



Defence
Safety Authority

DSA 03.OME Part 1: Defence Code of Practice (DCOP) 107

Explosive Materials Qualification



Version Record

Version 1.1

Version Date: August 2024.

Version changes: see amendment table.

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Preface

Requests for Change

1. Proposed changes, recommendations, or amendments to DOSR Regulations and Guidance can be submitted to the DOSR Regulations and Publications Team:

Email Address: dsa-dosr-prg@mod.gov.uk

Postal Address: Juniper #5004, Level 1, Wing 4, Abbey Wood North, Bristol, BS34 8QW

2. Any post and grammar change proposals can be approved or rejected by the DOSR without involvement of the associated Working Group.

3. Technical change proposals should be submitted to the associated Working Group for review and approval or rejection.

4. When incorporating changes, care is to be taken to maintain coherence across regulations.

5. Changes effecting Risk to Life will be published immediately. Other changes will be incorporated as part of routine reviews.

Review Process

6. The DOSR team will ensure OME Regulations remain fit for purpose by conducting regular reviews through the DOSR Governance Committees, consulting with MOD Stakeholders and other Defence Regulators as necessary on interfaces and where there may be overlaps of responsibility.

Further Advice and Feedback

7. For further information about any aspect of this document, or questions not answered within the subsequent sections, or to provide feedback on the content, contact the DOSR Regulations and Publications Team.

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Amendment Record

No	Section	Para	Amendment Summary	Agreed	Date
1.0	all	all	Document created.	Regs ATL	Apr 2024
1.1	all	all	Reformatted in line with DSA accessibility requirements.	Regs ATL	Aug 2024

DSA 02.OME Regulation 107

Explosive Materials Qualification

1. The Accountable Person shall ensure that explosive materials used within OME have known performance, safety, and functional characteristics independent of service application.

DSA 03.OME DCOP 107

Introduction

2. Explosive material qualification supports the MOD legal obligations under the UK Health & Safety at Work etc. Act and its directives. Further information on the requirements for the Qualification of EM for use in military weapons can be found in Def-Stan 07-085: Design Requirements for Weapons and Associated Systems.

3. The AP should understand the effect on safety of any explosive material before procurement action is taken. The early involvement of explosive materials subject matter experts should be considered by the AP to support safe introduction into service of new or significantly modified munitions.

4. A two-phased Qualification process is used to ensure explosive materials are safe and suitable for service use. These phases are defined as “Explosive Materials Qualification” and “Final (Type) Qualification”. DCOP 107 covers explosive materials qualification, which consists of a series of tests and analyses which demonstrated that an explosive material meets the fundamental safety and performance characteristics required in the explosives chain, independent of a specific end item.

5. Explosive materials qualification is carried out to support claims that the explosive materials used within OME will remain safe and suitable for service throughout the Manufacture to Target or Disposal Sequence (MTDS). Evidence from explosive materials qualification feeds into ‘Type’ qualification and Safe and Suitable for Service (S3) stipulations and arguments. Explosive materials qualification objectives are as follows:

- a. Demonstration that the explosive materials being used are used in an appropriate manner and at an appropriate point in the explosives chain,
- b. Characterisation and baselining of the physical, chemical, safety and performance properties of the explosive materials.

6. Explosive material qualification should provide greater understanding of the material properties, which can be used to reduce the technical risk in the choice of an explosive material within a particular application. Explosive material qualification is carried out at a material level and does not include tests specific to the service environment. Additional associated technical assessments on the explosive and associated materials should be conducted as part of the S3 assessment.

Policy and Relevant Standards

7. The policy and relevant standards for the qualification of explosive materials are as follows:

- a. AOP-07 - Manual of Data Requirements and Tests for the Qualification of Explosives Materials for Military Use.
- b. STANAG 4170 - Principles and Methodology for the Qualification of Explosive Materials for Military Use.
- c. DefStan 07-085 - Design Requirements for Weapons and Associated Systems.
- d. STANAG 4147 - Chemical Compatibility of Ammunition Components with Explosives (Non-Nuclear Applications).
- e. STANAG 4518 - Safe Disposal of Munitions, Design Principles and Requirements, and Safety Assessment.
- f. Energetic Materials Testing Assessment Policy Manual of Tests (EMTAP).

8. Explosives are characterised by making an assessment to determine whether they are safe and suitable for consideration for use in a particular role. The assessment may include, but are not limited to, the following characterisation of the explosive materials:

- a. General Characteristics, including composition, intended application, physical form, and service application.
- b. Sensitivity Testing to the following stimuli: Impact, Friction, Electrostatic Discharge (ESD), Shock, Adiabatic Compression.
- c. Thermal Characterisation, including thermal analyses, thermal stability, chemical compatibility, self-heating critical temperature, ignition temperature, volumetric changes, exudation, thermal sensitiveness, explosiveness, heat capacity/thermal conductivity, flash point/vapour phase ignition .
- d. Chemical and Mechanical properties, and Performance characterisation, including detonation velocity, critical diameter, burning rate.
- e. Ageing Protocol, Plan and Data.
- f. Hazard Classification.
- g. Toxicity.

9. The tests required to produce an Explosives Hazard Data Sheet (EHDS) will normally be included, together with any small-scale or large-scale tests appropriate to the intended role. EHDS should be produced in accordance with Def Stan13-129: Requirements for Explosives Hazard Data Sheets for MOD Use, and under DEFCON68 - Supply of Data for Hazardous Articles, Materials and Substances.

10. An explosive material should have been characterised prior to its selection for use in a particular munition. An assessment should be completed before the start of the system trials so that any problems can be addressed where this is not the case.
11. In some instances, it may not be possible for the UK to qualify the explosive materials prior to the store being brought into use. Evidence to support explosive materials qualification should be gained as early as is reasonably practicable to allow an assessment and characterisation of energetic materials and the resultant assessment of S3.

Methodology

12. Nations subscribing to NATO AC/326 Sub-Group A (Energetic Materials Team (EMT)) have adopted the methodology described in STANAG-4170 and AOP-07. The NATO documentation describes the minimum mandatory data that is required to demonstrate compliance, readers are referred to STANAG 4170 and AOP-07 for further details on required tests, dependent on the role of the explosive material being qualified.
13. DES Wpns-WTS Energetics and Vulnerability Group (EVG, formerly DES Wpns-DOSG-ST1) are delegated by the UK National Authority to identify the minimum data requirements that are needed to fulfil the conditions specified below and the test programme necessary.
14. After completion of the test programme, a characterisation report should be submitted to DES-Wpns-WTS EVG identifying the explosive composition, developer / manufacturer, the organisation that conducted the tests, test results, intended role and qualifying National Authority. The report may also include comparison of the test data with that of known explosive material that has proven satisfactory use in the same role.
15. If the explosive materials characteristics are considered acceptable, DES-Wpns-WTS EVG will provide confirmation, via an Explosive Materials Qualification Certificate, that the explosive material is safe and suitable for use in a defined role within a munition system. DES-Wpns-WTS EVG should record and maintain information collected in support of explosive materials qualification.
16. Where an explosive material proposed for UK service application has been qualified by another National Authority in accordance with STANAG-4170 and AOP-07, the supporting qualification evidence should be presented to DES-Wpns-WTS EVG. Where this data is sufficient to meet the requirements of DES-Wpns-WTS EVG, it may be possible to reconsider the extent of testing required to obtain UK explosive material qualification.
17. Where development or procurement of a munition is being carried out jointly by two or more nations subscribing to STANAG-4170 and AOP-07, a joint approach to explosive material qualification can be pursued. Early agreement between the respective nations to share test data should prevent duplication of testing and minimise costs.

18. The explosive material qualification certificate that DES-Wpns-WTS EVG issues to an AP relates to a defined explosive material specification from a particular manufacturer and manufacturing site. For previously qualified explosive materials, changes in the following will require explosive material requalification or partial requalification:

- a. Explosive Material, ingredient/raw material Specifications, technical drawings.
- b. Source of Formulation Ingredients.
- c. Manufacturing Processes.
- d. Manufacturer or Manufacturing Location.
- e. Significant Production Break.

19. The AP should be aware of the safety implications that may arise from any changes in the assessed specification, manufacturer, ingredients, or basic design of a munition.

20. The AP should ensure that changes which may invalidate Explosive material qualification are identified and that further characterisation is carried out when necessary. There should be a re-qualification test programme put into place for changes detailed in DCOP 107 Paragraph 18 a. to e. The timing for characterisation programmes is the responsibility of the AP but should be completed to a satisfactory level before a full production contract is let. Changes to specifications and manufacturing processes should be recorded, assessed, and approved, prior to implementation.

21. The following should be considered by the delegated National Authority when assessing whether an explosive material qualification certificate should be amended:

- a. The explosive materials subject to a change in manufacture should remain safe.
- b. The explosive materials should continue to have an acceptable service life.
- c. The explosive materials subject to a change in manufacture may not be to the same standard as the original.

22. The delegated National Authority should also consider the following:

- a. The complexity of the formulation and the degree of difficulty of manufacturing it to specification.
- b. The completeness of the specification, including critical processes.
- c. The extent and adequacy of the manufacturer's tests and assessments.
- d. The requirement for trials to demonstrate that the material meets the specification.

- e. The importance to overall safety of the material subject to a change in manufacture.
- f. The experience of the new manufacturer/site personnel compared to the manufacturer/site personnel of the original material.
- g. The extent to which the new manufacturer uses the same sources of raw material, equipment and processes as the original manufacturer, and the same personnel.
- h. The extent to which personnel involved in the original manufacture make available their expertise to the new site.
- i. The consequences of any new raw materials, processes or revised tolerances being introduced.
- j. The duration of the interruption and the potential loss of experienced personnel if interruption of production is involved.