Inventory management
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www.un.org/disarmament/un-saferguard/

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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

Ammunition is an expensive commodity which could be regarded as an ‘insurance’ policy for the nation. It is hoped that it will never be needed, but long production lead times and national security commitments mean that it must be procured in advance in order that it is available on demand. This all comes at a cost which means that the inventory management systems should not only be capable of accounting for ammunition in great detail to support explosive safety but should also be designed to ensure that best ‘value for money’ is obtained from the ammunition.

Ammunition and explosives may deteriorate or become damaged unless they are correctly stored, handled and transported, with the resultant effect that they may fail to function as designed and may become dangerous in storage, handling, transport and use. An accurate assessment of a munition’s life is of paramount importance in terms of safety, performance and cost.

Effective inventory management is an important component in ensuring that a national authority fulfills its ‘Duty of Care’ for ensuring that only ammunition that is serviceable and safe to use is issued to security agencies for both training and operational use. There is also a ‘Duty of Care’ to protect the civilian population in the local areas around explosive storage areas.

The ability to rapidly detect inadvertent inaccuracy, loss, theft, leakage or diversion from the national stockpile is also a key control measure of effective stockpile management. Ineffective stock accounting systems significantly increase the risks of proliferation.
Inventory management

1 Scope

This IATG introduces the concept of inventory management and explains the processes involved that will contribute to an overall safe, effective and efficient conventional ammunition management system.

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.

A further list of informative references is given at Annex B in the form of a bibliography, which lists additional documents that contain other useful information on the inventory management of conventional ammunition.

3 Terms and definitions

For the purposes of this guide 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 ‘accounting’ refers to information management systems and associated operating procedures that are designed to record, numerically monitor, verify, issue and receive ammunition in organisations and stockpiles.

The term ‘batch’ refers to a discrete quantity of ammunition, which is assembled from two, or more lotted components (one of which will be the Primary Governing Component), is as homogeneous as possible and under similar conditions may be expected to give uniform performance.

The term ‘batch key identity’ refers to a term used to identify a particular lot or batch of ammunition.

The term ‘inventory management’ refers to the systems and processes that identify stockpile requirements, the condition of the stockpile, provide replenishment techniques and report actual and projected inventory status.

The term ‘lot’ refers to a predetermined quantity of ammunition or components which is as homogeneous as possible and under similar conditions may be expected to give uniform performance.¹

The term ‘munitions life assessment’ refers to a systems approach to optimising the useful life of ammunition.

The term ‘through life management’ refers to an integrated approach to the process, planning and costing activities across the whole service life of a specific ammunition type.

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.

¹ A lot would normally be manufactured from the same raw materials, using the same production technique and in the same production run.
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 **Aim of an inventory management system**

The aim of an inventory management system should be to ensure:

a) the safety of personnel during the use, storage, handling, transportation or disposal of conventional ammunition;

b) the optimum use of the conventional ammunition stockpile, which is an expensive national asset;

c) the timely and reliable detection of losses or diversions; and

d) the controlled issue and use of specific or generic conventional ammunition.

5 **Inventory management functions (LEVEL 2)**

An effective inventory management system should have processes and procedures that cover the following activities:

a) forecast ammunition stockpile levels and future procurement and replenishment requirements;\(^2\)

b) record and numerically monitor stockpile levels by ammunition type, lot number and/or batch number and by exact location (ammunition accounting);

c) monitor the amount of physical storage space available for the safe storage of ammunition;

d) monitor the condition of the ammunition stockpile by each ammunition type, lot number and/or batch number (ammunition condition);\(^3\)\(^4\)

e) ammunition procurement and replenishment; and

f) establish and record the financial costs of the ammunition stockpile and its maintenance.

\(^2\) See IATG 01.30:2015[E] Policy development and advice.

\(^3\) This should be done using a system of surveillance, physical inspection, chemical analysis and in-service proof. See IATG 07.20:2015[E] Surveillance and proof for further details.

\(^4\) An explanation of lotting and batching systems is contained within IATG 03.20:2015[E] Lotting and batching.
6 Through life management (LEVELS 2 and 3)

6.1 Introduction

Ammunition, due to its inherent hazards, high cost, battle winning capability and technical complexity, has to be managed differently to all other commodities. A system of Through Life Management (TLM) should form part of the inventory management process as it enhances explosive safety and prolongs the useful life of the ammunition, hence delivering the optimum return on significant financial investment. It is the philosophy that brings together the behaviour, systems, procedures, processes and tools that deliver the safest and most effective and efficient methodology for the stockpile management of conventional ammunition.

6.2 Munitions life assessments (LEVEL 2 and 3)

An essential component of TLM is Munitions Life Assessment (MLA), which is a systems approach to optimising the useful life of ammunition. MLA requires an appreciation of how ammunition ages and what environmental factors, (due to storage conditions), will influence the ageing process. This is covered in detail in IATG 07.20:2015[E] Surveillance and proof.

TLM not only improves explosive safety but also can deliver substantial cost savings, which are normally accrued towards the end of the useful life of ammunition. This is because sufficient technical data is then available to allow for safe extension of in-service life, thereby delaying the date on which replacement ammunition should be procured. Yet in order to do this, a degree of investment in effective technical inspection capability and inventory management systems is necessary in the early stages.

If a stockpile management organisation can confidently know the actual conditions that ammunition have experienced throughout their life, and understands the way that they degrade under such conditions, then the in-service life can be extended for that particular ammunition without compromising safety. Even decisions taken about storage conditions during short term operational deployment of ammunition, (i.e. protecting the ammunition from extreme environments in terms of heat and cold), can have a major impact on prolonging ammunition in-service life.

6.2.1 MLA requirements and techniques

MLA consists of a range of knowledge requirements and techniques, which may be used throughout the life cycle of the ammunition to maximise its useful life. These include:

a) effective and efficient data capture and analysis systems for technical information about the ammunition;

b) effective protection of ammunition from extreme climatic conditions of heat and cold;

c) the use of effective surveillance and in-service proof systems; and

d) a technical knowledge of how ammunition ages and may therefore fail.

6.2.2 Requirements for MLA (LEVEL 2)

For MLA to provide the most benefit there are the following requirements:

a) ammunition should not be disposed of with residual life available when there is a requirement to maintain a planned operational capability. (This requirement should not be used as justification for the maintenance of surplus stocks though);

b) replacement of ammunition should only be carried out when the life of existing ammunition has been fully consumed (ensuring that the appropriate safety margins are considered); and
c) excess and unused stocks that have been operationally deployed should be returned to depot storage (after appropriate technical inspection) rather than procuring new stocks.

6.2.3. Benefits of MLA

Although the use of MLA may not result in immediate financial benefit in the terms of life-cycle costs for all of the ammunition currently within States’ current stockpiles, it will provide other equally important benefits:

a) increased safety in storage, handling, transportation and use through a better understanding of failure modes;

b) consistent performance of ammunition during operations;

c) increased reliability of ammunition during operations;

d) a reduction in logistic and administrative requirements through improved asset tracking;

e) an improvement in the technical surveillance system by using environmental data to better target surveillance requirements;

f) more accurate life-planning of ammunition; and

g) an improvement in behaviour in the care of ammunition and the development of an ‘ethos of explosive safety’ at all levels.

For legacy ammunition already in an ammunition stockpile MLA should be used to initially determine the current safety of that ammunition if it is not accurately known. A subsequent decision should then be taken to either: 1) specify an in-service life and continue MLA; or 2) to destroy or demilitarize the ammunition. In many cases destruction or demilitarization may be the only option as it may not even be cost effective to subject ammunition to MLA, even if such a technical capability already exists within an ammunition stockpile management organisation.

6.2.4. Ammunition management policy statements (AMPS) (LEVEL 2)

One means of ensuring that ‘value for money’ is obtained, as well as supporting safety, is the development of an Ammunition Management Policy Statement (AMPS)\(^5\) for each specific type of ammunition. AMPS may be used to define policy for the management of an item of ammunition or explosive throughout its service life and should list support information to assist staff with the maintenance and final disposal of the ammunition or explosive. This forms part of the inventory management process.

The contents of an AMPS are at Annex C.

6.3 Improvement of in-service life for ammunition (LEVEL 3)

6.3.1. Benefits

MLA will assist in the identification of options to improve the in-service life of ammunition. Ideally these measures should be taken prior to the introduction of the particular type of ammunition into service, but in many cases there are already large stockpiles of ammunition for which life improvement measures may need to be taken.

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\(^5\) These are sometimes also known as Through Life Management Plans (TLMP). The term AMPS is used in the IATG as it makes it clear that it specifically refers to ammunition, as TLMP may exists for other commodities.
Life improvement measures\textsuperscript{6} should be designed to either preserve or conserve the life of the ammunition whilst it is in depot storage, or is operationally deployed. The benefits of life improvement measures include:

a) the life of ammunition can be extended beyond that which would be possible without life improvement measures;

b) if life improvement measures are planned in advance of the introduction into service of an ammunition type then the service life increases may be significant;

c) the introduction of life improvement measures, even at the mid-life stage, for ammunition already in service can still increase service life;

d) the introduction of appropriate life improvement measures may reduce the overall life cycle costs of the ammunition, (see Clause 20.1); and

e) the introduction of appropriate life improvement measures will lead to improved confidence in predicting the whole life of the ammunition.

6.3.2. Options

Life improvement measure options may be applied individually or as part of an overall policy designed to reduce the aging effects of the environment on particular ammunition types. These measures are shown in Table 1.

<table>
<thead>
<tr>
<th>Generic In-Service Life Improvement Measure</th>
<th>Specific In-Service Life Improvement Measure</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled Storage</td>
<td>Use high quality Explosive Storehouses (ESH) with effective temperature and humidity control.</td>
<td>Explosives degrade when there are conditions of high temperature and humidity. Controlled storage conditions can defer the onset of, and control the rate of, degradation.</td>
</tr>
<tr>
<td></td>
<td>Use a dual-inventory process, whereby a small proportion of a particular lot or batch of ammunition is used for training or operations, with the main stock remaining in controlled storage conditions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Use high quality ammunition packaging.</td>
<td></td>
</tr>
<tr>
<td>Recording</td>
<td>Temperature and humidity records of an ESH are maintained, (ideally by use of a data logger).</td>
<td>To be most effective MLA requires complete visibility of the environmental conditions a munition has been subjected to.</td>
</tr>
<tr>
<td></td>
<td>Exposure to environmental conditions outside controlled storage is recorded. (Meteorological conditions and period of exposure).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exposure to operational transport and use conditions, (i.e. time spent by a missile vibrating on an armoured vehicle).</td>
<td></td>
</tr>
<tr>
<td>Data Logging\textsuperscript{7}</td>
<td>Use of an electronic data logger to record temperature and humidity conditions in each ESH.</td>
<td>If environmental conditions may be accurately recorded, then the percentage of in-service life consumed may be estimated.</td>
</tr>
</tbody>
</table>

\textsuperscript{6} Sometimes known as ‘amelioration’.

\textsuperscript{7} This would have been unmanageable until a few years ago, when compact and cheap data logging equipment and software arrived in the commercial market.
The effectiveness of life improvement measures may not become immediately quantifiable, and the cost benefit will depend to a degree on the type and quantity of ammunition subjected to such improvements. Yet storage under controlled conditions of those ammunition types most susceptible to environmental factors, (i.e. propellant, rocket motors and pyrotechnics), should be an effective option.

One of the aims of life improvement measures should be to build models of the ageing characteristics of the explosives in service use, which can be, used in future MLA processes. Immediate benefits may not be easily identifiable, but they should become more quantifiable over the longer term. As the effective service life of much ammunition is over 20 years the use of MLA should be considered as a long-term investment.

### 7 Types of ammunition stockpiles

An effective inventory management system should ensure that the type of ammunition stockpile is clearly defined and that detailed technical information on the quantity, location and condition of the ammunition itself, (by specific type), is readily available.

There may be a range of separate ammunition and explosive stockpiles within a country that are under the control of different organisations, (such as the police, military (both active and reserve), border guards, ammunition production company holdings etc). Each of these organisational stockpiles should have one or more of the following generic parts:

<table>
<thead>
<tr>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational ammunition and explosives</td>
<td>▪ The ammunition and explosives necessary to support the routine operations of military, police and other security agencies over an agreed period of time.</td>
</tr>
<tr>
<td>War reserve ammunition and explosives</td>
<td>▪ The ammunition and explosives necessary to support the operations of military, police and other security agencies during external conflict or general war over an agreed period of time.</td>
</tr>
<tr>
<td></td>
<td>▪ 30 days at intensive expenditure rates is often used as the time period.</td>
</tr>
<tr>
<td>Training ammunition and explosives</td>
<td>▪ The ammunition and explosives necessary to support the routine training of military, police and other security agencies. This will usually be an agreed percentage of the war reserve holdings.</td>
</tr>
<tr>
<td></td>
<td>▪ 15% would not be unreasonable, dependent on the training activities and frequency.</td>
</tr>
<tr>
<td>Experimental ammunition and explosives</td>
<td>▪ This type of ammunition is usually only held by those nations with a research, development and production capability.</td>
</tr>
<tr>
<td></td>
<td>▪ These holdings will be minimal, but must be included for intellectual accuracy.</td>
</tr>
</tbody>
</table>

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8 Also contained within IATG 01.30:2015[E] Policy development and advice and repeated here for convenience.
<table>
<thead>
<tr>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production ammunition</td>
<td>• This type of ammunition is usually only held by those nations with a production capability.</td>
</tr>
<tr>
<td></td>
<td>• The ammunition and explosives that have been produced and are awaiting sale under the control of the manufacturer. These may be available to the military during general war but would not form part of the war reserve as their availability cannot be guaranteed.</td>
</tr>
<tr>
<td>Ammunition and explosives awaiting disposal</td>
<td>• The ammunition and explosives that have been identified as unserviceable, unstable or surplus to requirements.</td>
</tr>
</tbody>
</table>

Table 2: Generic types of ammunition stockpiles

The total of all of these generic parts should be referred to as the ‘national stockpile’. The management of stocks of small arms ammunition in the possession of civilians or retailers should be determined in accordance with ISACS 03.30 National controls over the access of civilians to SALW and not in accordance with this guide.

8 Ammunition stockpile management system requirements (LEVEL 2)

An ammunition stockpile management system should be dependent on the organisational structure, administrative requirements and operational responsibilities of the security forces within a State. Notwithstanding the rights of States to maintain their own organisational structures, a clear chain of command and responsibility shall exist. The ammunition stockpile management system should be made up of the organisations shown in Table 3.

<table>
<thead>
<tr>
<th>Organisations</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammunition stockpile management department</td>
<td>• Usually at Ministry of Defence/Interior or Service (Army, Navy, Air Force, Police etc) level.</td>
</tr>
<tr>
<td>Ammunition storage units</td>
<td>• Subordinate to the stockpile management organisation.</td>
</tr>
<tr>
<td></td>
<td>• Usually the major ammunition storage depots.</td>
</tr>
<tr>
<td>Ammunition technical inspection units</td>
<td>• Subordinate to the stockpile management organisation and co-located with the major ammunition storage depots.</td>
</tr>
<tr>
<td>Ammunition training unit</td>
<td>• Subordinate to the stockpile management organisation.</td>
</tr>
<tr>
<td></td>
<td>• Should be co-located with a major ammunition depot.</td>
</tr>
<tr>
<td>Ammunition inspectorate</td>
<td>• Subordinate to, and reports directly to, the stockpile management organisation.</td>
</tr>
<tr>
<td></td>
<td>• Independent of other ammunition units.</td>
</tr>
<tr>
<td></td>
<td>• Consists of ammunition technical staff to ensure the safety and condition of ammunition within user units.</td>
</tr>
<tr>
<td>User units</td>
<td>• User units fall under the operational chain of command.</td>
</tr>
</tbody>
</table>

Table 3: Ammunition stockpile management system components

9 Stockpile management organisation responsibilities (LEVEL 2)

The role of the conventional ammunition stockpile management organisation\(^9\) shall include the responsibility to:

a) develop a policy for effective and efficient ammunition storage and accounting;

b) develop effective ammunition storage and accounting units, (usually major ammunition depots), and maintain their operational capability;

\(^9\) Which may also act as the National Technical Authority.
c) develop a policy for the technical inspection of ammunition when in-service;

d) develop effective ammunition technical inspection units and maintain their operational capability;

e) develop an effective ammunition training unit and maintain its operational capability;

f) develop an effective ammunition inspectorate and maintain its operational capability;

g) allocate and promulgate lot and batch numbers for specific ammunition types, (see IATG 03.20 Lotting and batching);

h) develop an ammunition descriptive asset code (ADAC) type system, or similar, then allocate and promulgate unique ADAC codes (see Clause 17);

i) develop and maintain ammunition management policy statements (AMPS) or their equivalent;

j) maintain an overview of the frequency and accuracy of ammunition stock checks;

k) develop and implement a system of explosive limits licences (ELL) for ammunition storage and processing facilities (see IATG 02.30 Licensing of explosive storage areas (ESA));

l) develop and promulgate a system for the issue and receipt of ammunition between manufacturers, stock holding units and user units;

m) develop and maintain an internal capability to undertake external audits of ammunition accounting and storage units, (stockpile safety and accuracy of ammunition accounts);

n) maintain an overview of the usage rates of the conventional ammunition stockpile;

o) maintain an overview of the technical condition of the conventional ammunition stockpile and ensure that appropriate inspection, repair maintenance or modification processes take place to ensure the safety of the ammunition stockpile;

p) develop and maintain a system for the technical surveillance and in-service proof of ammunition (see IATG 07.20:2015[E] Surveillance and proof);

q) procure new and/or replacement ammunition, when appropriate, to ensure that operational needs may be met (see Clause 20.1); and

r) maintain an overview of technical developments in the wider field of explosive engineering and conventional ammunition.

10 Ammunition storage unit responsibilities (LEVEL 1)

The ammunition storage units, (usually the major ammunition depots), which should be subordinate to the ammunition stockpile management organisation, shall have the responsibility to:

a) effectively implement the ammunition accounting system;

b) ensure the security of ammunition stocks;

c) accurately account for ammunition by specific type, quantity lot and/or batch number and exact location within the ammunition stockpile at all times. Records should be maintained for at least 10 years;
d) develop and maintain a system and capability to stock check ammunition by specific type, lot and/or batch number.\footnote{10} Records should be maintained for at least ten years;

e) accurately implement the system for the issue and receipt of ammunition between manufacturers, stock holding units and user units. Records should be kept for at least 10 years;

f) liaise with the ammunition technical inspection units to ensure the efficiency of in-service ammunition inspection, repair, maintenance and modification processes; and

g) maintain accurate records on the technical condition of ammunition in storage for at least 10 years.

11 Ammunition technical inspection unit responsibilities (LEVEL 2)

The ammunition technical inspection units, (usually co-located with the major ammunition storage and accounting depots), which should be subordinate to the ammunition stockpile management organisation, shall have the responsibility to:

a) safely and effectively inspect (physically), repair, repackage, maintain or modify ammunition when instructed by the ammunition stockpile management organisation. (Records should be kept for at least 10 years);

b) safely and effectively undertake chemical analysis of explosives and propellants to assure that the ballistic performance of the ammunition is within operational or training limits, and to ensure its chemical stability in storage. (This task may alternatively be undertaken by an appropriate explosives laboratory);

c) conduct surveillance and in-service proof of ammunition as instructed by the ammunition stockpile management organisation (see IATG 07.20:2015[E] Surveillance and proof; and

d) liaise with the ammunition storage units to ensure efficient stock transfer processes.

12 Ammunition training unit responsibilities (LEVEL 2)

The role of the ammunition technical inspection unit, which should be subordinate to the ammunition stockpile management organisation, should include the responsibility to:

a) develop and provide initial, upgrading and refresher ammunition technical training to ammunition technical staff;

b) develop and provide basic ammunition safety in storage training for non-ammunition units; and

c) maintain an overview of technical developments in the wider field of explosive engineering and conventional ammunition.

The ammunition training unit may also have the responsibility to:

d) develop and provide Explosive Ordnance Disposal (EOD) training; and

e) research technical developments in the wider field of explosive engineering and conventional ammunition and report, as appropriate, to the ammunition stockpile management organisation.

\footnote{10} The frequency of stock checks should be determined by the stockpile management organisation, and should not be less than three-monthly. For large stockpiles a continuous ‘rolling’ stock check may be necessary.
13 Ammunition inspectorate responsibilities (LEVEL 3)

An ammunition inspectorate is normally an independent unit consisting of ammunition technical staff that reports directly to the ammunition stockpile management organisation. It may be under the command of a formation (i.e. Army, Corps, Division or Brigade) for operational and administrative purposes, but it shall retain the right of direct reporting to the ammunition stockpile management organisation where areas of explosive safety are concerned.

An ammunition inspectorate should have the responsibility to:

a) conduct regular (annual) unit ammunition inspections to ensure the safety in storage at unit level and to assess the technical condition of the ammunition in unit storage; and

b) advise units and formation headquarters on ammunition safety and technical issues.

An ammunition inspectorate may also have the responsibility to:

c) investigate ammunition incidents and accidents (see IATG 11.20:2015[E] Ammunition accidents: reporting and investigation);

d) provide ‘expert witness’ evidence to judicial enquiries;

e) provide Explosive Ordnance Disposal (EOD) support;

f) provide support to technical intelligence units; and

g) research technical developments in the wider field of explosive engineering and conventional ammunition and inform the ammunition stockpile management organisation as appropriate.

14 Ammunition accounting

14.1 Ammunition accounting requirements (LEVELS 1 and 2)

Accurate records should be kept, (by specific type, quantity, lot and/or batch number and exact location), for the following stages of its life:

a) on manufacture;

b) on initial testing;

c) during transportation and shipment;

d) in depot storage;

e) on transfer to user units;

f) during storage at user units;

g) in case of loss or theft;

h) when used;

i) when returned to ammunition depots;

j) when repaired or modified;

k) when subjected to surveillance or in-service proof;\(^{11}\) and

---

\(^{11}\) See IATG 07.20:2015[E] Surveillance and proof.
14.2 Accounting systems (LEVEL 1)

Either manual or computer ammunition accounting systems may be used. Although manual systems are labour intensive and time-consuming compared to computer systems, and the transmission of information between higher formations and units is slow, they have proven capability and are simple to use when individuals are appropriately trained. Their effectiveness is determined by the administrative instructions for their use and the standing operating procedures used within the ammunition depot. For reasons of accounting accuracy, explosive safety and operational efficiency parallel systems that can identify specific ammunition by either stockpile location or by lot/batch number are required. Regular reports on inventory levels and condition should be made by the ammunition accounting and storage units to the stockpile management organisation.

Although computerised ammunition accounts are more efficient and capable they are expensive to develop, are usually specifically designed for a particular ammunition stockpile management organisation and are just as reliant as the manual systems on the accuracy of the data entered into them. They can be directly linked between the stockpile management organisation and the ammunition accounting and storage units, thereby reducing the requirement for reporting of stock levels as instant visibility is possible.

14.3 International accounting principles and standards (LEVEL 2)

Principles for ammunition accounting may be derived from Generally Accepted Accounting Principles (GAAP). Although these are a widely accepted set of rules, conventions, standards, and procedures for primarily reporting and recording financial information, the requirements for recording transaction activity and stock levels are equally applicable to ammunition as to any other commodity or process. The following accounting principles should be followed for the accounting of ammunition:

a) **objectivity**: ammunition accounts should be based on objective evidence derived from physical stock checks, independent audits and effective operating procedures for transactions;

b) **materiality**: the significance of an accounting issue should be considered when it is reported, (i.e. an ineffective component of an accounting method). An issue is considered significant when it would affect the decision of a reasonable individual;

c) **consistency**: the ammunition accounting unit shall use the same accounting principles and methods from year to year; and

d) **prudence**: when choosing between two options, the one should be picked that will be most likely to ensure that a discrepancy, loss or theft is detected.

14.4 Accuracy of ammunition accounts

No ammunition storage organisation is likely to be able to achieve 100% accuracy in its ammunition accounts. For example, if storage staff issue the right type of ammunition, but of the wrong lot or batch number, there is automatically a discrepancy until the error is identified and rectified during a regular stock check. In this example the quantity of ammunition in storage would

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12 Reporting frequency will depend on expected usage rates, and the current condition of the stockpile. It is recommended that reports should be submitted monthly.

13 GAAP are used by a range of countries. GAAP are being integrated into a range of new International Financial Reporting Standards (IFRS) and International Accounting Standards (IAS). IFRS and IAS are developed and promulgated by the International Accounting Standards Board (IASB) (www.iasb.org), an independent organisation.
be the same and there has been no criminal intent, but the ammunition account would be inaccurate as 100% visibility of that particular lot or batch number has been lost.

Organisations claiming 100% accuracy of ammunition accounts should be viewed with suspicion, as at the very least it is an indication that they do not understand ammunition depot processes, at worst it means that they have ineffective stockpile management processes as errors cannot be detected down to lot or batch level, and therefore safety in storage or use may have been compromised.

14.5  Stack tally cards (LEVEL 1)

The use of stack tally cards is an effective measure that supports accurate ammunition accounting, assists in stock taking and deters theft. Each stack of ammunition should have a tally card(s) attached to it that records the following information for that particular stack:

a)  grid locator reference;

b)  Explosive Storehouse (ESH) number;

c)  full description of ammunition;

d)  Ammunition Descriptive Asset Codes (ADAC) number, (or similar asset code system). (see Clause 17);

e)  lot and/or batch number, (a separate card should be used for each lot and/or batch number);

f)  ammunition condition code (see Clause 18.1);

g)  a record of transactions for that stack by quantity, lot/batch number and date; and

h)  the issue or receipt voucher reference for each transaction.

A specimen example of a stack tally card in use is at Table 4.

<table>
<thead>
<tr>
<th>Date</th>
<th>Issue/Receipt Voucher Number</th>
<th>Received</th>
<th>Issued</th>
<th>Balance</th>
<th>Signature</th>
<th>Name</th>
<th>Grid Locator Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>12/4/06</td>
<td>GT 12875</td>
<td>612</td>
<td>612</td>
<td>J Smith</td>
<td>Pte J SMITH</td>
<td>K3, K4, K5, K6 and K7</td>
<td></td>
</tr>
<tr>
<td>18/9/06</td>
<td>GT 13398</td>
<td>68</td>
<td>544</td>
<td>J Smith</td>
<td>Pte J SMITH</td>
<td>K8</td>
<td></td>
</tr>
<tr>
<td>10/6/08</td>
<td>GT 16587</td>
<td>68</td>
<td>170</td>
<td>D Jones</td>
<td>Pte D JONES</td>
<td>K5</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: Example stack tally card

---

14 A stack is the amount of ammunition that is contained within a particular Grid Locator base within an explosive storehouse. This may range from a single ammunition box within a ground level UOS, to a block of many pallets stored vertically over a number of particular ground level UOS.
Stack tally cards should be placed in plastic envelopes or suitable substitutes to prevent deterioration of the forms and to protect them from moisture. When the form is completed, or the last lot or batch of that particular ammunition has been issued, then the stack tally card should be kept by the ammunition depot stock taking department for at least two years. This allows future reconciliation of ammunition accounts should a discrepancy occur in the future during stock taking or audit.

14.6 Stocktaking and audits (LEVEL 1)

Stocktaking is an essential process in supporting the accuracy of ammunition accounts by identifying discrepancies, loss or theft. It means that trained staff, who fully understand the way that ammunition and its packaging is marked, should physically count and record the ammunition in each storage location.

A fundamental principle of effective stocktaking is that staff shall not be provided with a copy of what the ammunition account shows for each storage location. It is only the reconciliation between the ammunition account and the stocktaking record for each storage location.

Stocktaking should take place at least every three months, but for large stockpiles of ammunition a continuous ‘rolling’ stock check may need to be implemented.

15 Stock location in explosive storehouses (LEVEL 2)

15.1 Units of space concept

Ammunition stock location can be simplified if a Unit of Space (UOS) concept is adopted. It is generally assumed for planning purposes that the volume of the majority of pallets or unit load container equates to one square metre, with an average weight of 1 tonne. This approach simplifies ammunition storage planning, as the number of UOS within an explosive storehouse may be easily calculated by a simple volume measurement. A small amount of space can be deducted to allow for:

a) the maximum safe stacking height for the ammunition, (usually 3 or 4 metres if palletised);

b) aisles wide enough for the type of mechanical handling equipment being used, (usually at least 500mm);

c) a 600mm air gap from the front wall of the ESH to ammunition stacks; and

d) a 150mm air gap between the exterior walls of the ESH and the ammunition stacks.

The remaining floor space is then available for the first layer of pallets. As a UOS must be an integer the fractions of metres are discounted, (which has the benefit of increasing free air space within the ESH and hence improves air circulation). The floor area as an integer multiplied by the safe stacking height as an integer (1, 2, 3 or 4) then equates to the Units of Space, or standard pallets that may be physically stored within the ESH.

A similar approach can be used for un-palletised ammunition, but it is then essential that the exact dimensions of ammunition outer packaging are known.

Table 5 is an illustrative UOS calculation for an ESH.
<table>
<thead>
<tr>
<th>Item</th>
<th>Length (m)</th>
<th>Width (m)</th>
<th>Height (m)</th>
<th>Volume (m³)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe stacking height</td>
<td></td>
<td></td>
<td>3.00</td>
<td></td>
<td>To be used if height of ESH &gt; 3.0m.</td>
</tr>
<tr>
<td>ESH Interior</td>
<td>15.00</td>
<td>8.00</td>
<td>4.00</td>
<td>360.0000</td>
<td>3.0m used for volume calculation as this is safe stacking height.</td>
</tr>
<tr>
<td>Air Gap (Front Wall)</td>
<td>0.60</td>
<td>8.00</td>
<td>3.00</td>
<td>14.4000</td>
<td>3.0m used for volume calculation in remaining items as this is the safe stacking height.</td>
</tr>
<tr>
<td>Air Gap (Rear Wall)</td>
<td>0.15</td>
<td>8.00</td>
<td>3.00</td>
<td>3.6000</td>
<td></td>
</tr>
<tr>
<td>Air Gap (Side Walls)</td>
<td>14.25</td>
<td>0.15</td>
<td>3.00</td>
<td>6.4125</td>
<td>Space used for Front and Rear Wall air gap lengths deducted.</td>
</tr>
<tr>
<td>Aisle</td>
<td>14.25</td>
<td>0.50</td>
<td>3.00</td>
<td>21.3750</td>
<td>Space used for Front and Rear Wall air gap lengths deducted.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Volume available for storage 314.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>This is not the UOS available</strong></td>
</tr>
<tr>
<td>Effective Units of Space (UOS)</td>
<td></td>
<td></td>
<td></td>
<td>294</td>
<td><strong>See Footnote</strong></td>
</tr>
</tbody>
</table>

Table 5: UOS calculation example

15.2 Grid locator

Ammunition storage within each ESH should be organised in such a way that it can be easily found, as this will improve the issue, receipt and auditing processes. A simple Grid Locator concept may be used as a method of identifying storage locations, which can then be recorded in the ammunition account and on the Stack Tally Cards (see Clause 14.5). A separate record of the location plan, in diagrammatic form, should be kept as a UOS summary as this will identify spare storage space.

Table 6 is an illustrative Grid Locator for the ESH example in Table 5.16

| Ammunition Depot: Greentown |
|-----------------------------|-----------------------------|
| ESH | 21 | Date: | 23/11/09 |
| Grid | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| A | | | | | | | |
| B | | | | | | | |
| C | | | | | | | |
| D | | | | | | | |
| E | | | | | | | |
| F | | | | | | | |
| G | | | | | | | |
| H | | | | | | | |
| J | | | | | | | X |
| K | | | | | | | |
| L | | | | | | | |
| M | | | | | | | |

Table 6: Grid locator example

15 Obtained by dividing the Volume by 3 to get the floor area available, then taking the square route and rounding down to the nearest integer. 

16 Note that the letter ‘I’ is not used. This avoids confusion with the number ‘1’.
A further refinement then allocates the UOS in a single floor grid location by its position in the stack using (a), (b), (c) or (d). Therefore the third UOS from the floor in grid square K3 would be referred to as K3(c).

The use of the UOS concept with a Grid Locator for each ESH will assist in:

a) reducing time taken to locate ammunition for issue, receipt or internal depot transfer;

b) improving the efficient use of available storage space;

c) maintaining the accuracy of the ammunition account; and

d) ensuring that the ESH is not bulk overloaded.

15.3 Planographs

A similar system to the grid system at Clause 15.1.2 is that of planographs, which also include details of the ammunition stored within each grid locator. This is explained at Annex B to the OSCE Handbook of Best Practices on Conventional Ammunition.17

16 Storage space issues (LEVEL 2)

An explosive storehouse should be considered as ‘full’ when either:

a) all UOS contain ammunition stocks and the Net Explosive Quantity (NEQ) is within the Explosives Limit Licence (see IATG 02.20 Quantity and separation distances) for that particular ESH. This condition is known as ‘bulked out’; or

b) there are spare UOS available, but the ESH has reached its explosive limit for Hazard Division 1.1, 1.2 or 1.3 ammunition. This condition is known as ‘NEQ out’. In this case it may still be permissible to fill the remaining UOS with ammunition of Hazard Division 1.4S if storage space is at a premium.

If storage space permits, it is desirable that a UOS only contains the same specific type of ammunition with the same lot or batch number. Although this is not the most efficient use of storage space, it does make other ammunition management processes a lot easier, (i.e. stock taking, audit etc), and reduces the risks of discrepancies in the ammunition account.

17 Ammunition descriptive asset codes (LEVEL 2)

There is a very wide range of specific ammunition types all of which are specific to one or more weapons systems. This means that when referring to the ammunition the exact type must be quoted, (i.e. Shell 155mm High Explosive L15A1 or Charge Propelling 155mm L18A2).

The same specific type of ammunition is also often packaged differently dependent on the type of logistic distribution system that it is destined for on operational use, (i.e. a Unit Load Container (ULC) contained both HE Shell (Fuzed) and Propelling Charges or a Pallet of HE Shell (Un-fuzed only)).

The level of descriptive detail necessary to ensure that the right specific type of ammunition is being delivered to the user, or that the ammunition depot has counted the right specific type of ammunition during a stock check, means that mistakes are easily made.

One method of simplifying this process is by the use of a system of Ammunition Descriptive Asset Codes (ADAC),\(^{18}\) which may be used in place of long descriptive text. An ADAC system uses a five or seven digit numerical code with an optional suffix letter, which is specific for each different type of ammunition and the way that it is packed. This code represents:

a) the user group of the ammunition concerned, (i.e. infantry, artillery, tank etc);
b) the generic type of ammunition, (i.e. Shell, 155mm);
c) the specific type of ammunition, (i.e. Shell HE, 155mm); and
d) the mark or model number, (i.e. Shell HE, 155mm, L15A1).

An example of such a system is at Table 7.

<table>
<thead>
<tr>
<th>Figure</th>
<th>Numeral</th>
<th>Group</th>
<th>ADAC Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>• Common Light Ammunition.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>• Armoured Vehicle Ammunition.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>• Gunnery and Artillery Ammunition.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>• Aircraft, Air Delivered and Aviation Support Ammunition.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>• Mines, Explosives, Clearance, EOD and Engineering Ammunition.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>• Guided Weapons, Rockets, Torpedoes and Depth Charges.</td>
<td></td>
</tr>
<tr>
<td>Second and Third</td>
<td>11-99</td>
<td>• The generic type of ammunition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• (i.e. Shell, 155mm).</td>
<td></td>
</tr>
<tr>
<td>Fourth and Fifth</td>
<td>11-99</td>
<td>• The specific type of ammunition.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• (i.e. Shell HE, 155mm).</td>
<td></td>
</tr>
<tr>
<td>Sixth and Seventh</td>
<td>11-99</td>
<td>• The specific mark or model.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• (i.e. Shell HE, 155mm, L15A1).</td>
<td></td>
</tr>
<tr>
<td>Suffix Letter</td>
<td>A-Z</td>
<td>• The method of packaging.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• (i.e. Palletised or Unit Load Container).</td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Example of ADAC type system

Table 8 illustrates an ADAC system for the range of 155mm Shell used as examples in Table 7:\(^{19}\)

---

\(^{18}\) NATO also uses a 13 digit identification number for its ammunition stocks.

\(^{19}\) The numbers used in the ADAC example are illustrative only, and do not represent the real ADAC used by any State using a similar system.
### 18 Condition classification of ammunition (LEVELS 2 and 3) 20

All ammunition and explosives should be classified\(^\text{21}\) as to their condition, which will require a surveillance and in-service proof system.\(^\text{22}\) The ammunition condition is used to define the degree of serviceability of the ammunition and the degree of any constraints imposed on its use.

National authorities should ensure that the declared ammunition 'shelf life' is an indication of the performance capability of the ammunition and not necessarily just its safety or stability in storage; only physical inspection and ammunition surveillance can determine this.

National authorities should therefore develop a system that allows the condition of the ammunition to be clearly defined, as it is only in this way that safe storage conditions may be maintained, and subsequent disposal or destruction can be prioritised.

#### 18.1 Ammunition condition groups

The following groupings and codes could be used as a means of classifying the condition of ammunition stocks:

<table>
<thead>
<tr>
<th>Condition Type Code</th>
<th>Condition Sub-Type Code</th>
<th>Ammunition Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A1</td>
<td>Serviceable stocks available for use.</td>
</tr>
<tr>
<td></td>
<td>A2</td>
<td>Available for issue.</td>
</tr>
<tr>
<td></td>
<td>A3</td>
<td>Available for issue subject to national technical authority approval.</td>
</tr>
<tr>
<td>B</td>
<td>B1</td>
<td>Stocks banned from use pending a technical investigation.</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>Banned for use, but cleared for routine storage and movement.</td>
</tr>
<tr>
<td></td>
<td>B3</td>
<td>Banned for issue and use, and not cleared for movement.</td>
</tr>
<tr>
<td></td>
<td>B4</td>
<td>Awaiting manufacturer’s quality assurance reports.</td>
</tr>
<tr>
<td></td>
<td>C1</td>
<td>Shelf life expired.</td>
</tr>
<tr>
<td></td>
<td>C2</td>
<td>Stocks unavailable for use pending technical inspection, repair, modification or test</td>
</tr>
<tr>
<td></td>
<td>C3</td>
<td>Minor processing or repair only required.</td>
</tr>
</tbody>
</table>

20 Also see IATG 06.80:2015[E] Inspection of ammunition.

21 Best ammunition management practice further recommends that ammunition should also be classified by their Dangerous Goods Classification and UN Serial Number, Hazard Division, Compatibility Group and Hazard Classification Code. (See IATG 01.50 UN Explosive hazard classification system and codes for further details).

22 See IATG 07.20 Surveillance and proof for further details.
<table>
<thead>
<tr>
<th>Condition Type Code</th>
<th>Condition Sub-Type Code</th>
<th>Ammunition Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td></td>
<td>• Major processing or repair required.</td>
</tr>
<tr>
<td>C3</td>
<td></td>
<td>• Awaiting inspection only ex-unit.</td>
</tr>
<tr>
<td>C4</td>
<td></td>
<td>• Manufacturers processing or repair awaited.</td>
</tr>
<tr>
<td>C5</td>
<td></td>
<td>• Force regeneration processing required.</td>
</tr>
<tr>
<td>D</td>
<td></td>
<td>• Stocks for disposal.</td>
</tr>
<tr>
<td>D1</td>
<td></td>
<td>• Surplus, but serviceable stocks.</td>
</tr>
<tr>
<td>D2</td>
<td></td>
<td>• Unserviceable stocks.</td>
</tr>
</tbody>
</table>

Table 9: Ammunition condition classification groups

When ammunition should be subject to inspection and surveillance, which is good stockpile management practice, it is inevitable that defects will be found. These defects shall determine which 'Condition Group' the ammunition is placed in, and categorised as:

<table>
<thead>
<tr>
<th>Defect Type</th>
<th>Ammunition Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical</td>
<td>• Defects affecting safety in storage, handling, transportation or use.</td>
</tr>
<tr>
<td>Major</td>
<td>• Defects that affect the performance of the ammunition and that require remedial action to be taken.</td>
</tr>
<tr>
<td>Minor</td>
<td>• Defects that do not affect the safety or performance of the ammunition, but are of such a nature that the ammunition should not be issued prior to remedial action having been taken.</td>
</tr>
<tr>
<td>Insignificant</td>
<td>• Any defect that does not fall into any of these categories, but which could conceivably deteriorate into one of them if no remedial action is taken.</td>
</tr>
<tr>
<td>Technical</td>
<td>• Any defect that requires further technical investigation.</td>
</tr>
</tbody>
</table>

Table 10: Types of ammunition defect

Therefore it is possible that ammunition classified as B4, (shelf life expired), is not an urgent priority for disposal as further technical investigation may well extend its shelf life, and hence it would be re-classified as A for a further period of time.

19 Ammunition procurement and stockpile levels (LEVEL 2)

19.1 Introduction

Each State shall be responsible for deciding the type and quantity of ammunition necessary for its security forces to achieve their constitutional or legally mandated tasks, although such stockpile levels should be necessary, reasonable and justifiable.

19.2 Requirement planning criteria

National defence and security strategies or policies should provide the basic planning assumptions that determine military, policing and security tasks, the operational concepts and hence the size, organisational structure and equipment requirements of the security forces.

The following parameters should determine the types and quantities of weapons in the national stockpile, from which ammunition requirements can be calculated:

---

23 The economical surveillance of ammunition and accurate assessment of the quality, within known confidence levels, is achieved by taking a relatively small, random sample from a large bulk quantity.
a) the number of personnel in the security forces;
b) the organisation of the security forces;
c) the equipment needs of the security forces, based on capability requirements;
d) current holdings of weapons and their effectiveness for future tasks; and
e) available financial resources.

19.3 Calculation of requirements

Ammunition requirements to support the security forces may be estimated by use of the Daily Ammunition Expenditure Rate (DAER) system. The advantage of such a system is that it may be used by all levels of the security forces during peace and on operations. It can be used as an operational combat supplies planning tool (by all unit types and size) as well as a simple means of determining national stockpile levels.

Advice on the calculation of weapon requirements, (which is required for the methodology of Clause 19.3.1), may be found at Annex D.

19.3.1 Daily ammunition expenditure rates (DAER)

The Daily Ammunition Expenditure Rate (DAER)\(^{24}\) for a specific type of ammunition is the estimated amount of ammunition that a single equipment, (such as an artillery gun), will use in one day of combat or conflict at a certain intensity. These figures are usually classified and should be determined by operational analysis.\(^{25}\) For example the DAER for a 152mm Gun, at intensive war rates, may be 300 rounds per day, therefore to sustain an Artillery Battery of 8 Guns, over a 30 day period at intensive war rates would require 72,000 rounds of ammunition. An example spreadsheet to calculate this may look like this:

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>DAER</th>
<th>FORCE LEVEL</th>
<th>DAYS</th>
<th>FORCE DAER SUSTAINABILITY REQUIREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.45mm Ball</td>
<td>5 20 60 120 600 30</td>
<td>9000</td>
<td>360K</td>
<td>1.08M</td>
</tr>
<tr>
<td>Rocket A/Tk RPG 7</td>
<td>0 10</td>
<td>20</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>Mortar 60mm HE</td>
<td>0 10</td>
<td>50</td>
<td>30</td>
<td>8</td>
</tr>
<tr>
<td>152mm Gun HE</td>
<td>0 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 11: Example DAER calculation

The defence stockpile may then be calculated from an analysis of the DAER sustainability requirements to support the national defence and security strategy. For example it may be decided that the initial defence stockpile should be made of the following DAER components:

a) Operational Stocks (Police) - 30 DAER at Internal Security Operation rates;
b) Operational Stocks (Military) - 10 DAER at General War (Light) Rates;\(^{30}\)
c) War Reserve - 25 DAER at General War (Intensive) Rates; and

---

\(^{24}\) More information on the use of a DAER system is in IATG 01.30:2015[E] Policy development and advice.

\(^{25}\) The NATO alliance uses a classified system called ACROSS (Allied Command Resource Optimization Software System). ACROSS is highly complex, and it is highly classified as it relies upon NATO response plans, operational requirements and military threat analysis of potential opposition as a means of estimating the ammunition requirements.

\(^{26}\) Internal Security Operations.

\(^{27}\) Peace Support Operations.

\(^{28}\) General War (Light Rates).

\(^{29}\) General War (Intensive Rates).

\(^{30}\) With PSO ammunition coming from this stockpile.
d) Training Stocks - 10% of Defence Stockpile

The rate of ammunition usage at training, or on operations, and the condition of the ammunition over a period of time will then determine the restocking requirements of the defence stockpile. National authorities may choose to select a percentage reorder level, at which point new stocks are procured, whilst surplus stocks are then disposed of.

Although the concept of DAER as a means of overall stockpile planning is relatively straightforward, the system relies on an accurate estimation of the DAER for each individual ammunition type. This is not so straightforward as many operational variables have to be considered in order to determine each individual DAER. These include:

a) the potential targets presented by opposition forces (i.e. tanks, aircraft etc);

b) the type of own weapons;

c) the effectiveness of own ammunition (i.e. accuracy, probability of a hit \( P_{\text{hit}} \) and the probability of a kill \( P_{\text{kill}} \));

d) the survivability of own weapons systems, (i.e. what losses of own weapon systems are to be expected over the period of conflict);

e) targeting criteria, (i.e. which own weapons are to be used against which opposition target);

f) the range at which opposition targets need to be engaged; and

g) the function of the individual or weapon system, (i.e. a logistics soldier is unlikely to use as much small arms ammunition as an infantry soldier).

The DAER that are then estimated after consideration of the above will then require further adjustment based on more 'soft' factors which include:

a) false targets, (i.e. how often will a weapon operator fire at a suspected rather than real target?);

b) operator fear, (i.e. will the weapon operator be confident that a target is neutralised when hit, or will he/she fire another round just to make sure?);

c) logistic factors, (i.e. will the ammunition be guaranteed to be in the right place when needed, or does redundancy need to be built into the operational ammunition supply system); and

d) ammunition reliability, (i.e. will the ammunition function as designed every time, or should a more realistic reliability figure, which will reduce as the ammunition ages, such as 95% be used).

These additional 'soft' factors should not be used to unrealistically increase the DAER required for each individual ammunition type.

20 Financial accounting

20.1 Financial accounting systems (LEVEL 3)

The national authority should develop financial accounting systems to identify the true costs of procuring, maintaining and final disposal of the national ammunition stockpile. These life-cycle costs\(^{31}\) will include:

\(^{31}\) To include infrastructure, depreciation of infrastructure, operating and staff costs over the anticipated life of the ammunition.
a) initial procurement costs, (which will include research, development and purchase costs);
b) additional training requirements;
c) stockpile security costs;
d) stockpile storage costs;
e) stockpile maintenance and repair costs; and
f) final disposal costs.

Once the ammunition has reached the end of its useful shelf life it may well be the case that disposal of the ammunition is a cheaper option, in the mid to long-term, than continued storage. The financial accounting system should be sophisticated enough to enable management to make such decisions.

20.2 Stock valuation

Stock should be valued in accordance with International Accounting Standard 2 (IAS2) Inventories. 32

32 IAS2 was developed by IASB, is widely used and is regarded as international best practice.
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:

c) IATG 01.40:2015[E] *Terms, glossary and definitions*. UNODA. 2015;
d) IATG 01.50:2015[E] *UN Explosive hazard classification system and codes*. UNODA. 2015;
f) IATG 01.70:2015[E] *Bans and constraints*. UNODA. 2015;
g) IATG 02.20:2015[E] *Quantity and separation distances*. UNODA. 2015;
h) IATG 03.20:2015[E] *Lotting and batching*. UNODA. 2015;
j) IATG 07.20:2015[E] *Surveillance and proof*. UNODA. 2015; and
k) ISACS 03.30:2011[E] *National controls over the access of civilians to SALW*. CASA. 2011.

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.

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33 Where copyright permits.
Annex B
(informative)

References

The following informative documents contain provisions, which should also be consulted to provide further background information to the contents of this guide:

a) Joint Service Publication 762 Through Life Munitions Management. MOD. UK. 2005;

b) ISACS 05.20;2010[E] Stockpile management: Weapons. CASA. 2010; and

c) STANAG 4315 The Scientific Basis for the Whole Life Assessment of Munitions. NATO.

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-safeguard/. National authorities, employers and other interested bodies and organisations should obtain copies before commencing conventional ammunition stockpile management programmes.

34 Where copyright permits.
Ammunition management policy statements (AMPS)

AMPS are one means of determining and disseminating policy for the safe, effective and efficient management of an ammunition type throughout its service life. AMPS can contribute to ensuring that the ammunition is correctly and most cost efficiently looked after during its service life, including its final disposal.

This annex provides an example of the layout of an AMPS:

C.1. Ammunition configuration

The paragraph on ammunition configuration is to include details of the designation and manufacturer. Similar details are to be given for components such as fuzes and primers, even if they are the subject of separate policy statements.

C.2. General

C.2.1 General description

The ammunition is to be described briefly and approximate weights and dimensions are to be given.

C.2.2 Planned role and deployment

The planned role of the ammunition is to be explained with its deployment.

C.2.3 Associated equipments

Associated equipments are to be briefly described with, where appropriate, their use.

C.2.4 Deployment and use by other nations

Known or anticipated purchases of equipment by other nations, which may use the ammunition of the same design, (rather than similar ammunition of the same calibre), are to be listed.

C.3. Planned life

C.3.1 In-service date

The In-Service Date (ISD) is to be given.

C.3.2 Design shelf life

The designer's estimate of the minimum shelf life (Design Shelf-Life) for the ammunition is to be given.

C.3.3 Assessed shelf life

The Assessed Shelf-Life as stated by the relevant national technical authority or Cardinal Point Specification (CPS) is to be given.
C.3.4 Shelf-life extensions

Shelf-Life Extensions are to be included as amendments when they occur.

C.3.5 Arrangements for turnover at training

Brief details of the policy for guiding ammunition turnover from operational and war reserve to training are to be given.

C.4. Surveillance

The in-service surveillance and proof strategy is to be stated as advised by the relevant national technical authority.

C.4.1 Service quality requirement

The Service Quality Requirement (SQR) is to be expressed as a percentage.

C.4.2 Functional limiting quality

The Functional Limiting Quality (FLQ) is to be expressed as a percentage.

C.4.3 Operational limiting quality

If determined, the Operational Limiting Quality (OLQ) is to be expressed as a percentage.

C.5. Ammunition maintenance and repair policy

C.5.1 Policy

The maintenance policy is to be stated.

C.5.2 Tools, equipment and materials

The tools, equipment and materials required for maintenance and repair are to be listed and an indication given of the planned deployment, sources of supply and equipment management policy. The information, if lengthy, may be included as an Annex to the AMPS.

C.6 Storage

C.6.1 Net explosive quantity

The total Net Explosive Quantity (NEQ) is to be given for each ammunition nature.

C.6.2 Hazard classification code

The Hazard Classification Code (HCC) is to be given for each ammunition nature.

C.6.3 Temperature limitations

The upper and lower ammunition temperature limits for storage and use and the climatic zones for which the ammunition is cleared are to be given.

C.6.4 Stacking limitations

Any stacking limitations are to be given.
C.6.5 Special storage requirements
Any special storage requirements or limitations to the storage of the ammunition in normal or field storage conditions are to be given.

C.7 Transportability

C.7.1 Special requirements and restrictions on movement
Any special requirements for, or restrictions on, the movement of the ammunition by road, rail, sea and air are to be detailed.

C.7.2 Shipping stowage category
The shipping stowage category of the ammunition is to be given with any restrictions.

C.7.3 Air dropping
The suitability of the ammunition for air dropping is to be given.

C.8 Disposal

C.8.1 Individual rounds and bulk
Alternative methods of disposal for both an ammunition item and bulk stock are to be stated and are to be cross-referenced to ammunition destruction technical procedures.

C.8.2 Demilitarization
Proposed methods for the disposal of bulk quantities under controlled conditions (demilitarization) are to be stated.

C.9 Technical publications
All reference publications are to be listed.

C.10 Packaging

C.10.1 Authorized service packs
The Authorized Service Packs are to be listed.

C.10.3 Expendable/reusable packaging
Packages and packing fitments that are reusable are to be identified.

C.10.4 Commercial packaging
Any non-service or commercial packaging is to be briefly described.

C.11 Staff
All staff implications for the logistic support of the ammunition system, including the maintenance of the system in-service, are to be stated. This is to include surveillance and final disposal.
C.12  Training requirements

C.12.1  Courses

Any special requirements for training ammunition technical staff such as special to the system courses are to be stated.

C.12.2  Training materials

Training materials, including inert cross-sectional instructional rounds, extra clothing or equipment needs are to be listed with their source of supply and deployment.

C.13  Safety

Any safety or health hazards associated with the ammunition, other than the obvious explosives hazards, which are apparent from its normal functioning, are to be stated.

C.14  Security classification

The security classification of the ammunition is to be stated and reference is to be given, if appropriate, to the relevant entries in any national list of classified equipment.

C.15  Management responsibilities

Organisations and agencies that have responsibilities for the ammunition system are to be detailed.

C.16  Additional information

This paragraph is to be used, if necessary, for management information that would be inappropriate to be included in any other section. It may include information on such matters as technical problems that resulted in design changes, or problems that affect storage or use of the ammunition.
Annex D  
(informative)  
Ammunition requirement calculation matrices (example)\(^{35}\)

The matrices below contain example calculations to illustrate the use of the matrices for estimating ammunition requirements. Small arms and light weapons have been used in the example, but a full calculation will include all weapon types in services. The data is NOT based on any specific security force and is totally fictional. The data is only partially completed in each matrix for illustrative purposes.

In order to know the national/formation/unit ammunition requirements it is first necessary to know the weapon requirements. Further detail on this is available in Clause 11 of ISACS 05.20:2010\(^{[E]}\) Stockpile management: Weapons. A simplified version of the matrix necessary is at Table D.1 below.

<table>
<thead>
<tr>
<th>Serial</th>
<th>Specific stockpile function</th>
<th>Individual weapons(^{36})</th>
<th></th>
<th>Crew served weapons(^{37})</th>
<th></th>
<th>Weapons for equipments(^{38})</th>
<th></th>
<th>Total weapon requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of personnel</td>
<td>Enhancement factor(^{39})</td>
<td>Sub total ((c) x (d))</td>
<td>Number of crews</td>
<td>Enhancement factor</td>
<td>Sub total ((f) x (g))</td>
<td>Number of equipments</td>
<td>Enhancement factor</td>
</tr>
<tr>
<td>1</td>
<td>Operational weapons</td>
<td>65,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a</td>
<td>9mm Pistol</td>
<td>20,000</td>
<td>1.25</td>
<td>25,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1b</td>
<td>5.56mm Assault Rifle</td>
<td>65,000</td>
<td>1.4</td>
<td>91,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1c</td>
<td>12.7mm HMG</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4,000</td>
<td>1.4</td>
<td>5,600</td>
<td>290</td>
</tr>
<tr>
<td>2</td>
<td>Reservist weapons</td>
<td>140,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>9mm Pistol</td>
<td>20,000</td>
<td>1.25</td>
<td>25,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2b</td>
<td>5.56mm Assault Rifle</td>
<td>140,000</td>
<td>1.4</td>
<td>204,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2c</td>
<td>12.7mm HMG</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,000</td>
<td>1.4</td>
<td>1,400</td>
<td>30</td>
</tr>
</tbody>
</table>

---

\(^{35}\) Derived from ISACS 05.20 Stockpile management: Weapons.

\(^{36}\) For example, Pistols, Assault Rifles or Light Machine Guns (LMG).

\(^{37}\) For example, Heavy Machine Guns (HMG) or Mortars.

\(^{38}\) For example, Armoured Fighting Vehicles (AFV) pintle mounted machine guns.

\(^{39}\) This is a factor that may be used to allow for training weapons and operational reserve weapons. It shall be determined by the State holding the stockpile. Enhancement factors used in this matrix are for illustrative purposes only. If used, then Serials 3 and 4 should not also be used.
<table>
<thead>
<tr>
<th>Serial</th>
<th>Specific stockpile function</th>
<th>Individual weapons</th>
<th>Crew served weapons</th>
<th>Weapons for equipments</th>
<th>Total weapon requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of personnel</td>
<td>Enhancement factor</td>
<td>Sub total</td>
<td>Number of crews</td>
<td>Enhancement factor</td>
</tr>
<tr>
<td>(a)</td>
<td>(b)</td>
<td>(c)</td>
<td>(d)</td>
<td>(e)</td>
<td>(f)</td>
</tr>
<tr>
<td>3</td>
<td>Operational and war reserve weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Training weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>Experimental weapons</td>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Production weapons</td>
<td>1,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>Weapons awaiting disposal</td>
<td>2,500</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>Totals</td>
<td>205,000</td>
<td>346,525</td>
<td>5,000</td>
<td>7,620</td>
</tr>
</tbody>
</table>

Table D.1: Estimation of national weapons stockpile requirement

Information developed in Matrix 1 (Table D.1) is then transferred to Matrix 2 (Table D.2), which then estimates total requirements for each weapon type and any possible surplus stocks. Please note that the data for Serials 4 to 7 would also require breakdown by weapon type as well as specific function.

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40 Usually calculated as a percentage of operational and reservist weapons by the use of the enhancement factor.
41 Number of training equipments should be entered in cells 3(i) and 4(i).
42 This can be done automatically using the appropriate spreadsheet software.
<table>
<thead>
<tr>
<th>Serial</th>
<th>Weapon type</th>
<th>Specific stockpile function</th>
<th>Individual weapon requirement</th>
<th>Crew served weapon requirement</th>
<th>Weapons for equipments</th>
<th>Sub total (d) + (e) + (f)</th>
<th>Total weapon requirement sum (g) column for each weapon</th>
<th>Current stockpile(^\text{(i)})</th>
<th>Possible surplus (i) – (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>9mm Pistol</td>
<td>Operational weapons</td>
<td>25,000</td>
<td>0</td>
<td>0</td>
<td>25,000</td>
<td>50,000</td>
<td>53,221</td>
<td>3,221</td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>Reservist weapons</td>
<td>25,000</td>
<td>0</td>
<td>0</td>
<td>25,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1c</td>
<td></td>
<td>Operational and war reserve weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1d</td>
<td></td>
<td>Training weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1e</td>
<td></td>
<td>Experimental weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1f</td>
<td></td>
<td>Production weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1g</td>
<td></td>
<td>Weapons awaiting disposal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>5.56mm Assault Rifle</td>
<td>Operational weapons</td>
<td>91,000</td>
<td>0</td>
<td>0</td>
<td>91,000</td>
<td>295,000</td>
<td>265,000</td>
<td>-30,000(^\text{44})</td>
</tr>
<tr>
<td>2b</td>
<td></td>
<td>Reservist weapons</td>
<td>204,000</td>
<td>0</td>
<td>0</td>
<td>204,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2c</td>
<td></td>
<td>Operational and war reserve weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2d</td>
<td></td>
<td>Training weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2e</td>
<td></td>
<td>Experimental weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2f</td>
<td></td>
<td>Production weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2g</td>
<td></td>
<td>Weapons awaiting disposal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a</td>
<td>12.7mm HMG(^\text{45})</td>
<td>Operational weapons</td>
<td>0</td>
<td>5,600</td>
<td>435</td>
<td>6,035</td>
<td>12,525</td>
<td>44,000</td>
<td>31,475</td>
</tr>
<tr>
<td>3b</td>
<td></td>
<td>Reservist weapons</td>
<td>0</td>
<td>1,400</td>
<td>45</td>
<td>1,445</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3c</td>
<td></td>
<td>Operational and war reserve weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3d</td>
<td></td>
<td>Training weapons</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3e</td>
<td></td>
<td>Experimental weapons</td>
<td>25</td>
<td>20</td>
<td>100</td>
<td>145</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3f</td>
<td></td>
<td>Production weapons</td>
<td>1,000</td>
<td>100</td>
<td>500</td>
<td>1,600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3g</td>
<td></td>
<td>Weapons awaiting disposal</td>
<td>2,500</td>
<td>500</td>
<td>300</td>
<td>3,300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td></td>
<td></td>
<td>348,525</td>
<td>7,620</td>
<td>1,380</td>
<td>357,525</td>
<td>357,525</td>
<td>332,221</td>
<td>4,696</td>
</tr>
</tbody>
</table>

Table D.2: Estimation of total stockpile requirement by weapon type and possible weapon surpluses

The DAER can then be estimated as follows in Table D.3

\(^{43}\) Example only again.

\(^{44}\) This would indicate that procurement action may be necessary.

\(^{45}\) It has been assumed that the totals for Experimental, Production and Awaiting Disposal weapons in Matrix 1 are all 12.7mm HMG. This is obviously very unlikely to be the case.
<table>
<thead>
<tr>
<th>Ammunition</th>
<th>DAER</th>
<th>FORCE EQPT LEVEL</th>
<th>DAYS</th>
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Table D.3: Example DAER calculation

46 Internal Security Operations.
47 Peace Support Operations.
48 General War (Light Rates).
49 General War (Intensive Rates).
**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/](http://www.un.org/disarmament/un-saferguard/).

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