be found at www.un.org/disarmament/ammunition.

¹ S/2008/258.

² See also the urgent need to address poorly-maintained stockpiles as formulated by the United Nations Secretary-General in his Agenda for Disarmament, *Securing Our Common Future* (2018).

Introduction

The safe and effective storage of ammunition and explosives is expensive in terms of storage infrastructure and stock maintenance requirements. Efficient storage, thus ensuring maximum cost efficiency, requires effective storage planning. This IATG module provides guidance on the general practical considerations for storage space planning, whilst other IATG modules provide more specific safety advice for storage, handling, processing, special safety precautions and equipment requirements.

Storage space requirements

1 Scope

This IATG module introduces and explains the general requirements for the estimation of storage space requirements.

2 Normative references

A list of normative references is given in Annex A. These documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

A further list of informative references is given in Annex B in the form of a bibliography, which lists documents that contain additional information related to the contents of this IATG module.

3 Terms and definitions

For the purposes of this module the following terms and definitions, as well as the more comprehensive list given in IATG 01.40 *Glossary of terms, definitions and abbreviations*, shall apply.

The term 'explosive storehouse' (ESH) refers to *any building or structure approved for the storage of explosive materials. (c.f. magazine).*

The term 'national technical authority' refers to *the government department(s), organisation(s) or institution(s) charged with the regulation, management, co-ordination and operation of conventional ammunition storage and handling activities.*

The term 'unit of space' (UOS) refers to, *for planning purposes, storage space for palletised stores.*

In all modules of the International Ammunition Technical Guidelines, the words 'shall', 'should', 'may' and 'can' are used to express provisions in accordance with their usage in ISO standards.

- a) **'shall' indicates a requirement:** It is used to indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.
- b) **'should' indicates a recommendation:** It is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required, or that (in the negative form, 'should not') a certain possibility or course of action is deprecated but not prohibited.
- c) **'may' indicates permission:** It is used to indicate a course of action permissible within the limits of the document.
- d) **'can' indicates possibility and capability:** It is used for statements of possibility and capability, whether material, physical or casual.

4 Unit of space (UOS) (LEVEL 2)

As ammunition packaging varies in terms of volume it may be palletised so as to occupy a standard 'unit of space'. This UOS can then be compared against the available storage volume within an explosive storehouse (ESH) to determine the volumetric storage capacity of that ESH.

In NATO, each UOS equates to a standard unit load of a maximum size of 1080mm x 1300mm x 1372mm (i.e. 1.93m³), subject to a maximum floor loading of 7257kg for a single stack pallet base

area. This allows for pallets to be stacked either 3 or 4 high, dependent on the individual pallet weights.

For non-NATO countries, it is recommended that a UOS should equate to 1m³, with an All Up Weight (AUW) of 1 tonne, because this significantly simplifies storage planning. Alternatively, the UOS may equate to a cube based on the maximum liner dimension of the type of pallet base in use.

Care should be taken to ensure that the stacking limitations imposed by Clause 5 of IATG 06.30 *Storage and handling* are not exceeded.

5 UOS estimation factors (LEVEL 2)

To safeguard against flashover from a lightning strike on an ESH, all ammunition and explosives, except for correctly packaged small arms ammunition (SAA)³ in Hazard Division (HD) 1.4, are to be spaced from the ESH structure as follows:

A) the default separation between the outer face of any explosive package including those stored on racks or trolleys and the inner face of any adjacent structural wall or from metallic fittings such as heaters and luminaries should normally be at least 500 mm. As well as providing protection against flashover, this distance allows good natural airflow around stacks and good access for visual inspection, etc;

B) when explosives are packaged in containers larger than the standard NATO pallet and it is impractical to observe the standard 500mm separation distance, then a lesser separation may be used after consultation with the national technical authority; and

C) under no circumstances must the separation distance be less than 150 mm. Where the separation is less than 500mm, the storage arrangements should be periodically reviewed with the aim of re-establishing the standard 500mm separation distance.

Additional spacing requirements are that:

D) all ammunition should be raised 100mm off the floor by the use of pallet bases or wooden dunnage;

E) aisles should be wide enough to permit the operation of mechanical handling equipment (MHE) (usually 2.0m) or for hand pallet transporters (usually 1.2m); and

F) a 20mm air gap should surround each pallet.

The volumetric requirements of the above limitations should be considered when estimating theoretical storage space.

6 Explosive limits

The explosive limits of the ESH should be determined as recommended in IATG 02.30 *Licensing of explosive facilities* and these limits shall not be exceeded.

This may mean that the amount of ammunition that may be stored in that particular ESH occupies a volume of less than the theoretical maximum UOS available. This situation is known as 'NEQ⁴ Out'.

Conversely, in some cases for low NEQ ammunition, all of the UOS will be occupied without reaching the licensed explosive limit. This situation is known as 'Bulk Out'.

³ Defined as less than 20mm calibre.

⁴ Net explosive quantity.

7 Example estimation of UOS capability

Table 1 summarises the methodology to estimate theoretical maximum UOS (of one cubic metre) for an ESH.

Dimension	#	Remarks
ESH Width	6m	▪
ESH Length	8m	▪
ESH Height	3.7m	▪
ESH Volume	177.6m ³	▪
MHE Gangway	2m	▪ This reduces the available width.
Available ESH Width	3m	▪ ESH Width minus MHE Gangway and 2 x 0.5m air space at ends of ESH.
Available ESH Length	7m	▪ ESH Length minus 2 x 0.5m air space at ends of ESH.
Available ESH Height	3m	▪ ESH Height minus 100mm air space to floor and 500mm air space to roof. Rounded down to nearest metre for palletisation reasons. Block loose stack height would be 3.1m.
Maximum Theoretical UOS	63	<ul style="list-style-type: none"> ▪ One row of 7UOS, three high, = 21 UOS. ▪ MHE Gangway of 2m. ▪ Two rows of 7 UOS, three high = 42 UOS.

Table 1: Example methodology for theoretical UOS maximum

If the ESH has an explosives licence for the storage of 50,000kg of HD 1.1 ammunition, then the effective number of UOS for the storage of HD 1.1 would be 50 UOS. A situation of 'NEQ Out' is in place. Conversely, should HD 1.4 be stored in this ESH then a situation of 'Bulk Out' would occur.

Annex A

(normative)

References

The following normative documents contain provisions which, through reference in this text, constitute provisions of this module. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this module 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 maintain registers of currently valid ISO or EN:

- a) IATG 01.40 *Glossary of terms, definitions and abbreviations*. UNODA;
- b) IATG 03.10 *Inventory management*. UNODA; and
- c) IATG 06.30 *Storage and handling*. UNODA.

The latest version/edition of these references should be used. The UN Office for Disarmament Affairs (UNODA) holds copies of all references⁵ used in this guideline and can be found at: www.un.org/disarmament/un-safeguard/references. A register of the latest version/edition of the International Ammunition Technical Guidelines is maintained by UNODA, and can be read on the IATG website: www.un.org/disarmament/ammunition. National authorities, employers and other interested bodies and organisations should obtain copies before commencing conventional ammunition stockpile management programmes.

⁵ Where copyright permits.

