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 the UN SaferGuard IATG project through the United Nations Office for Disarmament Affairs (UNODA) website at:


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Foreword

Ageing, unstable and excess ammunition stockpiles pose the dual hazards of illicit proliferation and accidental explosion, which have caused destabilization and humanitarian disaster in all regions of the world.

Crucial for adequate stockpile management is the identification of surpluses – that is, the portion of weapons and ammunition that does not constitute an operational need. When surpluses are not recognized, the entirety of the stockpile may continue to be seen as of operational value. Although not used, weapons and ammunition surpluses thus continue to fill warehouses and can thus pose a significant risk to safety and security.

Defective stockpile management has been assessed as the norm rather than the exception in many countries. Often it is not only surplus stocks that should be the focus of attention, but the lack of appropriate policy for stockpile management. Governments remain unaware of surpluses; their national stockpiles remain a risk to public safety; and diversion from warehouses feed into crime and armed violence.

In 2011, the United Nations developed the International Ammunition Technical Guidelines (IATG) to ensure that the United Nations as a whole consistently delivers high-quality advice and support in ammunition management. Many stakeholders, including international organizations, non-governmental entities and national authorities, use these guidelines.

The IATG, along with other conventional ammunition issues, are managed through the United Nations SaferGuard programme.

Taking into account the diversity in capacity of States, three levels of ascending comprehensiveness are offered in the IATG, referred to as “risk-reduction process levels” (RRPLs). These are indicated within each IATG as either LEVEL 1 (basic), LEVEL 2 (intermediate) or LEVEL 3 (advanced).

The aim of implementing partners should be to maintain stockpile management processes at RRPL 1 as a minimum. This will often reduce risk significantly. Ongoing and gradual improvements could then be made to the stockpile management infrastructure and processes as staff development improves and further resources become available. These additional actions would equate to RRPLs 2 and 3.

The RRPLs are determined by calculating a weighted score of questions about a particular ammunition stockpile. A checklist is available at: https://www.un.org/disarmament/un-saferguard/risk-reduction-process-levels/.

The IATG are reviewed on a regular basis to reflect developing ammunition stockpile management norms and practices, and to incorporate changes due to changing international regulations and requirements. The IATG are also available in multiple languages.

The latest version of each guideline, together with practical IATG implementation support tools, can be found at https://www.un.org/disarmament/un-saferguard/.
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. Maximum use should be made of the available units of space (UOS) in covered storage to reduce the requirement for field or temporary storage of ammunition and explosives during peacetime.

This IATG provides guidance on the general practical considerations for storage space planning, whilst other IATG provide more specific safety advice for storage, handling, processing, special safety precautions and equipment requirements.
Storage space requirements

1 Scope

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

2 Normative references

The following referenced documents are indispensable for the application 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 list of normative references is given in Annex A. Normative references are important documents to which reference is made in this guide and which form part of the provisions of this guide.

3 Terms and definitions

For the purposes of this guideline the following terms and definitions, as well as the more comprehensive list given in IATG 01.40:2015(E) 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 7.257kg 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 $1\text{m}^3$, 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, with the exception of correctly packaged small arms ammunition (SAA)\(^1\) 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 500 mm 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 500 mm, the storage arrangements should be periodically reviewed with the aim of re-establishing the standard 500 mm separation distance.

Additional spacing requirements are that:

da) 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 ‘NEQ\(^2\) Out’.

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\(^1\) Defined as less than 20mm calibre.

\(^2\) Net explosive quantity.
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’.

## 7 Example estimation of UOS capability

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

<table>
<thead>
<tr>
<th>Dimension</th>
<th>#</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESH Width</td>
<td>6m</td>
<td>•</td>
</tr>
<tr>
<td>ESH Length</td>
<td>8m</td>
<td>•</td>
</tr>
<tr>
<td>ESH Height</td>
<td>3.7m</td>
<td>•</td>
</tr>
<tr>
<td>ESH Volume</td>
<td>177.6m³</td>
<td>•</td>
</tr>
<tr>
<td>MHE Gangway</td>
<td>2m</td>
<td>• This reduces the available width.</td>
</tr>
<tr>
<td>Available ESH Width</td>
<td>3m</td>
<td>• ESH Width minus MHE Gangway and 2 x 0.5m air space at ends of ESH.</td>
</tr>
<tr>
<td>Available ESH Length</td>
<td>7m</td>
<td>• ESH Length minus 2 x 0.5m air space at ends of ESH.</td>
</tr>
<tr>
<td>Available ESH Height</td>
<td>3m</td>
<td>• 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.</td>
</tr>
<tr>
<td>Maximum Theoretical UOS</td>
<td>63</td>
<td>• One row of 7UOS, three high, = 21 UOS.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• MHE Gangway of 2m.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Two rows of 7 UOS, three high = 42 UOS.</td>
</tr>
</tbody>
</table>

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 part of the guide. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of the guide 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 01.40:2015[E] Terms, glossary and definitions. UNODA. 2015;
b) IATG 03.10:2015[E] Inventory management. UNODA. 2015; and
c) IATG 06.30:2015[E] Storage and handling. UNODA. 2015.

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

Management of IATG amendments

The IATG guidelines 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 IATG they will be given a number, and the date and general details of the amendment shown in the table below. The amendment will also be shown on the cover page of the IATG by the inclusion under the edition date of the phrase 'incorporating amendment number(s) 1 etc.'

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

The most recently amended, and thus extant, IATG will be the versions that are posted on the UN SaferGuard IATG website at www.un.org/disarmament/un-saferguard/.

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
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<tr>
<td>0</td>
<td>01 Feb 15</td>
<td>Release of Edition 2 of IATG.</td>
</tr>
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