Defence
Safety Authority

DSA 03.OME Part 1: Defence Code of Practice (DCOP) 108

Initiation Systems (IS) Qualification

Version Record

Version 1.0

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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.

Contents

Amendment Record

Version	Section	Para	Amendment Summary	Agreed	Date
1.0	All	All	Document created	DOSR Regs ATL	Nov 2024

DSA 02.OME Regulation 108

Initiation Systems (IS) Qualification

1. The Accountable Person shall ensure that the risks associated with Initiation Systems for OME, including subsystems and components, are understood, documented, and managed to be ALARP and tolerable.

DSA 03.OME DCOP 108

Introduction

2. An Initiation System (IS) is designed to safely control the actuation of an energetic train, component, or weapon effect, as a consequence of a sequence of actions, resulting from the sensing of environments and/or user inputs. Initiation Systems encompass fuzing systems, ignition/launch systems, firing and actuation systems, flight termination systems, and hazard mitigation devices. This includes all components, hardware and software that may fulfil the following functions in an OME system:

a. Isolate sensitive energetic materials in the initiation train and/or the functioning energy.

b. Arm the system ready for functioning.

c. Activate energetic payloads and/or alternative weapon or OME effects.

3. An Initiation System contains safety features to prevent premature arming and inadvertent functioning. Systems are commonly categorised by their type of energetic train:

a. Interrupted: Where the energetic train is physically separated using an interrupter (e.g., barrier, shutter, slider, or rotor). The interrupter physically isolates the sensitive energetics in the initiation chain until pre-defined sequential safety feature parameters are met, arming the system.

b. Non-Interrupted: These systems require the use of less sensitive energetic qualified as suitable for in-line use. Arming is controlled by sequential safety features and implemented through either:

(1) Prevention of arming through accumulating all functioning energy from the post launch environment and until defined verification, by the system, of a proper launch and attainment of the required arming delay.

(2) Prevention of arming through operation of successive independent energy breaks functioning in both static and dynamic modes.

4. Initiation Systems exist which do not conform to the traditional explosive train designs. These systems are still required to safely control arming and functioning or actuation of the system.

5. Safety features employed are designed only to be disengaged upon the attainment of a validated, unique arming stimuli. It is important to assess the choice and the usage of stimuli during the review of the preliminary design. Arming stimuli usually consist of either:

a. Environmentally Derived Stimuli - Where practicable, arming stimuli should be environmentally derived and support autonomous arming. Additionally, any environmental sensors contributing to the arming process are part of the Initiation System. Common examples of environmental stimuli include:

(1) Axial (Launch) acceleration (Setback),

(2) Air pressure or flow (Velocity),

(3) Hydrodynamic and hydrostatic pressure.

b. User Generated Stimuli - Where the use of environmental stimuli is not possible, arming stimuli is generated by independent, intentional, and sequenced user actions.

6. For both cases, arming stimuli should be:

a. Unique and robust,

b. Capable of being validated,

c. Incapable of inadvertent generation or subversion.

7. Safe separation is the distance from the delivery system or launcher to the munition, beyond which the hazards to the users and/or the delivery system (resulting from functioning of the munition system) are acceptable. At least one of the independent safety features of the fuzing system should prevent arming after launch or deployment, until the specified safe separation distance (or equivalent arming delay) has been achieved. Additional safety features may be required for specific systems after safe separation distance has been achieved (e.g., overheard safety requirements).

8. Electro-Explosive Devices (EED) are usually the first item in an energetic train, often referred to as the initiator. The initiation of an EED is usually controlled via a firing circuit, with the availability of functioning energy being dependent upon verification of a proper launch and attainment of the required arming delay.

9. The EED used in an OME system vary in design but can be categorised into low and high voltage devices. Low voltage devices are commonly used in interrupted explosive trains, whilst high voltage EED are generally used in non-interrupted devices. Common types include:

a. Low Voltage

(1) Bridge Wire (BW)

(2) Film Bridge (FB)

(3) Conducting Composition (CC)

b. High Voltage

(1) Exploding Foil Initiator (EFI)

(2) Exploding Bridge Wire (EBW)

10. EED need to be characterised to understand their firing properties. This defines the stimulus levels, which result in a response from an EED with a certain probability and statistical confidence. Characterisation is conducted to understand the EED electrical sensitivity, and how it may be influenced by the in-service mechanical, climatic, and electro-magnetic environment, to ensure that the system remains safe and suitable for service (S3).

Initiation Systems Acceptable Means of Compliance.

11. OME IS, including subsystems and components are regulated by the Defence OME Safety Regulator (DOSR) under DSA 02.OME Regulation 108. This regulation requires that risks associated with IS are understood, documented, and managed to be As Low As Reasonably Practicable (ALARP) and tolerable.

12. The regulation provides a framework to ensure that suitable and sufficient evidence is available to demonstrate that an acceptable risk level against premature arming and inadvertent initiation of the weapon effect, propulsion/launch system, subsystems, or components of the OME has been achieved.

13. The following are the acceptable internationally recognised standards relevant to the design and test of IS. Demonstrating conformance against the relevant standards is expected to be sufficient to claim compliance against the regulation.

a. STANAG 4187 / AOP-4187: Fuzing Systems - Safety Design Requirements

b. STANAG 4368: Ignition Systems for Rockets and Guided Missile Motors, Safety Design Requirements

c. STANAG 4497 / AOP-4497: Hand-emplaced Munitions (HEM), Principles for Safe Design

d. STANAG 2818 / AOP-31 / AOP-32 : Demolition Materiel: Design, Testing and Assessments

e. STANAG 4797 / AOP-4797 : Safety Requirements for Hazard Mitigation Devices (HMD) employed to address Fast/Slow Heating threats to munitions.

f. Defence Standard 59-114: Safety Principles for Electrical Circuits in Systems, Incorporating Explosive Components - Assessment, Safety Margins and Trials

g. STANAG 4809 / AOP-67: Safety Design Requirements for Remotely Controlled Safety, Arming and Functioning (SAF) Systems

h. STANAG 4560 / AOP-43: Electro-Explosive Devices, Assessment and Test Methods for Characterization.

i. STANAG 4157 / AOP-4157 / AOP-20: Safety, Arming and Functioning Systems (SAF Systems) Testing Requirements

14. DSA 02.OME allows for an Alternative Acceptable Means of Compliance (AAMC) to be used, if agreed and approved by DOSR (DSA-DOSR-PERMISSIONS@mod.gov.uk) which should be discussed at the earliest opportunity.

Demonstration of Compliance

15. Compliance should be demonstrated as a coherent case detailing the claims, arguments, and evidence (CAE) against the latest edition of the applicable standards. The CAE should include (as a minimum) the following, to ensure the best chances of the best possible outcome of the task:

a. A comprehensive compliance matrix against the requirements of the applicable standard(s).

b. A rationale should be provided for any requirements which are not applicable to the system.

c. Compliance determinations against the remaining requirements should be provided with justification including references to the relevant supporting documentation.

16. The UK Initiation Systems National Authority is the Defence OME Safety Regulator (DOSR) who have delegated Weapon Technical Services (WTS) Initiation Systems Team (IST) (DES-WpnsWTS-IS@mod.gov.uk) to undertake this role on their behalf.

17. The NATO IS STANAGs include requirements to engage with a National Authority to conduct the following:

a. Assessment and determination of compliance, qualification and/or characterisation of a product and/or a process to established standards.

b. Waiving and/or tailoring the requirements where alternative and/or equivalent acceptable evidence has been demonstrated.

c. Assessment and acceptance of design proposals.

d. Obtain and share compliance, qualification and/or characterisation assessments including any non-compliances and waivers from/with other NATO nations.

18. Any technical queries regarding initiation systems should be directed to WTS IST, or another demonstrably OME IS competent personnel/organisation.