Foreword

AMENDMENT RECORD

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<tr>
<td>1</td>
<td>24.11.06</td>
<td>Clause 10.2 and introduction of Annex C</td>
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REVISION NOTE

This Part (2) of the Def Stan is Re-printed at Amdt 1 to update its content.

HISTORICAL RECORD

This standard supersedes the following:


Defence Standard 13-92 Issue 3 dated 23 February 1996, Manufacture, Inspection and Proof of Ordnance of 20mm Calibre and Over, Section 4, Proof of Ordnance. (Section 4 only)

Ordnance Board Pillar Proceeding P128 (3), MOD Proof Policy for Ordnance, Munitions and Armour

a) This standard provides guidance for the proof of ordnance, munitions, armour and explosives.

b) This standard has been produced on behalf of the Defence Material Standardization Committee (DMSC) by the Proof Policy and Standards Committee (PPSC). Under the auspices of Defence Ordnance Safety Group (DOSG), the PPSC is composed of representatives of the Ministry of Defence (MOD), QinetiQ and Industry and under its terms of reference acts as the UK focal point for the coordination and review of proof policy. The technical content of this standard is ratified by the PPSC before publication.

c) This standard has been agreed by the authorities concerned with its use and is intended to be used whenever relevant in all future designs, contracts, orders etc. and whenever practicable by amendment to those already in existence. If any difficulty arises which prevents application of the Defence Standard, the UK Defence Standardization (DStan) shall be informed so that a remedy may be sought.

d) Any enquiries regarding this standard in relation to an invitation to tender or a contract in which it is incorporated are to be addressed to the responsible technical or supervising authority named in the invitation to tender or contract.
e) Compliance with this Defence Standard shall not in itself relieve any person from any legal obligations imposed upon them.

f) This standard has been devised solely for the use of the Ministry of Defence (MOD) and its contractors in the execution of contracts for the MOD. To the extent permitted by law, the MOD hereby excludes all liability whatsoever and howsoever arising (including, but without limitation, liability resulting from negligence) for any loss or damage however caused when the standard is used for any other purpose.
Introduction

This Part of the Defence Standard provides guidance relating to the proof policy and requirements contained in Def Stan 05-101 Part 1 for the proof of ordnance, munitions, armour and explosives that were previously contained in a number of Standards. The Standard addresses proof of ordnance over 51 mm (including mortars), cannon, small arms, munitions, guided weapons, rockets, mines, demolition stores, pyrotechnics, explosives, armour and armour containing explosives.

Def Stan 05-101 is in three Parts as listed below. All Parts should be considered and used where applicable.

— Part 2 - Proof of Ordnance, Munitions, Armour and Explosives, Guidance.
Proof Ordnance, Munitions, Armour and Explosives

Part 2 - Guidance

1 Scope

This standard provides, in clause 6, guidance relating to the generic proof policy and requirements applicable to all weapons, munitions and other explosive related components. Subsequent clauses specify additional requirements specific to the proof of:

a) Ordnance of calibres greater than 51mm.

b) Small arms and cannon.

c) Munitions (less guided weapons and rockets).

d) Guided weapons and rockets.

e) Armour and armours containing explosives.

f) Mines, demolitions, explosives and pyrotechnics.

2 Warning

The Ministry of Defence (MOD), like its contractors, is subject to both United Kingdom and European laws regarding Health and Safety at Work, without exemption. All Defence Standards either directly or indirectly invoke the use of processes and procedures that could be injurious to health if adequate precautions are not taken. Defence Standards or their use in no way absolves users from complying with statutory and legal requirements relating to Health and Safety at Work.

3 Normative References

The publications shown below are referred to in the text of this standard. Publications are grouped and listed in alpha-numeric order.

AAP 6, NATO Glossary of Terms

AC/225 (LG/3-SG/1)D9, Manual of Proof and Inspection Procedures for NATO 7.62mm Ammunition (MOPI)

AOP 38, Glossary of Terms and Definitions Concerning the Safety and Suitability for Service of Munitions, Explosives and Related Products

APIOOC-12, RAF Explosive Engineering Inspection, Proof and Surveillance of Explosives and Associated Non-Explosive Components

Army Form BS 562-2, Daily Record of Rounds Fired

BR 1203, Instructions for the Quality of Naval Armament Stores, Inspection of Stores on Naval Department Charge

BS 3811, Glossary of Terms Used in Terotechnology
DEF STAN 05-101 Part 2 Issue 1

BS 4778-2 Quality vocabulary — Part 2: Quality concepts and related definitions

BS 4778-3 Quality vocabulary — Part 3: Availability, reliability and maintainability terms — Section 3.1 Guide to concepts and related definitions

BS 6001 Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection

BS 6002-1 Sampling procedures for inspection by variables — Part 1: Specification for single sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection

BS EN ISO 9000 Quality management systems — Fundamentals and vocabulary

BS EN ISO 9001 Quality management systems — Requirements

CINO Form 338, Memorandum for Inspection, for Barrels

CINO Form 365, Memorandum for Inspection, for Guns

D4, NATO Manual

DCI Gen 197/97, Product Conformity Certification Policy

Def Stan 05-61 Part 1, Quality Assurance Procedural Requirements, Concessions

Def Stan 07-85, Design Requirements for Weapons and Associated Systems

Def Stan 13-36 Part 8, Ballistic Standardisation of Gun Ammunition, Crushers and Crusher Gauges

Def Stan 13-92, Manufacture, Inspection and Proof of Ordnance of 20mm Calibre and Over

Def Stan 93-111, Fibre Reinforced Polymer Composite for Ballistic Protection Purposes

Def Stan 95-18, Armour Plate, Aluminium Alloy (AA 5083).

Def Stan 95-19, Armour, Homogeneous Aluminium Alloy, Heat Treatable, Extrusions and Forgings (6mm Thick and Over)

Def Stan 95-22, Aluminium Alloy Armour Plate (Heat Treatable 6-120 mm)

Def Stan 95-23, Ferrous Armour Quality Extrusions & Forgings

Def Stan 95-24, Armour Plate, Steel (3-160 mm)

Def Stan 95-25, Armour Quality Steel Castings

Def Stan 95-26, Specialized Armour Quality Steel Castings

Def Stan 96-03, Laminated Bullet Proof Glass Vision Blocks


DPEE SOP No 59/2, Mk 8 and Mk 9 Copper Crusher Gauges

ITOP 4-2-606, Establishment of Master and Reference Calibration Rounds

ITOP 4-2-700, Propelling Charges
Joint Warfare Publication 0-01.1 United Kingdom Glossary of Joint and Multinational Terms and Definitions

MVEE Spec 577, Proof of Cradle and Recoil Systems

MOD Form 77, Application of MOD Quality Assurance Authority for a Major Concession/Production Permit

OB Pillar Proceeding P104, Procurement of Munitions Involving a Change in Manufacture


STANAG 2310, Small Arms Ammunition (7.62 mm)

STANAG 2920, Ballistic Test Method for Personal Armour Materials and Combat Clothing

STANAG 4090, Small Arms Ammunition (9mm Parabellum)

STANAG 4110, Definition of Pressure Terms and their Inter-Relationship for Use in the Design and Proof of Cannons and Ammunition

STANAG 4113, Pressure Measurements by Crusher Gauges

STANAG 4157, Fuzing Systems: Test Requirements for Assessment of Safety and Suitability for Service

STANAG 4172, 5.56mm Ammunition (Linked or Otherwise)

STANAG 4187, Fuzing Systems – Safety Design Requirements

STANAG 4368, Electric and Laser Ignition Systems for Rockets and Guided Missile Motors – Safety Design Requirements

STANAG 4383, 12.7mm (.50) Ammunition Packed as Linked Belts

STANAG 4403, NATO 40mm High Velocity Linked and Packed Grenade Ammunition (Note: Ratified by not promulgated)

STANAG 4516, Cannon (>12.7mm) Design Safety Requirements and Safety for Suitability for Service Evaluation of the Weapon/Munition Combination

STANAG 4519, Gas Generators Design Safety Principles and Safety and Suitability for Service Evaluation

tl 1025-005, Not Found. (Origin Def Stan 13-92. Relates to FH 70)

UK/SC/5449, Ballistic Test Method for Personal Armours and Lightweight Materials

4 Definitions

Wherever practicable, the definitions used in this Standard are contained in the following sources, listed in order of precedence:
DEF STAN 05-101 Part 2 Issue 1

— NATO AOP 38 NATO Glossary of Terms and Definitions Concerning the Safety and Suitability for Service of Munitions, Explosives and Related Products.

— NATO AAP-6 The NATO Glossary of Terms and Definitions.

— Joint Warfare Publication 0-01.1 United Kingdom Glossary of Joint and Munitional Terms and Definitions.

Where a term is used in this standard and its intended meaning is in conflict with or has a more specific application than that given in the documents listed above, the definition given below shall apply.

1 **action**
such parts of a small arm as are intended to prevent the escape from its breech of gases generated by firing a load.

2 **barrel**
includes the barrel and breech of every category of small arm which would, in the use of the small arm, contain all or any part of the charge of the small arm, in, from, or through which all or any part of the charge thereof would be exploded or discharged.

3 **control firing**
a term used in the guided weapons and certain other fields particularly where only small samples can be taken.

4 **design authority**
the organization that holds the design rights, maintains the Technical Data Pack and in some cases holds the Intellectual Property Rights (IPR).

5 **design sponsor (DS)**
the MOD Authority named in Box 2 to the Appendix to the Contract. Before the item subject to proof is declared “Fully Mature” the DS will be the MOD IPTL. Once the item is declared “Fully Mature” the DS will be the MOD Equipment Support Manager.

6 **examination**
a comprehensive scrutiny supplemented by measurement and physical testing in order to determine the condition of any item (BS 3811).

7 **explosive**
includes high explosive, propellant, pyrotechnic, intermediary and initiating compositions.

8 **explosive product**
a separate, distinct component, sub-assembly, assembly or whole round of ammunition containing explosive(s).

9 **inspection**
activities such as measuring, examining, testing, gauging one or more characteristics of a product or service and comparing these with specified requirements to determine conformity (BS 4778).
10 Integrated Project Team Leader/Integrated Project Team (IPTL/IPT)
the person or branch in the Defence Procurement Agency (DPA) or Defence Logistics Organisation (DLO) directly responsible for the control of a project or an authorized representative.

11 MOD authority
the Customer’s Authority, or other appropriate authority designated in the contract, that is responsible for all MOD and Quality Assurance matters of the contract. These will normally be:

— The IPTL in the DPA for acceptance of ordnance for production and its introduction into all three Services.

— The IPTL in the DLO for mature systems.

— The DA for experimental equipment, ie ordnance used for development.

12 proof pressure (PP)
the chamber pressure at which an ordnance or small arm is proofed.

13 proof schedule
a document that prescribes the proof requirements for a specific ordnance or ordnance component. It will be based on the criteria as specified in this Standard

14 small arms
explosive operated systems of every description, whether of present use or future invention, adapted for the discharge of shot, bullet or other projectile. Such arms include shotguns, machine guns, rifles, pistols, revolvers, cattle killers, line throwers, signal pistols, alarm guns and nail-driving or other industrial tools, with a barrel bore diameter up to and including 2 inches (<51 mm).

15 top service charge
'S' signifies the top service charge conditioned to $21^\circ C \pm 2^\circ C$ that is used for the proof of ordnance.

5 Abbreviations

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<tr>
<th>Abbreviation</th>
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<tr>
<td>ACEM</td>
<td>Armour Containing Explosive Material</td>
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<td>AFV</td>
<td>Armoured Fighting Vehicle</td>
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<tr>
<td>AP</td>
<td>Armour Piercing</td>
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<tr>
<td>APDS</td>
<td>Armour Piercing Discarding Sabot</td>
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<tr>
<td>APFSDS</td>
<td>Armour Piercing Fin Stabilised Discarding Sabot</td>
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<td>APSE</td>
<td>Armour Piercing Secondary Effect</td>
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<td>ARW</td>
<td>Anti Riot Weapon</td>
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<td>ATW</td>
<td>Area Target Weapon</td>
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<td>BFA</td>
<td>Blank firing attachments</td>
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<td>B/LA</td>
<td>Batch/Lot Acceptance</td>
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<td>Cannon DP</td>
<td>Cannon Design Pressure</td>
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<td>Cannon Max PP</td>
<td>Cannon Maximum Proof Pressure</td>
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<td>Cannon PP</td>
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CM    Configuration Management
CRS   Configuration Status Record
CRT   Complete Round Testing
CSW   Crew Served Weapon
DGM   Defence General Munitions (DGM)
DMSC  Defence Materiel Standardisation Committee
DA    Design Authority
DOSG  Defence Ordnance Safety Group
DP    Design Pressure
DPA   Defence Procurement Agency
DS    Design Sponsor
DStan UK Defence Standardization
EFC   Effective Full Charge
ECM   Electronic Counter Measures
FMECA Failure Mode Effects and Criticality Analysis
EOD   Explosive Ordnance Device
FSP   Fragment Simulating Projectiles
FTA   Fault Tree Analysis
GW    Guided Weapon
HE    High Explosive
HEAT  High Explosive Anti-Tank
HESH  High Explosive Squash Head
HMG   Heavy Machine Gun
HVG   High Velocity Grenade
ICW   Infantry Combat Weapon
IM    Insensitive Munitions
IPT   Integrated Project Team (IPT)
IPTL  Integrated Project Team Leader
ISS   In-Service Surveillance
ITOP  International Test Operating Procedure
LAT   Lot Acceptance Testing
LAW   Light Anti Tank Weapon
LMG   Light Machine Gun
LSW   Light Support Weapon
Max PP Maximum Proof Pressure
Min PP Minimum Proof Pressure
MLRS  Multiple Launched Rocket System
MMG   Medium Machine Gun
MTS   Mission Termination System
MORAT Mortar Anti-Tank
6 General Proof Policy

6.1 In this Standard, proof encompasses the following tests performed with explosive present, whether or not that explosive is fired, as specified by Def Stan 05-101 Part 1:

a) On ordnance to establish that any components considered to be vulnerable to the effects of a rapid change of pressure, such as barrels, breech blocks, breech rings, obturators, bolts vent axial etc. will safely withstand firing at specified pressures.

b) As an overpressure test on small arms, applied by the firing of a proof load generating a higher pressure than the maximum likely to be generated by the Service load in the specified extreme Service conditions.

c) On samples of experimental explosive items to estimate their performance and gather information to enable either the setting of acceptance parameters for production proof or as part of the assessment of Service Life.

d) On samples of specially filled components to establish that they will resist the effects of firing so as to ascertain whether the remainder of the lot or batch is fit to fill with explosive.
e) On samples of filled explosive items and components to compare their performance with previously established criteria in order to accept lots or batches of them either into Service or for the next stage of production or to estimate their remaining Service life.

f) On filled explosive products to ascertain that they remain safe and do not fire under specified circumstances.

6.2 A test involving the presence of explosive previously accepted at ‘proof’, which plays no part in the test, or which is used merely to function part of the item under test (e.g. gas generator charge used to run up a gyroscope), is not regarded as a ‘proof’ test unless the success or failure of any explosive item fired is to be used for acceptance or rejection purposes.

6.3 Proof is the last check of product safety and fitness for purpose prior to issue to the Services. In many areas, it also makes a significant contribution to product cost. It is, therefore, important that before proof is specified the possibilities of simulation or hydraulic or non-destructive testing as alternatives to proof are explored fully, providing this alternative is acceptable to the IPTL and DOSG.

7 Proof Equipment

7.1 General

7.1.1 To ensure that no doubt exists regarding the standards set for acceptance and rejection at proof, it is necessary for specifications and proof schedules to define clearly the proof tests required, the number of items to be proof tested and the acceptance/rejection criteria that are to apply.

7.1.2 Proof may involve using an arrangement of facilities and equipment including:

a) permanent proof yard/range installations, e.g. shooting houses, rocket motor runways, environmental conditioning equipment.

b) targets.

c) service weapons.

d) general instrumentation, e.g. timers, safety ohmmeters.

e) purpose designed equipment, e.g. heavy barrels, weapon mounts, firing boxes for electrically initiated items, equipment to test safe sealing and correct detonation and closed vessel propellant testing equipment.

7.1.3 It is important for MOD to be able to compare proof results obtained in the R&D phase firstly with those obtained in production, (regardless of the Contractor) and later with those obtained in-service. The design of purpose designed proof equipment may influence results obtained. It may therefore be necessary for the MOD to accept formally the design of purpose designed proof equipment and invoke its use in the specification or schedule.

7.1.4 This clause of the Standard gives guidance relating to the procedures by which MOD accepts designs of proof equipment and related instructions for its use when the use of that equipment is considered likely to affect the results obtained during the proof of weapons, ammunition and explosive items.

7.1.5 This clause of the Standard does not apply to equipment used for the proof of small arms in accordance with the Gun Barrel Proof Acts. (Clause 10.2).
7.2 Contracts – Proof Equipment Defined

The extent of the information supplied in the data pack for purpose designed proof equipment will depend on the Design Sponsor’s (DS) knowledge of the prospective contractor’s proof facilities and capabilities. Prospective contractors may also request additional relevant information from the DS. The DS may:

a) supply a General Assembly Drawing and Item List for any necessary purpose designed proof equipment to give the prospective contractor an appreciation of what is required.

b) supply a full manufacturing data pack to enable procurement by the contractor of any necessary purpose designed proof equipment.

c) inform the contractor of any organization holding such equipment who may be in a position to conduct proof on a sub-contract basis, or

d) exceptionally, assist with the supply of equipment.

7.3 Contracts – Proof Equipment Not Defined

Where the need for proof is foreseen, or becomes necessary, but no method or equipment has been defined or accepted, the Contractor may be asked to submit proposals to the DS detailing how it is intended to fulfill the proof requirement in accordance with the requirements of Def Stan 05-101 Part 1.

8 Proof Schedules

8.1 Proof schedules are drawn up and agreed prior to acceptance. They are based on functioning samples of the stores at manufacture; similar schedules are applied for in-service surveillance proof. Rather than applying a “standard” schedule, the Proof Schedule should be tailored to each munition, with particular regard to its intended use in service. This should include consideration of the following:

a) The expected service environment needs to be considered in order to determine whether any particular environmental aspects need to be taken into account and applied to the Proof Schedule.

b) For In-Service Proof the level of usage needs to be considered and thus the likelihood of collecting data by a means other than conducting proof. Where there is evidence that such data will be recorded and that it will be readily available in service, then consideration should be given to reducing the extent or frequency of proof.

c) Careful consideration must be given to all aspects of performance. Thus for example, in the case of pyrotechnic flares, range, direction, point of burst, light intensity, colour and the duration of the flare all need to be taken into account, with clear pass/fail criteria. Merely recording successful launch and flare burst is not sufficient.

d) Full account should be taken of any in-service failures or defects.

8.2 Consideration needs to be given to the means of measuring the required aspects of an equipment or a munition’s performance. This should include provision of appropriate instrumentation and facilities.

8.3 As part of the Through Life Management Plan (TLMP), a formalised system should be established by the IPT for reviewing Proof Schedules as part of the process for the Whole Life Assessment of munitions.

8.4 The Design Authority (DA) is fully responsible for the correctness of his documentation. Thus, when the DA offers a Proof Schedule to the IPTL for verification it should be correct in all aspects. The IPTL may wish to verify the accuracy of the documentation by seeking advice from his QA staff, DOSG, DGM IPT etc, as required, prior to the issuing of an approval number.
Ordnance, including Mortars, of calibre greater than 51 mm

9.1 General

It is an assumption that prototypes of ordnance and ordnance components presented for proof will have been subjected to rigorous and well documented strength of design trials and tests. These trials and tests are designed to demonstrate that the strength of design of the ordnance system is sufficient to sustain all firing loads likely to be experienced in service environments.

9.2 Proof

9.2.1 Prior to identifying proof requirements, a hazard analysis should consider all ordnance system assemblies and sub assemblies that are subject to firing loads. These are likely to include:

a) Barrels, including muzzle brakes and fume extractors.

b) Breech assemblies including obturators.

c) Mountings.

d) Platform installations.

9.2.2 The extent to which proof is needed will depend on the belief, developed through design assessment, strength of design trials and production quality that the weapon can withstand all firing loads generated by its use under the service conditions for which it is intended. Where such belief is high, based on the assessment of a robust design underwritten by thorough, well documented strength of design trials and tests, production techniques (eg, full bore length autofrettage) and rigorous production quality procedures, the requirement for the number of proof firings to be based upon statistical methods may be relaxed. Where the opposite is the case, the Ordnance Safety Adviser is likely to recommend a more rigorous proof schedule that may include the proof by firing of each ordnance.

9.3 Proof Pressure Terms and Measurement

9.3.1 Pressure terms are defined in STANAG 4110. The STANAG specifies a tolerance band of the proof pressure such that the Maximum Proof Pressure (Max PP) coincides with the ordnance Design Pressure (DP) and the Minimum Proof Pressure (Min PP) should be ideally 1.75 standard deviations (sd) in pressure less than Cannon DP, ie Cannon Permissible Maximum Pressure (Cannon PMP).

9.3.2 For calibres below 40 mm, and for ordnance using fixed rounds, crusher gauges may not be appropriate. A dedicated Proof Round, which will produce a pressure within the tolerance band specified in clause 9.3.1, may be used.

9.4 Rounds to be fired

The number of rounds to be fired at proof of ordnance and parts of ordnance are given at Def Stan 05-101 Part 1 Annex C. For chain guns, revolver, multi-barrel and blow back cannons, the subsequent firing of service rounds to prove cyclic function and confirm ballistics is acceptable. The precise number of service rounds to be fired should be determined by the DA in consultation with the IPTL.

9.5 Variations and Exceptions

9.5.1 If difficulty is experienced in maintaining the pressure of proof rounds, within the requirements of clause 13.3.1, the IPTL may, after consultation with DOSG, agree with the contractor alternative methods of achieving the proof requirements.

9.5.2 When a combined proof of gun and carriage is carried out invoking MVEE 577, the first ‘S’ charge specified in Def Stan 05-101 Part 1 Annex C may be replaced by a lower service charge.
9.6 Submission for Reproof

9.6.1 Should the measurements taken before and after proof indicate an expansion of the chamber or bore outside drawing/specification tolerance, the ordnance may be rejected. In these cases the contractor may arrange the firing of further rounds at his expense, to determine whether expansion has ceased or not. If, after firing of such rounds, it is found that no additional expansion has taken place, and that the chamber and bore dimensions are still within the after-proof limits shown on the drawing, the ordnance may be accepted by the IPTL.

9.6.2 In the case of steel obturators, should a component fail at proof, the undamaged components may be re-mated and the new steel obturator so formed sent for proof. Components which are chromium plated may be re-chromium plated. Only one de-plate and re-plate is permitted.

9.6.3 When any ordnance and/or component has failed at proof due to faulty material or workmanship, it shall be liable for rejection. Provided that the failed ordnance and/or component is rectified to an agreed procedure and with the permission of the IPTL/DA, the ordnance and/or component may be submitted for reproof at the contractor's expense.

10 Small Arms and Cannon

10.1 Small Arms

The following weapons are categorised as small arms (SA):

a) Personal Defence Weapons - Personal Defence Weapons (PDW) include those weapons which are primarily designed for personal defence such as revolvers, pistols and sub machine guns (SMG).

b) Individual Combat Weapons - Individual Combat Weapons (ICW) include rifles of all types (including sniper and anti materiel), shotguns, light machine guns (LMG) including light support weapons (LSW) and squad automatic weapons (SAW).

c) Crew Served Weapons - Crew Served Weapons (CSW) include medium machine guns (MMG), heavy machine guns (HMG) and vehicle mounted machine guns (VMMG).

d) Area Target Weapons - Area Target Weapons (ATW) include HE grenade launchers both individual and crew-served.

e) Anti Riot Weapons - Anti Riot Weapons (ARW) include baton guns, stun guns and grenade launchers (gas and special effect).

f) Special Weapons - The special weapons category includes hand held weapons primarily designed for use by Special Forces, which because of their unusual nature or usage, require specific consideration.

g) Miscellaneous - The miscellaneous category includes sub-calibre systems, spotting rifles, signal pistols, line throwers, explosively-operated tools (bolt guns) or devices (such as nail guns) to which the design safety principles of SA would be applicable. In addition, the following categories of weapon and attachment present hazards similar to those related to SA and shall be subject to proof under this section:

i) Scatterable mine systems that are usually vehicle borne, from which mines are ejected from a tube by the firing of a small charge.

ii) Blank firing attachments (BFA) for SA that must be designed so that when fitted to the weapon they remains safe in the inadvertent event of a live round or, if applicable, a live burst being fired.
10.2 Proof Policy

10.2.1 The Gun Barrel Proof Act of 1868 prescribes a statutory requirement for all firearms up to 51 mm (2 in) calibre to be proofed. The UK has now also joined the Commission Internationale Permanente (CIP) for the Proof of Small Arms. The MOD is exempt from the CIP agreement, but has to show that it is as good as, or better than, this procedure for all UK military Small Arms (SA). In general the CIP proofing involves firing two dry rounds at 25% over pressure, but the MOD policy is to fire two rounds as defined in clause 8.2.2 in Def Stan 05-101 Part 1.

10.2.2 Proof testing needs to be carried out on every weapon or no proof mark will be applied. A sample of weapons being tested is not acceptable, each individual weapon, including spares and barrel attachments, (e.g. Suppressors) shall be proof tested.

10.3 Strength of Design Testing

10.3.1 The proof policy contained in this Def Stan 05-101 Part 1 is based on the assumption that prototypes of SA and cannon presented for proof will have been subjected to rigorous and well documented strength of design trials and tests following the guidance given in OB Pillar Proceeding P116(2), NATO Manual D/14 and STANAG 4516. These trials and tests are to demonstrate that the strength of design of the SA system is sufficient to sustain all firing loads and should have included the following:

a) A statistically significant number of rounds from a statistically significant number of weapons fired at pressures equivalent to or in excess of design pressure.

b) Firings at the maximum achievable rates of fire at both the upper and lower firing temperatures.

10.3.2 These trials and tests should be carried out to the satisfaction of the IPTL and DOSG.

10.3.3 Any weapons have been subjected to pressures in excess of their design pressure in the course of strength of design trials, should not to be taken into service use.

10.4 Proof Schedule

The proof schedule should form part of the weapon system acceptance test schedules and should include provision for the proofing of spares.

11 Munitions (less Guided Weapons and Rockets)

11.1 General

11.1.1 Proof of munitions is carried out as a series of tests specified in the proof schedule accepted by the IPTL that is normally developed by the DA as part of the munition’s development programme and evolves into Production Proof Schedules that are used in Batch/Lot Acceptance (B/LA) and In Service Surveillance Plans.

11.1.2 This clause gives guidance relating to proof policy for a range of munitions including base bleed shells. It does not address proof of GW, torpedoes, rockets and rocket propelled munitions for which reference should be made to clause 12 (Guided Weapons & Rockets). Guidance on proof after a munition has entered service is addressed in clause 15 (In-Service Surveillance).

11.1.3 Compliance with contractual reliability, safety and performance requirements of munitions are required to be demonstrated by the DA to the IPTL. Where the evidence gathered in the development and qualification trials is not sufficient, a proof firing may be specified. Where sub-component proof is required due to a split between different DAs, it is the responsibility of the Prime DA to ensure that it is carried out.
11.2 Munition Testing

11.2.1 Batch/Lot Acceptance (B/LA)

B/LA is intended to provide confidence that the product delivered conforms to the specification. Procurement Specifications/Proof Schedules for B/LA are normally developed by the DA in accordance with the current guidelines and agreed by the IPT. The single sampling schemes specified in BS 6001 (for sampling by attributes) and BS 6002 (for sampling by variables) are appropriate for long production runs and may be used in most situations. Where these are not suitable, the DA should refer to Def Stan 05-101 Part 3 for guidance on the choice of a suitable sampling scheme or plan. Where off-the-shelf munitions are procured, the B/LA procedures used should be identified.

11.2.2 Complete Round Testing (CTR)

CRT (sometimes referred to as All-Up-Round Testing) is necessary to proof the complete operation of the munition, including, where appropriate, the munition's launcher, launch canister or tube. Where a warhead event may not be appropriate for CRT, evidence of explosive train operation will still be required. Component level testing, along with modelling, can be used to augment the information supplied by CRT. The following pragmatic approaches to reduce cost and improve effectiveness of testing may be considered as part of a CRT programme:

a) Incorporation of B/LA testing of complete munitions into normal service firings.

b) Non destructive testing at sub-assembly level and of complete munitions.

c) B/LA testing at sub-assembly level.

11.2.3 Component Testing

Component testing and modelling rarely provide universal confidence in the safety and performance of complete munitions. Complete round testing will remain the preferred method of proving that the deliverable design meets the munition requirements. Where cost is the prime reason for excluding complete round testing, the risks involved in relying upon sub-munition testing must be quantified. Proposed proof schedules with justification should be provided to the Proof Policy & Standards Committee for dispensation. Component testing is also resorted to when it is necessary to measure a munition characteristic which cannot easily be measured at CRT, e.g. the light output of the 51 mm Illuminating flare is tested statically in addition to the CRT.

11.3 Small Arms Ammunition

11.3.1 The minimum proof and performance requirements for SA ammunition of NATO calibres are covered in STANAGs as follows:

a) 5.56 mm. STANAG 4172 and NATO Manual of Proof and Inspection AC/225 (LG/3-SG/1) D/8.

b) 7.62 mm. STANAG 2310 and NATO Manual of Proof and Inspection AC/225 (LG/3-SG/1) D/9.

c) 9 mm. STANAG 4090 and NATO Manual of Proof and Inspection AC/225 (P111-SP1) D/170(REV).

d) 12.7 mm. STANAG 4383 and NATO Manual of Proof and Inspection AC/225 (LG/3-SG/1) D/11.

11.3.2 Although the above documents contain the lowest common denominator of performance and proof requirements agreed as acceptable within NATO, they are not suitable for issue to ammunition producers as contractual Production Testing and Proof Schedule documents. Such contractual documents are normally produced by the Defence General Munitions (DGM) IPTL and are already in existence for 5.56mm, 7.62mm and 9mm ammunition. Where SA ammunition of other calibres is procured for MOD use, a Proof Schedule is required to be provided for production (Def Stan 05-101 Part 1).
DEF STAN 05-101 Part 2 Issue 1

11.4 Cannon Ammunition

Cannon ammunition includes armour piercing (AP), high explosive (HE), armour piercing secondary effects (APSE), incendiary and practice ammunition. Where a cannon shell includes HE it will usually have a fuze. Land and Naval Service cannon shell usually contain a tracer. The performance of every explosive component should be assessed at proof.

11.5 Grenades

11.5.1 Grenades may be hand projected, bullet trap projected or fired from a grenade launcher.

11.5.2 The proof requirement for the 40 mm High Velocity Grenade (HVG) is covered by STANAG 4403 and the NATO Manual of Proof and Inspection AC/225 (LG/3-SG/1) D/17. The criteria for the 40 mm HVG should be based on the NATO documents referenced above which contain the lowest common denominator of performance and proof requirements agreed as acceptable within NATO.

11.5.3 Smoke grenades are addressed in clause 12 - Mines, Demolitions, Explosives and Pyrotechnics Proof Policy.

11.6 Mortar Ammunition

11.6.1 Mortar ammunition includes HE, smoke, illuminating, practice and mortar anti-tank (MORAT). For the latter, which can be either active or passive homing dependent upon design, refer to clause 11. The mortar payload will vary in type and function according to the weapon requirement.

11.6.2 For propelling charge aspects refer to sub clause 11.11 below.

11.7 Bombs

11.7.1 Bombs are air dropped and contain an explosive charge and a fuze system.

11.7.2 Bombs may be free fall or precision guided, and they may also dispense sub-munitions.

11.7.3 For precision guided bombs refer to clause 12 - Guided Weapons and Rockets Proof Policy.

11.8 Depth Charges

Depth charges may be air dropped or launched from a ship and contain an explosive charge and a fuze system.

11.9 Large Calibre Ammunition

11.9.1 Large calibre ammunition includes armour piercing fin stabilised discarding sabot (APFSDS), armour piercing discarding sabot (APDS), high explosive anti-tank (HEAT), high explosive squash head (HESH), HE, smoke, training, carrier shell and proof shot.

11.9.2 For propelling charge aspects refer to sub clause 11.11 below.

11.10 Sub-munitions

11.10.1 Sub-munitions are dispensed from a bomb or a carrier shell and include anti-light armour, anti-personnel, smoke, illuminating, mines and ECM.

11.10.2 For precision guided sub-munitions refer to clause 12 - Guided Weapons and Rockets Proof Policy.
11.11 Propellant

The policy, method and requirement for propellant proof are contained in the Manual on Proof of Propellants for Guns, Mortars and Cannon (DOSG/006/030/006 dated 01 March 2005). Other relevant references relating to propellant proof include STANAG 4113 (Pressure Measurements by Crusher Gauges), ITOP 4-2-606 (Establishment of Master and Reference Calibration Rounds) and ITOP 4-2-700 (Propelling Charges).

11.12 Action Prior to Disposal

The DA may be able to gain valuable information both for future design and in-service use from the proof of munitions, sub-munitions and components of a munition when it has reached the end of its service life. Therefore, IPTLs should consult with the DA and DOSGTS, in addition to making provision of adequate funds for appropriate investigations prior to disposal of the munition.

12 Guided Weapons and Rockets

12.1 General

12.1.1 Guided weapons are generally complex in their design and in their In-Service management requirements compared with other forms of munitions. Unguided rockets are less complex but have similar proof requirements.

12.1.2 Compliance with contractual performance and contractual safety requirements is required to be demonstrated in development. Production process control needs to be adequate to ensure that development trials results are representative of those to be expected from production items. Where sufficient confidence in performance cannot be obtained by this method (eg shaped charge penetration) a proof firing may be specified. Where the performance of a component in an explosive train is complex (eg the simultaneity of a peripheral initiation mechanism) or where responsibilities are split between different DA, sub-component proof may be required. Where sub-component proof is required due to a split between different DA, it is the responsibility of the Prime DA to ensure that it is carried out.

12.2 Scope

This Standard gives guidance on proof policy for all guided weapons (GW), torpedoes, rockets and rocket propelled munitions. It does not include base bleed shells. The policy can be applied to rocket motors used in other service applications. The scope of proof policy within this document is limited to those parts of the systems or munitions associated with energetic materials and any associated canisters/tubes subject to pressure. When the munition passes into service reference should be made to clause 15 - Tri-Service Policy for In-Service Surveillance.

12.3 Sub-Systems

Systems covered by this policy may contain some or all of the following sub-systems which should be considered for proof:

b) Missile Propulsion.
c) Warhead and Fuzing Systems.
d) Safety and Arming Units (SAU).
e) Ignition Safety Devices.
f) Power Supplies.
12.4 Missile Propulsion

12.4.1 Rocket Motors and Launch Tubes/Canisters

The requirement for proof applies to all rocket motors whether used in a GW or in an unguided rocket such as MLRS as these motors need to withstand the pressure and heat developed by the rocket motor during its operating period. In many cases the motor structural integrity must be sustained for the duration of the mission. Proof is also applicable to launch tubes or missile canisters that need both to withstand the pressures of launch for efficient operation and to protect the firer or launch platform. The proof schedule should include tests, particularly where a Pressure Relief System (PRS) is employed, to determine levels of toxicity, noise, local pressures (when used in closed areas), efflux characteristics, and degree of particle ejection from the boost motor.

12.4.2 Ramjets and Ramrockets

Ramjet and Ramrocket motors operate by ingesting atmospheric oxygen, mixing this with a fuel rich gas generator efflux or liquid fuel, and burning the mixture in a combustion chamber. Both must first be accelerated up to the operating velocity. This may be achieved either by a separate or integrated boost rocket motor or by the carrying aircraft. If the accelerator is a rocket, all of the proof requirements that apply to rocket motors applies equally to ramjets and ramrockets during the boost and ram phases. It should be noted, however, that proof firings of the ram phases require special test facilities and equipment to simulate atmospheric conditions and air intake performance which may be at supersonic velocities.

12.4.3 Gas Turbines

Gas turbines used in GW operate by mixing compressed atmospheric oxygen with liquid fuel and burning the mixture in a combustion chamber. The resulting gases drive a turbine which powers the compressor prior to the gases being exhausted to produce thrust. In sealed systems used in torpedoes, liquid oxidant and fuel are mixed and then burned in a combustion chamber. Mono-fuels which carry their own oxidants are, once combustion is initiated, self sustaining. The resulting gases are expanded in a turbine which drives the propulsor and are then exhausted. Air breathing gas turbines can operate in the supersonic regime provided that the intake ducting is so arranged to present air to the compressor at subsonic velocity. Depending on the design there may be a maintenance requirement to start up a gas turbine in-service, in which case, the IPT must be informed so that the in-service surveillance plan includes this requirement.

12.5 Warheads and Fuzing Systems

12.5.1 Warheads

A warhead is a device for transferring energy from the munition to the target. Warheads have a wide variety of operating principles and requirements which may include penetration, blast, fragmentation, time delays, response time, impulse, explosive sensitivity and explosive sensitiveness; these should be taken into account when producing proof schedules.

12.5.2 Boosters and Stemming

Boosters and stemming devices will normally be proofed as part of the warhead but may be subjected to a separate proof.
12.5.3 Pyrotechnic and Explosive Time Delays

Pyrotechnic and explosive time delays are reliable and cheap and can be used as the inter-charge delay mechanism. Where appropriate they may be proofed on statistical basis laid down in the proof schedule.

12.5.4 Detonators

Detonators are one shot devices which are relatively inexpensive and should also be proof fired on a statistical basis laid down in the proof schedule.

12.5.5 Triggering Mechanisms

Triggering mechanisms do not usually contain energetic materials but they are, of necessity, part of the firing chain and their correct function should be tested as part of proof. Dependent upon the design there may be more than one triggering mechanism employed. Triggering mechanisms include electro-optic, piezo-electric contact, radar, electrical contact (ogive deformation), inertial and magnetic sensor switches.

12.6 Ignition Safety Devices

Depending on the result of a hazard analysis of the motor ignition system, an ignition safety device may be required. It should be designed in accordance with the design safety requirements contained in STANAG 4368. If appropriate, an ignition safety device should be tested using the tests contained in STANAG 4157.

12.7 Power Supplies

Power supplies may be provided from host platforms, integral batteries (sea-water batteries in the case of torpedoes) or one shot device thermal batteries.

12.8 Missile Guidance and Control Sub-Systems

12.8.1 Energetic Devices

Many devices containing energetic materials may be used in missile guidance and control. These include:

a) **Gas generators.** - A gas generator is a sub-system that generates gases to be used for a purpose other than providing thrust for direct rocket propulsion of the host munition and is required to be tested in accordance with STANAG 4519. Gas generators may be multi shot and/or continuous supply or single shot. These devices comprise solid or liquid fuel and, where applicable, fuel tanks, combustion chamber, combustion controls, pressure release system, particle filter, initiation system, igniters and pipe-work to the application system.

b) **Piston gas motors.** - A piston gas motor is a special gas generator that generates a small amount of gas and converts it into a mechanical action using a piston. Whilst such components contain only a small amount of energetic material, reliability rather than safety is the main consideration. The Proof Schedule requirements are the same as for gas generators.

c) **Gas actuators.** - The control surfaces of a guided missile are frequently operated by a gas actuator. Gas pressure acts against a piston which is linked to the control surface. The Proof Schedule requirements are the same as for gas generators.
d) **Thrust Vector Control (TVC) and Thrusters.** - Where aerodynamic control is impractical, such as in low velocity launch or terminal agile manoeuvres, TVC may be used as a guidance technique. As many of these systems are integral with the rocket motor, rocket motor proof should include their performance assessment. Thrusters, which may or may not be independent of the rocket motor's gases, should also be proofed in the manner most representative of their design application.

e) **Exploding bolts.** - Exploding bolts are used in GW either for separating purposes (eg separating the boost motor from the flight motor) or in the MTS. The Proof Schedule requirements are the same as for gas generators.

f) **Explosive cutting devices.** - Explosive cutting devices may be used in missile MTS where a line charge will cut a missile in half. They may also be used in missile and rocket dispensing mechanisms to open a casing. The Production Proof Schedule should clearly indicate which safety and performance parameters are to be measured at sub-assembly and munition level and give pass/fail criteria for each test.

### 13 Armour and Armours containing Explosives

#### 13.1 General

13.1.1 Armour, generally, is defined as being a defensive covering designed to provide protection from a specific form of attack. Modern armour components may consist of passive or energetic materials. The components are normally assembled to provide an armour system.

13.1.2 The policy in this Standard covers:

- a) Rolled Plate Armour.
- b) Cast Armour.
- c) Extruded Armour.
- d) Forged Armour.
- e) Multi-component Armour.
- f) Transparent Armour.
- g) Fibre Reinforced Plastic Armour.
- h) Ceramic Armour.
- i) Spall Liners.
- j) Armour containing Explosive Material.
- k) Personal Armour Systems.

#### 13.2 Armour Proof Review

The policy and guidance in this Standard is based upon the findings of a comprehensive review into the requirement, specification, manufacture, supply, testing, acceptance and use of armour and armours containing explosive material. This review included an expert study (DERA/LSA/CR990043/1.0 dated 5 Nov 99) and visits to a representative sample of manufacturers and proof test authorities in the UK and overseas. The review concluded that:
a) There is a need for a formal armour proof policy to demonstrate safety and consistency of the armour product.

b) The level of proof evidence required should be proportional to the assessed risk.

c) There is a need to provide clear evidence that armour meets the requirements of this policy and that this should be demonstrated through a balance of manufacturers Quality Assurance processes and independent ballistic testing.

13.3 Requirements Rationale

Armour provides a critical level of hard protection to personnel and equipment against attack. It is therefore an essential element in the assurance of personnel safety and mission success. Each stage of the armour acquisition process, from initial requirement to final system acceptance into service, is critical to the achievement of the performance of the armour system. There are many variables within each of these stages and it is important that these are clearly identified and managed. Failure to do so could result in sub-standard armour entering service with unacceptable consequences. The study concluded that QA procedures and mechanical testing alone may not be sufficient in all cases to demonstrate consistency of the armour product. For this reason some ballistic testing will almost always be required, even if only as part of the acceptance process. Ballistic testing also plays an important part in assuring the User that the armour material is fit for purpose. Within the acquisition process, the following issues are deemed essential that:

a) the required level of protection of an armour system is clearly stated in the User Requirement Document (URD). This will be related to the threat.

b) the required level of protection is adequately defined within the contract.

c) armour should only be procured from competent armour suppliers. The onus is on the Prime Contractor to demonstrate to the MOD the competence of their supplier.

d) acceptable documentary evidence is provided to assure the customer that the required level of performance has been achieved. The key elements of this evidence should be derived from independent ballistic testing and from quality assurance documentation.

13.4 Material Specification and Properties

13.4.1 Material Specification

Armour components, wherever possible, should be manufactured and supplied to recognised and appropriate specifications such as Defence Standards, Mil Specs, or other specifications agreed with the MOD. Annex A provides a list of types of armour, related specifications and specific proof guidance.

13.4.2 Product Conformity Certificate

An example of a Product Conformity Certificate for Armour is at Annex B.

13.5 Test Houses

Ballistic Proof Testing should only be carried out by a UKAS accredited Test House (or international equivalent acceptable to the IPTL for the purposes of the contract). Such facilities may include the following depending on the nature of the requirement:

a) UK QINETIQ Proof Facilities (Test and Sentencing).

b) UK DCTA R & TG (Test and Sentencing).

c) US ATC, Aberdeen, Maryland, USA.
13.6 Armour Material Release

It is at the discretion of the Prime Contractor whether to accept the armour material before the ballistic test results are known and a pass is certified by the testing authority. The cost and risk of accepting armour material which subsequently proves unacceptable rests wholly with the Prime Contractor.

13.7 Procurement Aspects

The following should be considered during the procurement process:

a) A single plate or component might only be part of a complex armour system. The overall performance of a system may or may not be significantly influenced by minor variations in an individual plate or component.

b) Where a production test of a complex and/or expensive armour system is involved, it may be appropriate to test part of the system rather than the complete system. This should be agreed between the IPTL and the Prime Contractor and defined at contract negotiation as part of the Quality Plan.

c) It is important that adequate ballistic proof testing is conducted in any start up production phase of a new armour material or component, or when a known material or component is sourced from a new supplier.

d) Not all materials in an armour system require ballistic properties. In such cases, the Prime Contractor should be encouraged by the IPTL to consider the use of non-armour materials or to allow materials without proof evidence where such materials in the intended application do not serve in an armour function.

e) Due consideration must be given by the IPTL that proof is conducted appropriate to the threat attack mode (e.g., for some components it is only necessary to check shock and overload properties rather than conduct a $V_{50}$ penetration test).

14 Mines, Demolitions, Explosives and Pyrotechnics

14.1 General

14.1.1 Mines, demolitions, explosives and pyrotechnics cover a range of different types of munitions of which the complexity of design varies widely. While detonators or detonating cord are generally of a basic design, mine systems may be relatively complex, incorporating one or more of a number of fusing, safety and sensor features.

14.1.2 There are also a number of other differences between these types of munitions which have a bearing on the proof policy. These include the following:

a) With the exception of certain complex mine systems, these systems are relatively low cost stores which are generally procured in large numbers. By implication therefore, the conduct of proof tends to be relatively low cost and complete round proof is normally affordable.
b) Mine systems are not generally deployed in peacetime or during operations other than in war. As a result, there is little opportunity to identify problems with their safety, suitability or performance other than during in-service proof testing. Other stores on the other hand, in particular pyrotechnics and explosives stores, are in regular use during training. Therefore, given a reliable reporting system, there is potentially far more opportunity to monitor their safety and performance and this may reduce the need to conduct extensive or frequent proof.

c) The munitions covered by this policy have a wide range of applications and, because they are generally designed to be used in the close combat battle, they will be used in all extremes of the service environment. This needs to be taken into account when conducting proof on these stores.

14.1.3 This clause provides guidance on proof policy for all mines, demolitions, explosives and pyrotechnic stores. When a munition enters service, reference should be made to clause 15 (Tri-Service Policy for In-Service Surveillance) for additional guidance. For complex mine systems, reference should also be made to clause 11 (Guided Weapons and Rockets Proof Policy).

14.2 Reliability, Safety and Performance

Compliance with contractual reliability, safety and performance requirements are required to be demonstrated by the DA to the IPT. Production process control is also required to be adequate to ensure that development and qualification trials are representative of those to be expected from production items. Where sufficient confidence in performance cannot be obtained by this method then a proof firing may be specified. Where sub-component proof is required due to a split between different DA, it is the responsibility of the Prime DA to ensure that it is carried out.

14.3 Proof Schedules

Proof schedules are drawn up and agreed prior to acceptance. They are based on functioning samples of the stores at manufacture; similar schedules are applied for in-service surveillance proof. Rather than applying a “standard” schedule, the Proof Schedule should be tailored to each munition, with particular regard to its intended use in service. This should include consideration of the following:

a) The expected service environment needs to be considered in order to determine whether any particular environmental aspects need to be taken into account and applied to the Proof Schedule.

b) For In-Service Proof the level of usage needs to be considered and thus the opportunity for collecting data by a means other than conducting proof. Where there is evidence that such data will be recorded and that it will be readily available in service, then consideration should be given to reducing the extent or frequency of proof.

c) Careful consideration must be given to all aspects of performance. Thus for example, in the case of pyrotechnic flares, range, direction, point of burst, light intensity, colour and the duration of the flare all need to be taken into account, with clear pass/fail criteria. Merely recording successful launch and flare burst is not sufficient.

d) Full account should be taken of any in-service failures or defects.

14.4 Mines

Mines may be relatively simple systems consisting of a main charge, often a shaped charge, and a fuze. Increasingly, however, mines are becoming more complex and they may also incorporate a launch system and powered sensors to instil a degree of “intelligence” into the operation of the mine. Proof should be carried out on all relevant elements and the production Proof Schedule should clearly indicate which performance and safety parameters are to be measured, both at the sub-assembly and complete munition level. Whilst it is accepted that some testing may need to be carried out at component level, complete round testing should normally be conducted. Some characteristics of more complex mine systems are likely to be similar to those of guided weapons and therefore reference should also be made to clause 12 when drawing up the Proof Schedules.
14.5 Demolitions

Demolition stores are generally individually simple explosive stores which are normally combined to make up a demolition system; this would also include demolition kits such as those used for trench digging or for cratering. Compared to some other types of munitions, demolition kits are not subject to such high rates of usage; however, the components which make up the kits, detonators, detonating cord and explosive charges may themselves be subject to routine in-service use. Where there is routine high use in-service, the requirement to conduct proof should be reviewed depending upon the confidence in the failure reporting system. Similar to mine systems, whilst component level testing may be acceptable for demolition kits, complete round testing should normally be conducted.

14.6 Pyrotechnics

14.6.1 General

Pyrotechnic stores are used widely for signalling, screening, distraction, illumination, and training simulation. Notably, some types are also used in safety critical applications. Pyrotechnics are generally high volume usage stores subject to repetitive procurement with incremental changes in the materials and manufacturing process. Their high usage rate may provide evidence of their reliability, safety and successful performance, although it should be noted that the in-service failure reporting is currently by exception. ISS proof requirements should take into account usage, depending on the confidence in the failure reporting system. With repetitive buys of the same stores, LAT may also take into account data for in-service use.

14.6.2 Proof of Safety of Life at Sea and Life Saving Stores

A number of pyrotechnic stores are used in life saving applications such as man overboard markers, distress rockets and flares, and may be Safety of Life at Sea (SOLAS) approved. They can be often exposed to the extremes of service environments in ready-use lockers on ships’ decks, and as part of aircrew survival stores. Because of the nature of their use, they are likely to have a short service life; at the end of this life they are normally sent for disposal or used for training. Where appropriate, the information on sample proof of SOLAS approved and life saving stores should be fed back to the user to provide greater confidence in their reliability.

15 Tri-Service In-Service Surveillance Proof Policy

15.1 General

Prior to acceptance into service, safety tests and sequential environmental test data for each munition are assessed, in accordance with JSP 520, to verify to the relevant Acceptance Authority that it is safe and suitable for service (S3). This data will have been assessed and the munition will have been allocated an interim or assessed service life which will be confirmed by subsequent on-going In-Service Surveillance (ISS). Planning and conducting ISS is a key aspect of in-service munitions management, and JSP 520 delegates responsibility for this activity to the IPTL. The purpose of ISS is to ensure that:

a) Stocks of munitions are safe to use and will perform in accordance with requirements.

b) Any environmental effects after receipt into service are revealed.

c) Defective munitions are identified, down graded, have limitations imposed on their use or removed.

d) A feedback of in-service experience of munitions quality and reliability is provided for use in operational planning and proposed procurement.

The 3 Services each have procedures in place to ensure that munitions undergo surveillance to confirm that they are S3. The RN uses BR 1203, the Army uses QSTAG 670, and the RAF uses AP1OOC-12.
15.2 Principles of In-Service Surveillance

15.2.1 Unless there is sufficient evidence of the munitions safety to give confidence that it will remain safe during its service life, then all munitions should undergo ISS to confirm S3.

15.2.2 On acceptance into service a munition will have fulfilled the requirements specified in the User Requirements Document (URD) subject to acceptance provisos. This is taken to provide a baseline or start point from which ISS can begin.

15.2.3 In certain circumstances munitions may be accepted into service with associated concessions and/or a lack of baseline data. For these munitions ISS at year zero should be the norm to obtain baseline data.

15.2.4 If during acceptance trials a likely in-service failure mode is identified then this should be highlighted to the IPT munitions manager as a possible aspect on which ISS should focus.

15.2.5 Surveillance equipment utilised should provide results which comply with the surveillance criteria required both at Production and In-service.

15.2.6 All munitions should be subjected to ISS during their allocated life to provide confidence that the munition is ageing as predicted. This provides further points on the degradation curve, from which regression analysis may be applied. Munitions may be exempt if sufficient are being used at training to provide the confidence required in the stockpile.

15.2.7 All munitions may be subjected to ISS which will allow the remaining life to be assessed and/or extended. The point at which ISS is required for life extension will be included in the Surveillance Plan. Where appropriate, any environmental testing, as specified in the Surveillance Plan, should be included when conducting proof.

15.2.8 Where an extension of a munition’s life is to be determined using accelerated ageing processes, the oldest, naturally aged, munitions should be used. A sufficient quantity of munitions should be predetermined, procured and managed for such an intention.

15.2.9 Failures and defects detected during use either at training or on operations must form part of ISS. This will provide indicators toward potential failure modes or areas to focus attention. The imposition of any ban, constraint or restriction must be notified to each Service user.

15.2.10 In the case of high value munitions, training firings should be monitored by suitably qualified technicians.

15.2.11 ISS should be completed, wherever possible, in accordance with statistically valid techniques to provide a specified reliability at a stated confidence level (Def Stan 05-101 Part 3).

15.2.12 The environmental conditions experienced by munitions should be monitored wherever possible, and the data gathered taken into account when re-assessing the life of a munition. Every effort should be made to ensure that the complete environmental history of a munition is recorded and is available.

15.2.13 Where stocks of munitions have experienced differing environmental conditions, stock judged to have been exposed to the most environmentally adverse conditions should be the priority for ISS.

15.2.14 All munitions shall have a Surveillance Plan stating the surveillance required, including frequency, sampling basis and critical attributes to be measured. The production of the Surveillance Plan is the responsibility of the IPT munitions manager.

15.2.15 All results and analysis of ISS should be provided to the IPT munitions manager for dissemination to the DA and contractors to provide information for new designs and other procurement work.
Annex A
Armour Types, Related Specifications and Specific Proof Matters

A.1 Rolled Plate Armour

The specification for Steel plate armour is Def Stan 95-24. The specifications for rolled homogenous armour (RHA) internationally are very similar but not identical. Aluminium plate armour is proofed under Def Stan 95-22 Class 1 and Class 2. Lower strength rolled aluminium armour specification is contained in Def Stan 95-18.

Where ballistic protection is afforded from small arms at point blank range by a single thickness of plate, the proof of this plate is critical.

Overmatch/ballistic shock tests are sometimes more relevant than $V_{50}$ ballistic tests for plates with structural requirements, particularly plates forming vehicle structures.

A.2 Cast Armour

Cast steel armour specifications are found in Def Stan 95-25 and Def Stan 95-26. Where the proof of large expensive castings is involved, the IPTL may consider that it would be cheaper for the manufacturer to include an extra sacrificial piece of representative thickness on the pattern which when cast can be cut off and used as a ballistic test plate.

It is very important that adequate proof testing is conducted in any start up phase for the production of new castings.

A.3 Extruded Armour

Extruded steel armour is proofed under Def Stan 95-23. Aluminium armour is covered by Def Stan 95-19.

A.4 Forged Armour

Forged steel armour is proofed under Def Stan 95-23. Aluminium armour is covered by Def Stan 95-19.

It is very important that adequate proof testing is conducted in any start up phase for the production of new forgings.

A.5 Multi-Component Armour

Where multi-component armour is employed, only those parts of the armour whose function is directly to ensure safety need to be proofed. The complete multi-component armour will need to undergo acceptance proof.

A.6 Transparent Armour

Def Stan 96-03/1 defines the light transmission and ballistic tests for laminated glass vision blocks used in AFVs.
A.7 Fibre Reinforced Plastic Armour

Def Stan 93-111 specifies the performance of Glass Fibre Reinforced Plastic for ballistic protection purposes in the thickness range 7 to 28mm. Ballistic proof tests are conducted using Fragment Simulating Projectiles (FSP). The material must meet a specified $V_{50}$ dependent upon thickness.

A.8 Ceramic Armour

No Defence Standard currently exists for ceramic armour. For the treatment of its application see clause A.12 below.

A.9 Spall Liners

Spall liners are fitted to the inside of armoured vehicles to reduce the wide dispersion of spall within the vehicle following penetration by a chemical energy warhead. Spall liners undergo proof as set out in Def Stan 93-111.

A.10 Armours containing Explosive Material

The explosive used in armours containing explosive material (ACEM), though it may be qualified, may not meet all Insensitive Munition (IM) criteria. Therefore ACEM must be subjected to acceptance tests that are adequate to identify problems likely to be encountered in-service. For example, armour designed to defeat chemical energy warheads must be tested against threat machine gun and small arms fire to check that such fire does not cause premature functioning of the armour.

Where ACEM is bolted onto the outside of an AFV it may be necessary to impose quite short time limits between refurbishment due to the wear and tear of service use; if so this must be taken into account by the IPTL during procurement so that adequate stocks exist to maintain the required protection level.

When ACEM passes into service reference should be made to clause 15 (Tri-Service Policy for In-Service Surveillance Proof Policy).

A.11 Personal Armour Systems

The term personal armour includes body armour (fragmentation and bullet resistant vests), helmets (fragmentation and bullet resistance), face and eye protection (visor and goggles), Explosive Ordnance Disposal (EOD) suits and ballistic shields. In addition to ballistic performance, issues of non-ballistic protection, blast protection and behind armour blunt trauma protection may be specified.

Personal armour items may be procured against any of the following types of Defence Specifications:

a) UK/SC Product Specifications.
b) Purchase Descriptions.
c) Performance Specifications.
d) Cardinal Point Specifications.
e) Statement of Technical Requirement.
These documents specify the type and range or velocity of the threat. For bullet resistant systems a complete protection type test is stipulated. For acceptance of a modified construction, a minimum number of shots to achieve an adequate level of confidence would be specified for each threat. The primary acceptance criteria is based on the ballistic test of the item in its completed form. There may be additional key acceptance criteria which are specific to a given product e.g. optical distortion for EOD visors. The physical and/or chemical properties may be defined and may reference other standards. The test protocol may include references to test standards such as STANAG 2920 and UK/SC/5449.

A.12 Armour not covered by National Defence Standards

Where an armour is not covered by a Def Stan each application should be covered by a System Requirement Specification written for that particular armour which includes proof requirements.
Annex B
Example of Product Conformity Certificate for Armour

CERTIFICATE OF PRODUCT CONFORMITY (PCC) PROVIDED TO UK MINISTRY OF DEFENCE FOR ARMOUR MANUFACTURED, BALLISTIC PROOF TESTED AND SUPPLIED FOR INCORPORATION ON VEHICLE ARMOUR PROTECTION UNDER CONTRACT NO[__________]

1. ISSUED BY [Prime Contractor]

Prime Contractor Details ........................................................................................................................................

QA Accreditation (s)........................................................................................................................................

2. ARMOUR SPECIFICATION [eg Defence Standard, Mil Spec, GE, etc.]

Specification (s)........................................................................................................................................

Declared Chemical Composition....................................................................................................................

Factory Batch ID Reference.............................................................................................................................

Certified Mechanical Properties (e.g. Hardness, Charpy, Tensile)................................................................

Testing Laboratory Report Reference...........................................................................................................

NB A copy of the Mechanical Testing Laboratory Test Report must be attached to this Product Conformity Certificate

3. ARMOUR MANUFACTURER DETAILS (SOURCE)

Company..........................................................................................................................................................

Manufacturing Mill.........................................................................................................................................

QA Certification(s)........................................................................................................................................

Sub-Contract/Order Reference......................................................................................................................

4. BALLISTIC PROOF TESTING DETAILS

Proof Certifying Authority (Test House)........................................................................................................

QA Certification............................................................................................................................................

Sub-Contract / Order Reference...................................................................................................................

Test Specification Used.................................................................................................................................

Certified Results Pass / Fail...........................................................................................................................

NB A copy of the Proof Facility Test Report with ballistic data must be attached to this Product Conformity Certificate.
5. DECLARATION

We (the Prime Contractor) hereby declare that the armour supplied under MOD Contract Reference.................... is supplied fully in accordance with the selected specification requirements declared in this Certificate (less the PCC concessions given in the contract Reference ......................... ) and that the information given in this Certificate is true and accurate.

SIGNED [ PRIME CONTRACTOR] DATE [ ]
Annex C
Approved Proof Marks

Austrian Proof marks

Provisional proof of barrels

Compulsory definitive proof for Black Powder. All arms

Compulsory definitive proof with quick-burning powder of all firearms using Smokeless Powder cartridges

Voluntary superior proof for smoothbore sporting guns
Inspection of ammunition

Proof of certain small arms and portable devices using an explosive charge

Proof „steel shot“ of smoothbore arms

Belgium Proof Marks

- Muzzleloading smoothbore
- Compulsory proof
- Superior
- Ordinary

Barrel
- Locking lever
Breechloading smoothbore

Voluntary provisional
proof of barrel

Barrel

Compulsory proof

Action

superior

Barrel

Black Powder proof

Action

Salon rifles

Smokeless Powder proof

Barrel

Action

Rifles and carbines

Compulsory proof

Barrel

Action

Black Powder proof

Barrel and frame

cylinder

Rifles

Smokeless Powder proof

Barrel, frame and cylinder

Automatic Pistols

Smokeless Powder proof

Barrel

other proved parts
Black Powder proof

Pistols using Flobert or revolver cartridges

Smokeless Powder proof

Barrel

other proved parts

Ordinary proof

Foreign firearms

Barrel

other proved parts

superior proof

Barrel

Military firearms

other proved parts

Hard-tempered parts may be marked thus

Inspection of ammunition

Proof of certain small arms and portable devices using an explosive charge
Proof mark identifying the Proof House

Proof "steel shot" of smoothbore arms

Nitro Proof

Nitro Superior Proof

Definitive Foreign Arms

Definitive Black Powder and Military Nitro

Inspectors Mark (the letter and shape above the tower define the mark)
Nitro Proof (post 1968)

Superior Nitro Proof

Former Definitive (prior to 1968)

Rifled Arms (post 1968)

View Black Powder (post 1968)

Canada Proof Marks

Canada – Full Proof
Chile Proof Marks

Proof of firearms and of portable devices using an explosive charge

Inspection of ammunition

Proof of "steel shot" of smoothbore arms

Czech Republic Proof Marks

Individual proof of warning guns, alarm arms, narcotising arms and other devices using expansive propulsion

Inspection of ammunition for small gas guns

Individual proof of muzzleloading arms using black powder
Individual proof of breechloading smoothbore arms using smokeless powder cartridges

Individual proof of arms for use with shot cartridges—superior proof

Individual proof of breechloading rifled arms using powder cartridges

Homologation of arms and devices using expansion propulsion

Inspection of ammunition

Inspection of powder

Re-Proof of all arms
Proof "steel shot" of smoothbore arms

Proof House Prag

Finland Proof Marks

Inspection mark for commercial ammunition

Ordinary proof

Black powder proof
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Magnum or superior proof

Proof „steel shot“ of smoothbore arms

France Proof Marks

Voluntary Proof:

Barrels in the finished state: ordinary proof

Barrels in the finished state: double proof

Barrels in the finished state: triple proof

Compulsory Proof:

Devices classified as firearms: sample or modal proof
Guns in the finished state: ordinary black powder proof

Arms in the finished state when proved, i.e. ready for sale (supplementary mark)

Guns in the finished state: ordinary nitro proof

Proof “steel shot” of smoothbore arms

FRANCE (suit)

Guns in the finished state: superior nitro proof

Proof of long barrelled rifled firearms

Re-proof of long barrelled rifled firearms
Guns in the finished state: ordinary black powder re-proof

Ordinary nitro re-proof

Superior nitro re-proof

Proof of short barrelled firearms

Re-proof of short barrelled firearms

Inspection of ammunition

Mark on rejected firearms
Definitive Nitro Proof – Rifles

Definitive Nitro Proof – Short Barrelled Arms

Neutralisation Mark found on ex-military arms

Germany Proof Marks

7.1. Proof marks up to 1939:

Provisional proof (1. proof)

Definitive proof (2. proof)

Smooth bore arms (normal)
Smooth bore arms with choke

Rifles and carbines (rifle for single fire)

Reproof

Designation of foreign arms

Definitive proof with smokeless powder, rifles

Definitive proof with smokeless powder, smooth bore arms
7.2. Proof marks from 1939 to 1945:

Provisional proof

Definitive proof with black powder

Definitive proof with smokeless powder

Proof mark, special weapons

Provisional proof

Reproof
7.3. Proof marks BRD from 1945 to 1990:

Provisional proof

Definitive proof with black powder

Definitive proof with smokeless powder
Proof of special arms and devices using an explosive charge

Voluntary proof

Reproof

Superior proof with smokeless powder

Proof of weapons, used to fire a substance other than a solid projectile

Proof House Berlin

Proof House Hannover

Proof House Kiel
Proof House Köln

Proof House Mellrichstadt

Proof House München

Proof House Ulm

7.4. Proof marks DDR from 1945 to 1950:

Provisional proof with black powder, smooth bore arms and rifles of combined arms
Definitive proof with black powder

Definitive proof with smokeless powder

Definitive proof with smokeless powder

Proof House Suhl

3.5. Proof marks DDR from 1950 to 1975:

Proof mark, smooth bore arms

Proof mark, rifles
Definitive proof

Inspection after definitive proof (always combined with the definitive proof mark)

Definitive proof with smokeless powder (supplement to definitive proof mark), for smooth bore arms with “Nitro”

Supplement for smooth bore arms with choke

Reproof

Proof House Suhl

Date of proof with month and the two last numbers of the year (here June 1960)

7.6. Proof marks DDR from 1975 to 1990:

Definitive proof with smokeless powder
Proof of weapons, used to fire a substance other than a solid projectile

Superior proof with smokeless powder

Reproof

Inspection of ammunition

3.7. Proof marks BRD from 1991:

Definitive proof with smokeless powder
Superior proof with smokeless powder

Definitive proof with black powder

Proof of weapons, used to fire a substance other than a solid projectile

Reproof

Voluntary proof
Type approval mark, weapons, firing devices and sub-calibre devices

Type approval mark, alarm-, teargas- and signal arms

Proof „steel shot“ of smoothbore arms

Inspection of ammunition, Proof house Hannover

Inspection of ammunition, Proof House Kiel
Inspection of ammunition, Proof House Köln

Inspection of ammunition, Proof House Mellrichstadt

Inspection of ammunition, Proof House München

Inspection of ammunition, Proof House Suhl
Inspection of ammunition, Proof House Ulm

Proof House Hannover

Proof House Kiel

Proof House Köln

Proof House Mellrichstadt
Proof House München

Proof House Suhl

Proof House Ulm

Flobert Rifles Proof Mark (post 1973)

Kiel Proof Mark

Stylised Eagle may Surmount the Proof Mark

Oberndorf – Proof or Re-Proof at Heckler and Koch
UK Proof Marks

Provisional proof of barrel

On the action

Definitive proof for use with smokeless powders

On the barrel

Definitive proof for arms for use with black powder only

Special superior proof

Re-proof
Inspection of ammunition

Proof of certain small arms and portable devises using an explosive charge

Proof "steel shot" of smoothbore arms

Birmingham Military Proof

Birmingham Nitro (with the words NITRO PROOF)

MOD – Full Proof – marked on barrel and barrel extension
MOD (P and EE) – Breech Bolt

Enfield – Military Proof

London Military Proof

London – Not English Make

London – Not English Make

London – Nitro (Barrel)
London – GP (Barrel extension and Barrel Bolt)

London – Magazine Restricted

Birmingham – Magazine Restricted

Birmingham – De Activated

London – De Activated

Birmingham – De Activated
Hungary Proof Marks

Voluntary provisional proof

Definitive proof of arms in the white or in delivery condition

Reproof

Superior Proof

Inspection of ammunition

Proof of alarm devices
Proof of alarm guns, starting pistols and gas pistols
Proof of gas or compressed air arms using blank ammunition or ammunition with projectile energy less than 7.5 joules
Proof of certain small arms and portable devices using an explosive charge

Definitive proof with blackpowder

Proof "steel shot" of smoothbore arms

Irish Proof Marks

Provisional and definitive proof of shotguns

Italy Proof Marks

Distinctive proof mark of the Gardone V.T. Proof House impressed on all firearms

Definitive black powder proof
Definitive smokeless powder proof

Voluntary superior smokeless powder proof

Supplementary mark for arms proved in delivery condition

Re-Proof

Inspection of ammunition

Proof “steel shot” of smoothbore arms
Russian federation Proof Marks

Proof of arms and inspection of ammunition
Proof House of Ijevsk

Proof of arms and inspection of ammunition
Proof House of Klimovsk

Proof of arms and inspection of ammunition
Proof House of Krasnozavodsk

Proof “steel shot” of smoothbore arms

Slovakian Republic Proof Marks
Individual proof of warning guns, alarm arms, narcotizing arms and other devices using expansive explosion

Individual proof of muzzleloading arms using black powder

Individual proof of breechloading arms using smokeless powder

Individual proof of arms - superior proof

Homologation of arms and devices using expansion propulsion
Inspection of ammunition

Inspection of powder

Proof "steel shot" of smoothbore arms

Spain Proof Marks

Proof mark of Eibar Proof House
Impressed on all arms

Proof of muzzle-loading firearms (Black Powder)

Voluntary black Powder proof of breech-loading barrels
Compulsory Smokeless Powder proof of breech-loading smoothbore firearms

Supplementary Smokeless Powder proof of breech-loading smoothbore firearms

Proof of saloon pistols and saloon rifles (with the powder normally used)

Proof of foreign firearms not bearing C.I.P.-approved proof marks

Proof of foreign firearms not bearing C.I.P.-approved proof marks

Inspection of ammunition

Proof of certain small arms and portable devices using an explosive charge
Proof "steel shot" of smoothbore arms

Yugoslavian Republic Proof Marks

Normal proof with black powder, arms in the finished state

Normal proof with smokeless powder, arms in the finished state

Superior proof with smokeless powder, arms in the finished state

Supplement for firearms, ready for sale when proved

Re-proof with black powder

Re-proof with smokeless powder

Provisional proof of insert barrels
Double provisional proof of insert barrels

Triple provisional proof of insert barrels

Facultative provisional proof of forged brutes

Proof mark

Proof mark, breech mechanism

International mark, measuring instrument

Proof mark, foreign firearms

Proof mark, barrels well assembled
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Nominale calibre and length of chamber

12/70

Mark of the controller

*S*

Month and year of proof (example: June 1970)

0670

Indication of choke

CHOKE

Weight of barrel

KP

Proof of certain firearms and devices using an explosive charge

Inspection of ammunition
Inside Rear Cover
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An Executive Agency of The Ministry of Defence

UK Defence Standardization
Kentigern House
65 Brown Street
GLASGOW G2 8EX

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