5. SUMMARY OF REQUIREMENTS/CHECKLIST

5.1. COMMON

The tables on the following pages are to be used by the projects to manage compliance of the requirements.

When making presentations to FMV's advisory groups, the lists should be completed (see *Section 2.6*).

Whether a requirement is fulfilled or not, or if it is not applicable, is to be noted in the fulfilment column (Yes, No or Not applicable).

In the column "Remarks" it shall be noted as to how the requirement is fulfilled or why it is not applicable.

5.2. REQUIREMENTS IN CHAPTER 2 SAFETY ACTIVITIES AND REQUIREMENTS COMMON TO ALL EQUIPMENT

Section 2.1 Safety Activity Requirements

Req.no	Content	Fulfilled	Remarks
1.201.001 A	System safety requirements **shall** be specified in the Request for Proposal (RFP) in accordance with *Section 2.5*.		
1.201.002 A	For explosives, advice **shall** be obtained from FMV's Advisory Group for Explosives. See also *Section 2.6.3*.		
1.201.003 A	Advice from FMV's other advisory groups for ammunition safety **shall** be obtained when appropriate. See *Section 2.6*.		
1.201.004 A	Safety testing **shall** be performed by the supplier as part of the safety verification. See also *Section 2.7*.		
1.201.005 A	Test directives for safety inspections (part of the In-Service Surveillance of Ammunition) **shall** be produced in conjunction with the procurement. See also *Section 2.8* and the *FMV Handbok Ammunitionsövervakning (FMV H AmÖ)*[1].		

1 FMV Handbook of Regulations for In-Service Surveillance of Ammunition, (not available in English)

Req.no	Content	Fulfilled	Remarks
1.201.006 A	Supply classification data **shall** be provided and registered in current register.		
1.201.007 A	Draft handling, maintenance and user instructions **shall** be provided.		
1.201.008 A	Safety Statement **shall** always be submitted for ammunition		

Section 2.2 Requirements Common to all Equipment

Req.no	Content	Fulfilled	Remarks
1.202.001 T	Incorporated explosives **shall** be qualified in accordance with FSD 0214, STANAG 4170 or equivalent. *Comment:* Assessments relating to the scope of the qualification are carried out where appropriate by FMV's Advisory Group for Explosives, see *Section 2.6.3*.		
1.202.002 T	Incorporated materials **shall** be compatible so that the product remains safe during its lifetime. *Comment:* Incompatible materials are to be avoided even if their reaction products are harmless. During compatibility testing, all of the organic materials used in the explosives along with other safety critical components are often analysed. This applies to materials that are in direct contact with each other or that can be affected via exchange of gases or liquids.		
1.202.003 T	The product **shall** retain its safety properties for at least as long as its specified service life.		
1.202.004 T	Service life and compatibility testing **shall** be carried out in accordance with FSD 0223 or equivalent.		
1.202.005 T	Environmental requirements **shall** be specified as part of the procurement. The Defence Sector's criteria documentation **shall** be followed and any exceptions approved and documented.		

Req.no	Content	Fulfilled	Remarks
1.202.006 T	When procuring or modifying ammunition or explosive goods, information and/or reference materiel **shall** be procured so that ammunition surveillance monitoring according to *FMV FMV Handbok Ammunitionsövervakning (FMV H AmÖ)*[2] is made possible.		

Section 2.3 Requirements of International Law

Req.no	Content	Fulfilled	Remarks
1.203.001 A	Weapons and ammunition **shall not** be so designed that they violate applicable international law and conventions to which Sweden has acceded. *Comment:* Thus, there is a ban on weapons that have an indiscriminate effect, that unnecessarily aggravate suffering or cause unnecessary damage.		
1.203.002 A	Each project concerning the study, development, new acquisition or modification of weaponry or methods of warfare **shall** be reported to the Delegation for Supervision of Weapon Projects. *Comment:* Notification to the delegation must be carried out at an early stage and in cooperation with the Armed Forces.		
1.203.003 A	Booby traps that look like civilian utility goods, or which are marked with internationally recognised safety symbols, **shall not** be developed.		
1.203.004 A	Laser weapons mainly for use against people (anti-personnel laser weapons) **shall not** be developed.		
1.203.005 A	Weapons intended to poison **shall not** be developed.		
1.203.006 A	Incendiary weapons that have a non-discriminatory effect, or are mainly intended for anti-personnel use, **shall not** be developed.		

2 FMV Handbook of Regulations for In-Service Surveillance of Ammunition, (not available in English)

Req.no	Content	Fulfilled	Remarks
1.203.007 A	Weapons that are difficult to aim at a specific target **shall not** be developed. *Comment:* This requirement applies, among other things, to weapons used for carpet bombing.		
1.203.008 A	Weapons that may cause extensive, long-term, severe damage to the natural environment **shall not** be developed.		
1.203.009 A	High explosive shells designed primarily for anti-personnel purposes **shall** have a minimum weight of 400 grams.		
1.203.010 A	Mines **shall not** be designed to be of similar appearance to civil utility goods, neither may they be marked with internationally recognised safety symbols.		
1.203.011 A	Bullets **shall not** be easily expanded or flattened in the human body.		
1.203.012 A	Bullets **shall** have a full metal jacket and not have notches (compare dum-dum bullets).		

5.3. Requirements in Chapter 3 Weapons

Section 3.1.1 Danger Area

Req.no	Content	Fulfilled	Remarks
1.301.001 T	Based on analysis and testing, an assessment of the danger area for all current combinations of weapons, ammunition, and firing procedures **shall** be determined. *Comment:* Refer also to the relevant hazard, e.g. blast pressure, fragmentation, toxic substances.		

Section 3.1.2 Safety of friendly forces

Req.no	Content	Fulfilled	Remarks
1.301.002 T	There **shall** be an emergency stop function for laying and firing when the ordinary stop function is not sufficient to prevent injury to a person or damage to property. *Comment:* Compare standard SS-EN ISO 13850:2008.		
1.301.003 T	The emergency stop function for laying and firing should be designed and operate in such a way that the energy source can be disconnected.		
1.301.004 T	The emergency stop function for laying and firing should be located as close to the energy source as possible.		
1.301.005 T	It **shall** be possible to unload a loaded weapon (the removal of the ammunition from the chamber, magazine and equivalent. *Comment:* Some disposable weapons are not possible to unload.		
1.301.006 T	It should be possible to manually override automatic functions.		
1.301.007 T	It **shall** be possible for gun crews to wear specified equipment while at their operator station. *Comment:* Such equipment may comprise personal protective clothing such as gloves, a helmet, eye protectors (e.g. protective mask, anti-laser goggles) and CRBN protective clothing.		
1.301.008 T	Monitors/VDUs should be designed to enable them to be viewed with existing lighting, even outdoors in direct sunlight or in darkness.		
1.301.009 T	Symbols and texts on switches and other controls **shall** be legible and unambiguous in accordance with applicable standards.		
1.301.010 T	In weapon systems where several operators can fire the weapon, it **shall** be possible for each operator to render the weapon safe independently.		

Req.no	Content	Fulfilled	Remarks
1.301.011 T	Steps and footholds **shall** be fitted with appropriate anti-slip surfaces.		
1.301.012 T	Locking devices **shall** be provided to ensure that heavier hatches and doors remain in the open position, see also requirements *1.303.023 T* and *1.303.024 T*.		
1.301.013 T	Ventilation and heating/air conditioning systems should be incorporated if applicable.		
1.301.014 T	A safe separation distance **shall** be established for all relevant types of ammunition in the most unfavourable firing conditions. *Comment:* Protective features on the weapon are to be taken into consideration, compare requirement *1.401.028 T*.		
1.301.015 T	The firing mechanism **shall** have a transport safety device.		
1.301.016 T	Firing system **shall** have a safety device for the transport and operating phases.		
1.301.017 T	It **shall** be possible to render the system safe to prevent inadvertent firing during loading/unloading and during transport of the system. *Comment:* For example, it must be possible to reassemble a transport safety device.		
1.301.018 T	The necessity of using a specific stance when firing a weapon **shall** be documented in the Safety Restrictions.		
1.301.019 T	When fitting external equipment onto the weapon, consideration **shall** be given to the effect of possible muzzle blast.		
1.301.020 T	Muzzle blast **shall not** cause injury to the gunner.		
1.301.021 T	The weapon should not produce such a muzzle blast that personal protective equipment is required for the crew.		

Section 3.1.3 Toxic substances

Req.no	Content	Fulfilled	Remarks
1.301.022 T	The concentration of hazardous substances, such as air pollutants, **shall** be lower than the permissible values stated in AFS – Hygienic limit values.		
1.301.023 T	Emissions during firing **shall** be documented. *Comment:* The information provides a basis for assessing how users can be exposed to chemical substances and relates to the requirements in AFS – Hygienic limit values.		
1.301.024 T	Requirement *1.301.022 T* **shall** be verified for the worst possible firing conditions and at field conditions.		

Section 3.1.4 Electrical and magnetic fields

Req.no	Content	Fulfilled	Remarks
1.301.025 T	The susceptibility of electrical circuits to interference **shall** be analysed with regard to safety.		
1.301.026 T	The levels of electrical and magnetic fields to which the crew and equipment are subjected **shall** be determined.		

Section 3.1.5 Robustness to extreme climatic conditions

Req.no	Content	Fulfilled	Remarks
1.301.027 T	Weapons **shall** be verified from a safety point of view for the climate zones stated in the specification for the system. *Comment:* Stricter requirements normally apply to safety than to requirements specified for function. For data on climate, see NATO AECTP 230.		
1.301.028 T	The design of weapons and ammunition **shall** be formulated in a way that handling is possible also when operators are wearing protective clothing and using other equipment.		

Section 3.1.6 Fire

Req.no	Content	Fulfilled	Remarks
1.301.029 T	In the event of fire in a weapon platform or in equipment (ammunition or other) stowed in a confined space the crew should be protected by specific design measures and/or escape routes.		

Section 3.1.7 Sound pressure

Req.no	Content	Fulfilled	Remarks
1.301.030 T	The sound pressure level **shall** be determined for the personnel concerned. Measurements **shall** be carried out in accordance with the Armed Forces' regulations for the measurement of impulse noise from weapons and blasting in open areas as well as in built-up areas in accordance with Armed Forces' regulations. The results of measurements form the basis for the type of personal protective equipment required and the number of exposures (rounds) the crew concerned may be subjected to over a specified period of time. *Comment:* Regulations in accordance with HKV document ref. FM2019-25521:1 dated 2019-12-05 or equivalent replacements. The Swedish Armed Forces is conducting continuous work in this area; regulations will therefore most probably be updated. On this basis, checks have to be made to ensure that current regulations are applied. Proposals for requirements for the acquisition of new technical systems and for modification of existing systems are stated in the design rule "Requirements for sound levels and sound quality in technical systems", 14FMV10020-65: 1, 2018-12-06.		
1.301.031 T	The use of protective devices and the location of the crew relative to the launcher **shall** be stated in the Safety Instructions.		

Section 3.1.8 Back blast

Req.no	Content	Fulfilled	Remarks
1.301.032 T	The back blast (propellant gases and unexpended gunpowder) from the muzzle brake or equivalent via the rear opening during firing **shall not** have such high particle and energy content that it can cause injury to personnel or damage to equipment outside the specified danger area.		
1.301.033 T	Requirement *1.301.032 T* **shall** be verified by calculation and testing.		

Section 3.1.9 Vibration dose

Req.no	Content	Fulfilled	Remarks
1.301.034 T	Personnel **shall not** be exposed to a harmful vibration dose. *Comment:* Commonly used requirements for exposure to body vibration are stated in AFS 2005:15.		

Section 3.1.10 Pressure

Req.no	Content	Fulfilled	Remarks
1.301.035 T	When establishing the dimensions and design of the barrel, breech mechanism and other parts ex-posed to pressure, the pressure definitions and procedures stated in STANAG 4110 or equivalent standard **shall** be applied.		

Section 3.1.11 Spring forces

Req.no	Content	Fulfilled	Remarks
1.301.036 T	It **shall** be possible to determine whether a spring contains stored energy.		
1.301.037 T	Spring forces that alone, or in combination with other hazards, can result in an accident **shall** be analysed.		

Req.no	Content	Fulfilled	Remarks
1.301.038 T	Spring forces that can cause an accident **shall** either be provided with double locking devices or protective covers that prevent inadvertent release of the spring forces.		
1.301.039 T	Any spring that constitutes a component in a locking device which, in the event of malfunction, can cause injury, **shall** be analysed with regard to failure modes and characterised.		
1.301.040 T	Fastening elements **shall** be analysed with regard to failure modes and characterised together with the spring.		
1.301.041 T	The characteristics, according to requirements *1.301.039 T* and *1.301.040 T*, **shall** be maintained between inspection intervals for preventive maintenance purposes, so that safety is not impaired.		
1.301.042 T	Springs and their attachment elements that can affect safety **shall** be protected so that inadvertent contact by personnel or the environment around the system does not degrade their safety.		
1.301.043 T	Springs and their attachment elements that can cause a serious injury in the event of malfunction should have a duplicate (redundant) function or have a fail-safe function.		

Section 3.1.12 Hydraulic and pneumatic forces

Req.no	Content	Fulfilled	Remarks
1.301.044 T	It **shall** be possible to determine whether a hydraulic or pneumatic design contains stored energy.		
1.301.045 T	Accumulated pressure **shall** be monitored and equipped with a device for pressure equalisation if inadvertent actuation in the system can lead to injury during operation, unloading and/or maintenance.		

Req.no	Content	Fulfilled	Remarks
1.301.046 T	Monitoring as specified in requirement *1.301.045 T* should be duplicated (instrument and control lamp) or have a fail-safe function.		
1.301.047 T	Hydraulic hoses and components should be located outside confined crew compartments.		
1.301.048 T	Hydraulic fluid should be prevented from penetrating into crew compartments.		

Section 3.1.13 Recoil forces

Req.no	Content	Fulfilled	Remarks
1.301.049 T	The danger area around recoiling and recoilless systems **shall** be determined and specified in the Safety Instructions (SI). *Comment:* The actions of the gun crew in all situations (emergency firing, unloading, etc.) are to be considered.		
1.301.050 T	If overpressure can occur in the recoil brake and recuperator hence constituting a hazard, they **shall** be equipped with a device for relieving the pressure before disassembly.		
1.301.051 T	The recoil forces in a recoilless system **shall** be determined by calculation and testing.		

Section 3.1.14 Other forces

Req.no	Content	Fulfilled	Remarks
1.301.052 T	Rotating and other moving parts should be located so as to minimise the risk of injury. *Comment:* This requirement can be satisfied by the provision of safety guards or by preventing the presence of personnel inside the danger area.		
1.301.053 T	It **shall not** be possible for loading devices to be controlled by anyone other than the person performing the loading.		

Req.no	Content	Fulfilled	Remarks
1.301.054 T	Crew **shall** be protected against the ejection of empty cartridge cases.		

Section 3.1.15 Lasers

Req.no	Content	Fulfilled	Remarks
1.301.055 T	The laser should be equipped with a device to ensure that it is not activated in unintentional high power mode, as the power of the laser is so high that it is justified.		
1.301.056 T	It should be possible to equip high power lasers with optical attenuators.		
1.301.057 T	Lasers with higher class than laser class 1 **shall** be equipped with warning sign. *Comment:* For lasers with physical dimensions that make marking with a warning sign impossible, the warning text must be presented in the instruction manual and marking must be done on the laser's packaging.		
1.301.058 T	Sights, prism windows etc. should either have built-in laser protection filters or be designed in such a way that it allows the operators to wear laser safety goggles.		
1.301.059 T	New lasers **shall** be delivered with a classification certificate. *Comment:* The classification is based on requirements from AFS 2009:7 with current updates and SSMFS 2014:04. Competence that ensures that classification is carried out can be found within FMV.		

Section 3.1.16 Mechanical stability

Req.no	Content	Fulfilled	Remarks
1.301.060 T	The stability of the chassis, platform, controls, eyepiece, launcher etc. **shall** be such that there is adequate stability during firing.		

Req.no	Content	Fulfilled	Remarks
1.301.061 T	It **shall** be possible to secure doors and hatches in the closed and open position.		
1.301.062 T	Weapons/weapon platforms **shall** be designed so that stowed equipment and ammunition cannot move or be dislodged from their designated places during use. *Comment:* Requirements regarding resistance to mine shock are to be taken into account.		

Section 3.1.17 Transport

Req.no	Content	Fulfilled	Remarks
1.301.063 T	Racks and bins **shall** be designed so that the environmental impact during transport and movement **shall not** exceed the specified robustness of the ammunition.		

Section 3.2.1 Weapon installation

Req.no	Content	Fulfilled	Remarks
1.302.001 T	Launchers controlled by electronics systems **shall** meet the requirements that apply to electronics and software-controlled subsystems in *Section 4.4.5* and in accordance with relevant requirements in *H ProgSäk*. *Comment*: See also the requirements for ignition systems for propulsion devices in *Section 4.4.8.9*.		
1.302.002 T	Clearance between the elevating system and other parts at maximum recoil within the entire laying range in traverse and elevation **shall** be sufficient to prevent damage to the system.		
1.302.003 T	Protective barriers and covers should be fitted to prevent crew members from being injured by moving system parts (i.e. within the range of movement of the recoil system, etc). *Comment:* "Dangerous area" is to be marked.		

Section 3.2.2 Breech mechanisms

Req.no	Content	Fulfilled	Remarks
1.302.004 T	It **shall** be possible to operate the breech mechanism from outside the zone of motion of the recoil system to prevent injury to crew members by squeezing.		
1.302.005 T	When the breech mechanism is fully closed it **shall** be locked in its position.		
1.302.006 T	The breech mechanism **shall not** open as a result of vibration caused by firing or motion/transport.		
1.302.007 T	It should not be possible to assemble any component of the breech mechanism in an incorrect manner that could cause injury/damage or lead to an unsafe condition.		

Req.no	Content	Fulfilled	Remarks
1.302.008 T	When the breech mechanism is operated automatically the firing mechanism **shall** automatically become inactive before the breech mechanism is released from its locked position.		
1.302.009 T	It **shall** be possible to indicate or observe the status of the breech mechanism.		
1.302.010 T	It **shall not** be possible to fire the weapon if the breech mechanism is not fully closed.		

Section 3.2.3 Firing mechanism

Req.no	Content	Fulfilled	Remarks
1.302.011 T	It **shall** be possible to make the firing mechanism safe from outside the zone of motion of the recoil system.		
1.302.012 T	The weapon **shall** be fired by an active operation from outside the zone of motion of the recoil system.		
1.302.013 T	If an electromechanical device is used it **shall** be protected from radiated or conducted interference that could cause unintentional firing of the system.		
1.302.014 T	If firing button, pedal, lever or similar device is employed it **shall** be provided with protection against inadvertent operation such as by a trigger guard.		
1.302.015 T	Electrical firing systems **shall not** be susceptible to radiated or conducted interference generated by other electrical installations within the weapon system, or from external sources of interference (radio, radar etc.) that could result in inadvertent firing of the system.		
1.302.016 T	The firing system should be designed in such a way that the electrical connector does not make contact with the base connector of the artillery primer until intended firing.		

Req.no	Content	Fulfilled	Remarks
1.302.017 T	There should be at least one mechanical safety device that directly prevents the striker from actuating. This feature should not be a part of the firing linkage.		
1.302.018 T	There **shall** be a separate manually operated safety switch that breaks the electrical firing circuit.		
1.302.019 T	The safety switch specified in requirement *1.302.018 T* **shall** be located outside the zone of operation of the recoil system.		
1.302.020 T	The safety switch specified in requirement *1.302.018 T* **shall** be marked with actual position/mode such as: S for safe, P for single round, and A for automatic fire.		

Section 3.2.4 Breech ring

Req.no	Content	Fulfilled	Remarks
1.302.021 T	For a given load profile, the life of the breech ring **shall** be established by calculation and material testing.		

Section 3.2.5 Obturation

Req.no	Content	Fulfilled	Remarks
1.302.022 T	Obturation **shall** be designed to ensure that the crew is not exposed to either hot gases or harmful concentrations of toxic fumes.		

Section 3.2.6 Secondary combustion

Req.no	Content	Fulfilled	Remarks
1.302.023 T	Secondary combustion, which may cause injury to personnel, **shall not** occur.		

Section 3.2.7 Barrel wear

Req.no	Content	Fulfilled	Remarks
1.302.024 T	The barrel **shall not** constitute an increased risk (such as by imparting extra stress on ammunition or incorrect trajectory) when the ammunition in question is fired in either a new or worn barrel. *Comment:* A barrel is defined as worn when it has less than 25% left of its total service life.		
1.302.025 T	Requirement *1.302.024 T* **shall** be verified by testing.		

Section 3.2.8 Barrel fatigue

Req.no	Content	Fulfilled	Remarks
1.302.026 T	Fatigue life span **shall** be determined and verified. Theoretical calculations may be used. *Comment*: See STANAG 4516 and STANAG 4517.		

Section 3.2.9 Barrel rupture

Req.no	Content	Fulfilled	Remarks
1.302.027 T	The barrel **shall not** rupture when firing with a specified amount of snow, sand or gravel in the barrel.		
1.302.028 T	Requirement *1.302.027 T* should be verified by testing. *Comment:* The requirement applies primarily to small-calibre weapons but if the system is used in such a way that there is a high probability that foreign matter may enter the barrel it may also apply to larger calibre weapons. Testing is performed by filling the barrel with various quantities of sand and gravel to determine the durability of the weapon.		

Section 3.2.10 Cook-off

Req.no	Content	Fulfilled	Remarks
1.302.029 T	Cook-off **shall not** occur during the maximum specified fire engagement in combination with jamming involving rammed ammunition. *Comment:* Refer also to requirements *1.401.020 T*, *1.402.011 T* and *1.403.019 T*.		
1.302.030 T	To determine the risk of cook-off, the temperature and heat flux etc. for a hot barrel **shall** be established. *Comment:* The Safety Restrictions must state the permitted rate of fire, the permitted number of rounds per salvo, and/or the permitted duration for fire. If different types of ammunition are used in the weapon, this should be taken into account in the test. Refer also to requirement *1.401.019 T*.		

Section 3.2.12 Muzzle brakes, flame guards and recoil amplifiers

Req.no	Content	Fulfilled	Remarks
1.302.031 T	The muzzle brake should prevent rearward ricochets of driving bands, sabots, obturators, etc.		
1.302.032 T	During modification in the design, or new development, of ammunition or weapons relating to driving bands, sabots, obturators, jackets etc., or in the event of changed rifling pitch in the barrel or a new muzzle brake, testing **shall** be performed to determine the occurrence of fragmentation.		

Section 3.2.13 Muzzle flash

Req.no	Content	Fulfilled	Remarks
1.302.033 T	When fitting external equipment onto the weapon or weapon platform, consideration **shall** be given to the effect of possible muzzle flash.		

Section 3.2.14 Sub-calibre barrels

Req.no	Content	Fulfilled	Remarks
1.302.034 T	Applicable requirements stated in *avsnitt 3.2.7–3.2.10* above **shall** apply.		
1.302.035 T	It **shall not** be possible for a correctly fitted sub-calibre barrel to detach during firing.		
1.302.036 T	It **shall** be possible to inspect a sub-calibre barrel for cracks and other defects.		
1.302.037 T	Sub-calibre barrels **shall not** produce different levels of stress on ammunition, if the barrel length of the practice weapon differs from its original design. *Comment:* If, for example, a sub-calibre barrel is longer than a standard barrel, other acceleration and spin stresses may arise. It must be determined whether the ammunition is designed for such stresses.		
1.302.038 T	Requirements *1.302.035 T* and *1.302.037 T* **shall** be verified by test firing using the actual propelling charges and types of ammunition.		

Section 3.2.15 Ramming

Req.no	Content	Fulfilled	Remarks
1.302.039 T	The rammer should be provided with safety devices that prevent injury to personnel.		
1.302.040 T	The ramming environment for the weapon in question **shall** be verified by testing. Testing **shall** also be performed at the extreme temperatures that are specified as a basis for the requirements of the ammunition. *Comment:* Compare requirement *1.404.037 T*.		
1.302.041 T	During driving in terrain in accordance with specified conditions, the ammunition should not fall back from the rammed position. *Comment:* This requirement should be verified by testing with a barrel that has 50% or less of its service life remaining in terms of wear.		

Req.no	Content	Fulfilled	Remarks
1.302.042 T	The system should withstand rounds being fired with ammunition that is not rammed in a correct manner (i.e. in fall-back position). *Comment:* Gas leakage around the ammunition can damage both the ammunition and the barrel. Compare requirement *1.401.015 T*.		

Section 3.2.16 Recoil brakes

Req.no	Content	Fulfilled	Remarks
1.302.043 T	The system **shall** be designed so that the static pressure of the recoil buffer is retained.		
1.302.044 T	Leakage of recoil buffer fluid and gas should be minimised.		
1.302.045 T	The design of the recoil brake **shall** be of such type, quality and dimension that the required safety margin against exceeding the maximum permitted recoil stress exists in all specified environments.		
1.302.046 T	Maximum recoil stresses **shall** be verified.		
1.302.047 T	Forced recoil equipment **shall** withstand recoil forces with a safety margin.		
1.302.048 T	If gas dampers are included in the recoil system, there **shall** be indication for recoil brake pressure. *Comment:* The requirement refers to, among other things, inspection before shooting and preparation for maintenance.		

Section 3.2.17 Composite and compound barrels

Req.no	Content	Fulfilled	Remarks
1.302.049 T	When designing non-metallic and compound barrels, consideration **shall** be given to expected changes over time of material properties.		

Req.no	Content	Fulfilled	Remarks
1.302.050 T	When designing fastening of external parts onto non-metallic barrels, consideration should be given to the influence of mountings that are permanently attached for example by winding, so that elongation properties are not negatively affected.		

Section 3.2.18 Recoilless weapons and rocket systems

Req.no	Content	Fulfilled	Remarks
1.302.051 T	Applicable requirements stated in *Section 3.2.3* above **shall** apply.		
1.302.052 T	Any residual recoil for recoilless launch tubes and rocket systems should be directed rearwards.		
1.302.053 T	Recoil forces **shall** be established. This can be carried out by means of calculation and/or testing.		
1.302.054 T	Back blast from a recoilless weapon, rocket or missile motor **shall not** cause injury to the operator/crew.		
1.302.055 T	Requirement *1.302.054 T* **shall** be verified by testing.		

Section 3.3.1 Minelayers for anti-tank mines

Req.no	Content	Fulfilled	Remarks
1.303.001 T	If the minelayer arms the mine via a mechanical device it **shall** be equipped with an automatic monitoring system.		
1.303.002 T	A monitoring system as specified in requirement *1.303.001 T*, **shall** emit both a light and sound signal when a mine becomes jammed in the minelayer. The alarm **shall** be reset manually.		
1.303.003 T	A minelayer that mechanically arms the mine **shall** enable access to a mine that becomes jammed without the necessity for the use of any tools.		
1.303.004 T	It **shall** be possible to decouple a minelayer that mechanically arms the mine from the towing vehicle to enable personnel and the towing vehicle to be moved out of the danger area of the mine within the duration of the safety delay including a safety margin. *Comment:* If the above safety delay is 5+1 minutes it should be possible to decouple the minelayer from the towing vehicle and to move the personnel (with vehicle) outside the mine's danger area within two minutes.		
1.303.005 T	The minelayer should be designed so as to minimise the risk of a mine becoming jammed during laying. *Comment:* The shape of the mine should also be taken into consideration.		

Section 3.3.2 Launching equipment for underwater mines/depth charges

Req.no	Content	Fulfilled	Remarks
1.303.006 T	The launching equipment **shall not** arm the mine before the mine leaves the mine laying device.		

Req.no	Content	Fulfilled	Remarks
1.303.007 T	The launching equipment **shall** be designed so that the mine cannot jam during launch. *Comment:* The configuration of the mine is also to be taken into account, see requirement *1.401.027 T*.		
1.303.008 T	For self-propelled mines and torpedo mines that are launched or dropped from surface vessels, submarines or helicopters, requirements in accordance with *Section 3.3.3*, launching devices for torpedoes and *Section 3.3.4*, beams and shovels **shall** apply.		

Section 3.3.3 Launch devices for torpedoes

Req.no	Content	Fulfilled	Remarks
1.303.009 T	Torpedo tubes **shall** be equipped with sensors that indicate that the torpedo has left the tube after it has been launched.		
1.303.010 T	Torpedo tubes **shall** be so designed that the torpedo cannot jam on its way out of the tube or in the torpedo room of submarines. *Comment:* The design of the torpedo is also to be taken into account.		
1.303.011 T	It **shall not** be possible for the testing of a launcher to cause inadvertent launch. *Comment:* The test system is normally separated from the launch system.		
1.303.012 T	Power up (such as at system check, simulation or before launch) of a torpedo **shall not** lead to inadvertent launch.		
1.303.013 T	For torpedoes incorporating hydrogen peroxide, the torpedo tubes and standby storage **shall** be equipped with a draining system connected to the hydrogen peroxide system of the torpedo.		

Req.no	Content	Fulfilled	Remarks
1.303.014 T	Material and components used in the drainage system **shall** be chosen so that they are compatible with highly concentrated hydrogen peroxide. *Comment:* See instructions and requirements in HANDBOK VÄTEPEROXID, M7780-252981.		
1.303.015 T	The drainage system **shall** be designed for the maximum number of torpedoes used on board. *Comment:* When designing/dimensioning drainage systems on board submarines, the probability of abnormal decay of VP85 must be taken into account. See also instructions and requirements in HANDBOK VÄTEPEROXID, M7780-2529811.		
1.303.016 T	In an emergency situation, it **shall** be possible to jettison the torpedoes from a helicopter, emergency launch from a surface vessel and emergency launch with the use of a separate back-up firing panel from a submarine.		
1.303.017 T	For torpedoes, requirements *1.302.001 T* and *1.302.018 T* **shall** apply.		

Section 3.3.4 Launchers and pylons

Req.no	Content	Fulfilled	Remarks
1.303.018 T	A pylon/launcher **shall** enable a transport safety device in the form of an indicator or equivalent to be clearly visible while the munition is in transport safe mode.		
1.303.019 T	A pylon/ launcher as specified in requirement *1.303.018 T* should enable the transport safety device to be carried together with the munition. *Comment:* This enables replacement of the transport safety device if the aircraft lands at a different site from the ammunition preparation site.		
1.303.020 T	Pylons/launchers **shall** enable separation of the weapon system or munition in such a way that there is no risk of collision with weapon platforms. *Comment:* This includes incorrect manoeuvring of the ammunition.		

Section 3.3.5 Weapon platforms

Req.no	Content	Fulfilled	Remarks
1.303.021 T	The platform **shall** satisfy applicable traffic regulations for civil and military use. *Comment:* Dispensation may be given.		
1.303.022 T	Sound pressure from the launch/firing **shall** be acceptable for the crew. Verification is required, see *Section 3.1.7*.		

Section 3.3.6 Openings/hatches and doors

Req.no	Content	Fulfilled	Remarks
1.303.023 T	The locking/bolt mechanism **shall** be designed to withstand the stresses arising during operational use.		
1.303.024 T	The locking/bolt mechanism should be accessible and manoeuvrable from both inside and outside.		
1.303.025 T	Locks on hatches and doors should be manoeuvrable by crew wearing regulated personal protective equipment at all extreme temperatures.		

Section 3.3.7 Sights and aiming systems

Req.no	Content	Fulfilled	Remarks
1.303.026 T	There **shall** be devices to prevent the armament being aimed or fired in prohibited directions such as towards fixed obstacles. *Comment:* During maintenance, it is permissible to aim in prohibited directions.		

Section 3.3.8 Guidance and control systems

Req.no	Content	Fulfilled	Remarks
1.303.027 T	Sources of radiation aimed at the launch unit from the guided weapon/munition should be so designed that they do not require any danger zones at the launch unit.		
1.303.028 T	Sources of radiation for guidance that can have a dangerous effect **shall** be indicated to the operator when transmission is in progress.		
1.303.029 T	During exercises the indication specified in requirement *1.303.028 T* should also be visible to anyone anywhere in the vicinity.		
1.303.030 T	It **shall not** be possible for guidance signals to the weapon/munition to initiate motor or warhead igniters.		
1.303.031 T	The guided weapon/munition should incorporate a function which, in the event of a target miss, or if a malfunction is detected which definitively precludes effect in the target, renders the weapon safe. *Comment:* This can be achieved, for example, by self-neutralisation, self-destruction, or sterilisation.		
1.303.032 T	There should be a system for function monitoring and fault detection for the guidance system. This may result in self-neutralisation or sterilisation of the weapon, etc.		
1.303.033 T	The guidance system **shall** be designed and documented in a way that enables a safety analysis to be performed.		
1.303.034 T[a]	The safety analysis **shall** be performed or audited by a party that is independent of the designer. *Comment:* Another department or special safety function within the same company may be considered as an independent party.		

Req.no	Content	Fulfilled	Remarks
1.303.035 T	All materials incorporated **shall** be selected and combined in such a way that effects detrimental to safety do not arise during the life of the guidance system, for example as a result of corrosion, ageing, chemical change or short-circuits.		
1.303.036 T	Data transfer between the weapon and fire control, both before and after launch, should conform to standardised communication protocols.		
1.303.037 T	Data transfer between the weapon and fire control, both before and after launch, **shall** be subject to function monitoring. *Comment:* Function monitoring can, for example, be by means of parity checking or a 'watch-dog' function.		

a. Please note that this requirement was given the wrong number (1.303.033 instead of 1.303.034) in the printed, Swedish version, July, 2020. However, this has been corrected in the digital edition and requirement checklist.

Section 3.4.1 Pressure vessels

Req.no	Content	Fulfilled	Remarks
1.304.001 T	Pressure vessels **shall** be type approved in accordance with the Swedish Work Environment Authority's regulations.		

Section 3.4.2 Lifting devices

Req.no	Content	Fulfilled	Remarks
1.304.002 T	Lifting devices intended for use in military equipment **shall** undergo a process similar to that of the CE marking. *Comment:* The process is the same as for CE marking of products according to EU directives, with the only difference that the products that follow the process are not marked with the letters "CE" on the product's nameplate. See also *H SystSäk*, the Machinery Directive, and AFS.		

Req.no	Content	Fulfilled	Remarks
1.304.003 T	The danger area for a lifting device **shall** be established and taken into consideration when formulating Safety Restrictions. *Comment:* The danger area is greater than the area immediately beneath a hanging load, for example.		

5.4. Requirements in Chapter 4 Ammunition

Section 4.1.1 Insensitive Munitions (IM)

Req.no	Content	Fulfilled	Remarks
1.401.001 A	During procurement, overhaul, or modernisation of ammunition for the Swedish Armed Forces, ammunition with sufficient IM properties **shall** be considered. *Comment:* The desired IM properties are to be assessed in each case with regard to the threat, the desired effect (performance), the risk of injury and cost. Requirements for IM properties are to be established in the Armed Forces' Operational Requirements (SMS).		
1.401.002 A	The potential threats that an ammunition item could be subjected to should be determined with the help of a THA (Threat Hazard Analysis) which covers all the phases in the service life of the munition. *Comment:* For each individual threat, it is necessary to identify what tests has to be conducted and the type of reactions that may be permitted in order to verify the desired level of insensitivity. The work is carried out in accordance with STANAG 4439 and AOP-39. If threats are detected which are not defined in STANAG 4439, these should also be addressed.		

Section 4.1.3 Batteries

Req.no	Content	Fulfilled	Remarks
1.401.003 T	When designing weapon systems or ammunition with batteries, hazards with regard to batteries **shall** be analysed and reported. *Comment:* Risk of injury due to high current and voltage levels, short circuit, leakage and more are to be taken into account.		
1.401.004 T	The structure and operating principle of batteries **shall** be reported, among other things, with regard to the constituent chemical substances and quantities thereof. *Comment:* Chemical substances in batteries can affect transport classification and the possibility of co-storage, as well as measures required by chemical legislation.		
1.401.005 T	Every project that intends to use batteries in a design **shall** get assurance from an accredited authority about the possibility of co-storage with explosive goods. *Comment:* In addition to risks with stored chemical energy, there may also be risks with leakage of battery electrolyte over time and compatibility problems with other substances, for example with explosive goods and risks of self-ignition.		
1.401.006 T	High temperatures generated by batteries in normal operation **shall** be considered and verified in the application where they are intended to operate. *Comment:* Placing batteries near explosive products can lead to hazard ignition of the explosive, poorly thermally protected cabling can lead to short circuits and more.		

Section 4.1.4 Chemical legislation and FMV's chemical management

Req.no	Content	Fulfilled	Remarks
1.401.007 A	With reference to the REACH Regulation (EC No 1907/2006), the supplier **shall** classify the ammunition as: a. a substance or mixture, or b. a combination of an article and a substance / mixture, or c. an article.		
1.401.008 A	Based on the classification of the ammunition according to requirement *1.401.007 A*, the supplier **shall** inform about how obligations imposed by the Reach regulation are handled, and submit such information or documentation that follows from imposed obligations. *Comment:* Documentation can, for example, be safety data sheets or substances included in the candidate list.		
1.401.009 T	With reference to the CLP Regulation (EC No 1272/2008), the ammunition **shall** be labeled in accordance with CLP, if the ammunition is covered by the aforementioned Regulation.		
1.401.010 A	Information on chemical substances included in the ammunition **shall** be documented as follows: 1. Chemical name of the substance 2. CAS number 3. Concentration (percentage by weight). *Comment:* The information is to be documented, for example in current register or in the appendix Environmental Plan to System Life Cycle Plan (SLCP).		

Req.no	Content	Fulfilled	Remarks
1.401.011 A	Information whether the ammunition contains a Candidate List substance, present in a concentration above 0.1% by weight, **shall** be documented. As a minimum, the name of the substance and CAS number for the substance in question **shall** be documented. *Comment:* The information is to be documented, for example in the Basic and Management Data or in the appendix Environmental Plan to System Life Cycle Plan (SLCP).		
1.401.012 A	Information whether the ammunition contains a substance included in Annex XIV to Reach **shall** be documented. If the substance included in Annex XIV requires an authorization for use, the supplier **shall** inform how the obligations imposed by the REACH Regulation are handled, when relevant. *Comment:* The information is to be documented, for example in current register or in the appendix Environmental Plan to System Life Cycle Plan (SLCP).		
1.401.013 A	Emissions to the surrounding environment in connection with the effects of the ammunition **shall** be mapped to a sufficient extent to support the needs of the Swedish Armed Forces. *Comment:* The information provides a basis for assessing the environmental impact on firing ranges, etc., which may have a bearing on the Swedish Armed Forces'/FMV's environmental permit.		

Section 4.1.5 Other ammunition common requirements

Req.no	Content	Fulfilled	Remarks
1.401.014 T	Data for assessment of the danger area **shall** be created for all combinations of launchers and ammunition. *Comment:* Data is created by analysis and tests, for example with respect to the danger area for lasers, shrapnel, thermal radiation, and sound pressure etc.		
1.401.015 T	The projectile and propelling charge **shall** be designed so that the projectile remains in the rammed position with the gun at maximum elevation without any special devices being needed on the gun. *Comment:* The above applies for ammunition where ramming is desirable. This is particularly important when the projectile and propelling charge are separated. See also *Section 3.2.15*.		
1.401.016 T	The function stated in requirement *1.401.015 T* **shall** be tested using a worn barrel. *Comment:* Refer to the definition of a worn barrel.		
1.401.017 T	Ammunition should be designed so that clearing/unloading can be performed in a safe manner by the crew operating the weapon. *Comment:* This also applies to clearing/unloading after an ammunition misfire.		
1.401.018 T	Verification of requirement *1.401.017 T* **shall** include testing of what forces can be permitted for the unloading tool in question. *Comment:* Testing also includes the force required to achieve clearing/unloading.		
1.401.019 T	To establish the risk of cook-off for the ammunition, the temperature/heat flux etc. for a barrel at its maximum operating temperature and for the shell **shall** be determined. Refer also to requirements *1.302.029 T* and *1.302.030 T*.		

Req.no	Content	Fulfilled	Remarks
1.401.020 T	Driving bands, casings or equivalent **shall** be designed so that they do not inadvertently disintegrate outside the barrel when firing.		
1.401.021 T	Sabots and separating driving bands **shall** be designed to ensure safe separation. *Comment:* The risk of sabot fragments and any change in projectile trajectory has to be considered.		
1.401.022 T	Driving bands, sabots, obturators, casings etc. should be designed so that no fragments are formed that can impact the muzzle brake (if fitted) and ricochet rearwards.		
1.401.023 T	Projectile **shall** be designed to achieve external ballistic stability in all permitted types of firing so that specified danger areas are still valid. *Comment:* Worn barrels, driving bands, fins etc. can affect external ballistics.		
1.401.024 T	Explosives incorporated in the ammunition **shall** be qualified in accordance with FSD 0214 or with applicable international standard, such as STANAG 4170. *Comment:* Assessments concerning the scope of qualification can be made by the Advisory Group for Explosives (Rg Expl), see *Section 2.6.3*.		
1.401.025 T	The ammunition should be able to withstand abnormal environments such as accidents or the effects of enemy fire so that together with the system's safety measures, it contributes by making the vulnerability of the system as low as possible. *Comment:* The above is to be based on the robustness of the ammunition and the protection level of the system. Compare STANAG 4439. See also *Section 4.1.1, Insensitive Munitions (IM)*.		
1.401.026 T	Torpedoes **shall** be designed so that they do not jam in launch tubes. Compare requirement *1.303.010 T*.		

Req.no	Content	Fulfilled	Remarks
1.401.027 T	Landmines, underwater mines and depth charges **shall** be designed so that they don't interfere with or get stucked in mine-laying equipment. Compare requirement *1.303.007 T*.		
1.401.028 T	The safe separation distance/time **shall** be established for the severest case of operational use. Refer also to requirements *1.301.014 T*, *1.402.021 T*, *1.403.007 T* and *1.404.014 T*.		
1.401.029 T	The design and the materials used in munition **shall** be chosen to enable the casing to withstand all stresses arising, including pressure in the barrel, without exceeding acceptable deformation. *Comment:* In the design of the ammunition the pressure definitions and procedures stated in STANAG 4110 are to be applied.		
1.401.030 T	Incorporated materials **shall** be compatible. *Comment:* See also requirement *1.202.002 T*.		

Section 4.2.2 Joint requirements for warheads

Req.no	Content	Fulfilled	Remarks
1.402.001 T	Warheads of CBRN type (chemical, biological, radioactive, or nuclear weapons) **shall not** be developed.		
1.402.002 T	Warheads, in which fuel is sprayed into the air and detonates owing to the oxygen in the air and where the main purpose is anti-personnel, should not be developed. *Comment:* Must meet requirements *1.203.001 A* and *1.203.006 A* regarding the prohibition of indiscriminate effect and firearms. May also produce effects equivalent to chemical weapons in cases where the gas is toxic and does not ignite, which is also prohibited, see requirement *1.402.001 T*.		
1.402.003 T	Warhead casings whose main effect is fragmentation **shall** be made of material that can be easily detected by X-ray.		

Req.no	Content	Fulfilled	Remarks
1.402.004 T	Multiple weapons and guided weapons shall be considered as several warheads and propulsion devices. Separation charges and guidance or trajectory correction motors **shall** be treated as propulsion devices.		
1.402.005 T	The design of and the materials used in the warhead **shall** be chosen to enable the casing to withstand all stresses arising, including pressure in the barrel, without exceeding acceptable deformation. *Comment:* Example of detailed requirements stipulated: Safety margin for deformation, freedom from cracks, overlaps, pores or incorrect heat treatment that can lead to hazardous events. With regard to pressure in the barrel, refer to *kapitel 3*.		
1.402.006 T	When tempered steel is used in the casing the material and heat treatment chosen **shall** be such that hydrogen embrittleness or other dangerous corrosion does not occur.		
1.402.007 T	The internal surface of the casing **shall** be smooth and clean. *Comment:* The warhead casing must be protected from moisture and foreign particles before casting/filling of the explosive.		
1.402.008 T	The design and composition of HE charge (High Explosive charge) and pyrotechnic charge **shall** be such that they can withstand all stresses arising without any risk of a hazardous event occurring. *Comment:* Testing is carried out in accordance with FSD 0060 or other relevant international standard. See also *Section 4.1.1, Insensitive Munitions (IM)*.		
1.402.009 T	The warhead **shall** be designed to avoid the presence of high explosive or pyrotechnic composition in threads or joints in such a quantity as to create a risk of inadvertent initiation when screwing components on or off or at launch or release.		

Req.no	Content	Fulfilled	Remarks
1.402.010 T	Requirements *1.402.008 T* and *1.402.009 T* **shall** be verified by testing. *Comment:* The parts in the warhead can be examined prior to testing by using X-ray, radiography, ultrasonic testing or other methods.		
1.402.011 T	The warhead **shall** not be susceptible to cook-off in the event of a misfire or interruption in firing when the barrel is at its maximum operating temperature for the operational profile in question. *Comment:* Refer also to requirements *1.302.029 T* and *1.403.019 T*.		
1.402.012 T	The melting point of the high explosive should be higher than the temperature reached by the ammunition in a barrel heated to its maximum operating temperature for the operational profile in question.		
1.402.013 T	The warhead in its application should not detonate in the event of fire. *Comment:* This requirement is part of the IM requirements defined in STANAG 4376. See also requirements *1.401.001 A* and *1.401.002 A*.		
1.402.014 T	Requirement *1.402.013 T* should be verified by testing.		
1.402.015 T	The warhead in its application should not detonate from bullet attack from small calibre ammunition. *Comment:* This requirement is part of the IM requirements defined in STANAG 4376. See also requirements *1.401.001 A* and *1.401.002 A*.		
1.402.016 T	Requirement *1.402.015 T* should be verified by testing.		
1.402.017 T	The design of the warhead **shall** facilitate upgrading, in-service surveillance and disposal.		
1.402.018 T	The possible identification and destruction of UXO (unexploded ammunition) **shall** be taken into account during the design of the warhead.		

Req.no	Content	Fulfilled	Remarks
1.402.019 T	The blast pressure from a detonating warhead **shall** be determined to be used to calculate the danger area. *Comment:* This applies, among other things, to hand grenades, thunder flashes and spotting charges. See also *Section 3.1.7*. For applications in underwater environments, see *FM Reglemente Sjösäkerhet vapen*; M7739-353134[a].		
1.402.020 A	Environmental aspects arising from manufacture, use and clearance of UXO (unexploded ammunition), recovery of target materiel, and disposal **shall** be taken into account. *Comment:* The information is documented in the appendix Environmental plan to System Life Cycle Plan (SLCP).		
1.402.021 T	A safe separation distance **shall** be established for all warheads, see also requirement *1.401.028 T*.		

a. Armed Forces´ Regulations for Maritime Safety Weapons

Section 4.2.3.1 Warheads containing High Explosive (HE)

Req.no	Content	Fulfilled	Remarks
1.402.022 T	If it is likely that the material from which the shell body is fabricated may contain pipes, a base plate or equivalent **shall** be employed and be attached in a satisfactory manner.		
1.402.023 T	When filling a shell body with high explosive it **shall** be ensured that unacceptable pipes, cavities, gaps or cracks do not occur and that required adhesion is achieved. *Comment:* The level of defects; quantity, size, etc., must be dealt with in each item according to the explosive chosen and environment specific requirements.		
1.402.024 T	Requirement *1.402.023 T* **shall** be verified by X-ray inspection, sawing the shell bodies, or by the use of bisectable shell bodies.		

Req.no	Content	Fulfilled	Remarks
1.402.025 T	Pressed shell bodies **shall** be free from explosive dust.		
1.402.026 T	Pressed explosive bodies **shall** keep the prescribed freedom from unacceptable defects such as cracks. When pressing explosive bodies, it **shall** be ensured that unacceptable defects (for example cracks) do not occur. *Comment:* Levels regarding defects, number, size and so on must be taken care of in each individual object with regard to the selected explosive and environment specific requirements.		
1.402.027 T	Any joints or splits in the hell body **shall** be satisfactorily sealed to prevent explosives in the joint/split and to prevent hot propellants from reaching the explosive.		
1.402.028 T	When installing a primary charge it **shall** be ensured that no cavity occurs that could cause inadvertent initiation.		
1.402.029 T	In shells equipped with an end screw or base fuze, the charge in the shell **shall** be well filled against the base of the shell.		
1.402.030 T	In shells fitted with a base-bleed unit, any uncontrolled base-bleed combustion **shall not** lead to deflagration or detonation of the warhead.		

Section 4.2.3.2 High explosive warheads for rockets and guided missile

Req.no	Content	Fulfilled	Remarks
1.402.031 T	The warhead casing should not consist of separate parts within the zone adjacent to the rocket motor in order to avoid gas leakage.		
1.402.032 T	The HE charge in the warhead should be protected from heat-generating components.		

Section 4.2.3.3 High explosive warheads for bombs

Req.no	Content	Fulfilled	Remarks
1.402.033 T	If the casing consists of separate parts, there **shall** be a sufficiently good seal to ensure that the ingress of moisture or the leakage of explosive does not occur.		
1.402.034 T	Where separated charges are used the intervening space **shall** be filled with an appropriate filler material.		

Section 4.2.3.4 High explosive warheads for land mines

Req.no	Content	Fulfilled	Remarks
1.402.035 T	If the casing consists of separate parts there **shall** be sealing to prevent the ingress of moisture.		
1.402.036 T	Metal casings **shall** be protected against corrosion.		

Section 4.2.3.5 Warheads containing high explosive for depth charges, underwater mines and torpedoes

Req.no	Content	Fulfilled	Remarks
1.402.037 T	If there is a risk of overpressure in the warhead it **shall** be possible to remove plugs or other seals without risk of injury to personnel, such as during in-service surveillance of ammunition.		
1.402.038 T	Fuzes that are installed from the outside **shall** form a seal with the casing or have a sealed seat/location.		
1.402.039 T	Metal casings **shall** be protected against corrosion internally and externally.		
1.402.040 T	Where separate charges are used, any intervening space **shall** be filled with an appropriate filler material.		

Req.no	Content	Fulfilled	Remarks
1.402.041 T	Explosives in warheads **shall**, when adequate sealing cannot be guaranteed, be compatible with surrounding media. *Comment:* This should be taken into account even if good sealing can be guarantee.		
1.402.042 T	Explosives in warheads should be easy to inspect with respect to environmental impact, such as moisture. *Comment:* This especially applies to ammunition that is intended to be used internationally and then returned to Sweden.		

Section 4.2.3.6 High explosive warheads for other ammunition

Req.no	Content	Fulfilled	Remarks
1.402.043 T	Ammunition should be such that co-storage and joint transportation with other types of ammunition are in accordance with IFTEX and the 'UN Recommendations on Transport of Dangerous Goods, Model Regulations' can be permitted. *Comment:* Choice of packaging can affect the classification.		

Section 4.2.4 Pyrotechnic warheads

Req.no	Content	Fulfilled	Remarks
1.402.044 T	Pyrotechnic ammunition should be designed and the compositions selected such that co-storage with other types of ammunition in accordance with IFTEX and the 'UN Recommendations on the Transport of Dangerous Goods, Model Regulations' can be permitted.		
1.402.045 T	The charge **shall** meet the prescribed moisture content.		
1.402.046 T	The charge **shall** meet the prescribed purity from foreign particles.		

Req.no	Content	Fulfilled	Remarks
1.402.047 T	The pyrotechnic composition used should have good storage stability.		
1.402.048 T	Compressed pellets **shall** meet the prescribed structural strength.		
1.402.049 T	Insulation adhesion **shall** meet the prescribed value.		
1.402.050 T	Requirement *1.402.049 T* **shall** be verified by testing, if necessary by destructive testing.		
1.402.051 T	Insulation **shall** be free from cracks, cavities and symmetry deviations.		
1.402.052 T	The charge casing **shall** be sealed.		

Section 4.2.4.1 Pyrotechnic warheads for tube-launched ammunition

Req.no	Content	Fulfilled	Remarks
1.402.053 T	The base of the shell **shall** be completely sealed against hot propellant gases, moisture etc. and against composition dust.		
1.402.054 T	At final assembly the charge **shall** have the correct moisture content. *Comment:* If necessary the charge may need to be dried before final assembly.		

Section 4.2.4.2 Pyrotechnic warheads for rockets and bombs

Req.no	Content	Fulfilled	Remarks
1.402.055 T	The dividing wall (partition) between the warhead and rocket motor **shall** be sealed and insulated so that ignition of the composition does not occur through the ingress of propellant gases or by heat transmission.		

Req.no	Content	Fulfilled	Remarks
1.402.056 T	At final assembly the charge **shall** have the correct moisture content. *Comment:* If necessary the charge may need to be dried before final assembly.		

Section 4.2.5 Other warheads

Req.no	Content	Fulfilled	Remarks
1.402.057 T	Applicable parts of the requirements specified for pyrotechnic charges in *Section 4.2.4* **shall** apply.		

Section 4.3.2 Joint requirements for launching and propulsion systems

Req.no	Content	Fulfilled	Remarks
1.403.001 T	The design of, and materials in, a propelling charge casing **shall** be selected so as to ensure that the casing resists all specified loads without exceeding the permissible deformation or stress.		
1.403.002 T	Adjacent materials, and materials in the propellant, **shall** be compatible. These materials may comprise internal protective paint, sealing agents, insulation materials, combustion catalysts, wear protectants, etc. Refer also to requirements *1.202.002 T*, *1.202.003 T* and *1.202.004 T*.		
1.403.003 T	When using hardened steel the material and heat treatment chosen **shall** be such that neither hydrogen brittleness nor detrimental corrosion occurs.		
1.403.004 T	The propelling charge **shall** be of a type, quality, and size to ensure that the required safety margin for permissible maximum pressure in all specified environments is not exceeded. *Comment:* The requirement applies to both tube-launched ammunition (limited by the strength of the barrel) and rocket motors (limited by the strength of the casing), see also the guideline text in the first paragraph in *Section 4.3*.		

Req.no	Content	Fulfilled	Remarks
1.403.005 T	The propulsion force development and pressure–time curves **shall** be reproducible within the stated requirement specification.		
1.403.006 T	Propelling charge should be designed to minimise fragments propelled rearwards from e.g. the base plate or nozzle plug.		
1.403.007 T	The safe separation distance/time **shall** be established for all propulsion systems for the most unfavourable operating conditions. Refer also to requirement *1.402.017 T*.		
1.403.008 T	Metal additives, if any, **shall not** be able to block the exhaust nozzle.		
1.403.009 T	The propelling charge casing **shall** be sealed as required.		
1.403.010 T	The propelling charge casing **shall** withstand handling throughout its service life.		
1.403.011 T	The composition of the propellant should be such that itself, its components and its combustion products are of minimal toxicity and have as little environmental impact as possible. This applies to manufacture, use, clearance of UXO and disposal. *Comment:* See also *Section 4.1.4*.		
1.403.012 T	The design should facilitate disassembly (e.g. for upgrading, in-service surveillance and disposal).		
1.403.013 T	The propulsion device in its tactical application should not detonate when subjected to the specified attack from bullets, fragments etc. *Comment:* This requirement is part of the IM requirements defined in STANAG 4439.		
1.403.014 T	Requirement *1.403.013 T* should be verified by testing.		
1.403.015 T	The propulsion device in its tactical application should not detonate if subjected to fire. *Comment:* Compare also general IM requirements.		

Req.no	Content	Fulfilled	Remarks
1.403.016 T	A fuel fire test should be performed to verify requirement *1.403.015 T*.		

Section 4.3.3 Propulsion devices in tube-launched ammunition

Req.no	Content	Fulfilled	Remarks
1.403.017 T	Within the permitted temperature range the propelling charge **shall** produce a pressure (MOP) that is lower than the permitted maximum value for the barrel and shell. *Comment:* In the design of the ammunition the pressure definitions and procedures stated in STANAG 4110 must be applied.		
1.403.018 T	For recoiling barrels the combustion of the propelling charge should be designed so that the charge has burnt out before the projectile exits the muzzle. This is to avoid giving rise to backflash/secondary combustion when the weapon's breach is opened.		
1.403.019 T	Maximum fire engagement with regard to the risk of cook-off when firing is interrupted for a barrel at its maximum operating temperature **shall** be determined. *Comment:* Refer also to requirement *1.302.029 T*.		
1.403.020 T	The cartridge case **shall** seal against the chamber seat so that unpermitted gas leakage does not occur.		
1.403.021 T	When using percussion caps in artillery primers etc., the impact surface **shall** be countersunk so that the risk for inadvertent initiation during use is minimised.		

Section 4.3.4.1 Solid propellant rocket motors and gas generators

Req.no	Content	Fulfilled	Remarks
1.403.022 T	Propulsion devices should be designed such that the pressure vessel does not burst or detonate as a result of the impact of shrapnel from fragment-forming ammunition (or equivalent). *Comment:* This requirement is part of the IM requirements defined in STANAG 4439.		
1.403.023 T	Propulsion devices should be designed such that if the pressure vessel bursts a minimum of dangerous fragments are formed.		
1.403.024 T	Propulsion devices **shall**, with regard given to transport and storage, be designed such that a specified fire does not cause uncontrolled flight.		
1.403.025 T	Propulsion devices containing propellants with metallic powder **shall** be analysed with regard to risks in the event of electrostatic charging.		

Section 4.3.4.2 Liquid propellant rocket engines and gas generators

Req.no	Content	Fulfilled	Remarks
1.403.026 T	Requirements *1.403.015 T, 1.403.016 T, 1.403.022 T* and *1.403.023 T* **shall** apply.		
1.403.027 T	The tank system **shall** be designed such that direct contact between propellants cannot occur inadvertently.		
1.403.028 T	Tanks for propellants **shall** have adequate space for the expansion of the liquids.		
1.403.029 T	Leakage of propellants **shall not** cause the engine to start.		
1.403.030 T	Leakage of propellants **shall not** cause the pressure vessel to burst.		

Section 4.3.4.3 Jet engines

Req.no	Content	Fulfilled	Remarks
1.403.031 T	Requirements *1.403.013 T*, *1.403.015 T*, *1.403.016 T* and *1.403.022 T* **shall** apply.		
1.403.032 T	The quantity and size of discarded parts (debris) at the start of ramjet function should be minimised.		
1.403.033 T	The number of components containing pyrotechnic or explosive charges should be minimised.		

Section 4.3.4.4 Ram rocket engines

Req.no	Content	Fulfilled	Remarks
1.403.034 T	Requirements *1.403.013 T*, *1.403.015 T*, *1.403.016 T*, *1.403.022 T*, 1.403.032 T and *1.403.033 T* **shall** apply as should requirement for ram rocket engines.		
1.403.035 T	Fire tests for verification of requirement *1.403.015 T* **shall** be carried out for ram rocket engines.		

Section 4.3.4.5 Propulsion devices for torpedoes , self-propelled mines, and torpedo mines

Req.no	Content	Fulfilled	Remarks
1.403.036 T	Requirements *1.403.005 T*, *1.403.015 T*, *1.403.016 T*, *1.403.022 T*, *1.403.023 T*, *1.403.027 T* and *1.403.028 T* **shall** all be applied as shall-requirements for torpedo systems.		
1.403.037 T	Water leakage or battery failure **shall not** lead to the inadvertent start of the torpedo.		
1.403.038 T	Torpedoes **shall** be designed in such a way that any inadvertent contact between battery acid and explosives does not occur.		
1.403.039 T	Short circuits which can lead to a battery explosion **shall not** be able to occur.		

Req.no	Content	Fulfilled	Remarks
1.403.040 T	Explosive gases formed during the self-discharge or charging of batteries **shall** be ventilated away and/or disposed of in order to avoid initialisation occurring.		

Section 4.3.4.6 Systems for highly concentrated hydrogen peroxide

Req.no	Content	Fulfilled	Remarks
1.403.041 T	Highly concentrated hydrogen peroxide (HTP) **shall** meet quality requirements and undergo regular inspections specified in *HANDBOK VÄTEPEROXID*, M7780-252981.		
1.403.042 T	HTP tanks **shall** be equipped with adequate relief and drainage devices.		
1.403.043 T	Materials in HTP tanks **shall not** contain catalytic substances that can lead to a reaction by HP.		
1.403.044 T	Spaces in buildings or on board vessels where HTP or HTP-filled torpedoes are handled or stored **shall** be designed in accordance with the instructions and requirements in *HANDBOK VÄTEPEROXID*, M7780-252981.		
1.403.045 T	Materials and components included in systems that store or consume HTP or handle the drainage of HTP **shall** be designed in accordance with the instructions and requirements in *HANDBOK VÄTEPEROXID*, M7780-252981.		
1.403.046 T	HTP **shall** meet quality requirements and undergo regular inspections specified in *HANDBOK VÄTEPEROXID*, M7780-252981.		

Section 4.4.2.1 Design requirements

Req.no	Content	Fulfilled	Remarks
1.404.001 T	Fuzing systems **shall** be designed to enable safety analysis to be performed.		

Req.no	Content	Fulfilled	Remarks
1.404.002 T	The safety level of the fuzing system should be specified numerically as a probability and should be verified by analysis. *Comment:* An analysis can be carried out with the help of the FTA (Fault Tree Analysis) and FMECA (Fault Modes, Effects and Criticality Analysis).		
1.404.003 T	Single failures that can lead to inadvertent initiation of explosives after the interrupter or circuit safety device within the arming distance/time **shall not** occur. *Comment:* For some applications, the requirement for redundancy to prevent inadvertent initiation can be resolved so that a system failure results in a fail-safe state.		
1.404.004 T	Explosive trains containing primary explosives or sensitive explosives (not approved for use after an interrupter) **shall** have at least one mechanical interrupter. Only explosives in accordance with requirement *1.404.005 T* are permitted after that interrupter. *Comment:* Refer also to requirements *1.404.142 T*, *1.404.143 T* and *1.404.144 T*.		
1.404.005 T	Explosives after the interrupter or for use in systems without an interrupter **shall** be qualified for such use as specified in FSD 0214 or STANAG 4170 or other relevant international standard.		
1.404.006 T	Fuzing systems should not contain stored energy, such as mechanical, pyrotechnical or electrical, for removing the interrupter towards an armed position in the explosive train. *Comment:* Energy for removing an interrupter can best be provided by some unique environmental factor after launch/release.		
1.404.007 T	Stored energy **shall not** be used for both disabling safety features and removing interrupters.		

Req.no	Content	Fulfilled	Remarks
1.404.008 T	The probability of inadvertent initiation of an explosive after the interrupter or circuit safety device **shall not** be higher than the probability for inadvertent arming. *Comment:* A failure must thus not lead to initiation unless all the steps normally required for arming have been completed.		
1.404.009 T	Encapsulation of the explosive train **shall** be designed such that hazard initiation of the explosive train before the interrupter while the interrupter is in unarmed mode does not lead to ejection of fragments or other effects that can cause injury or damage to personnel, property or the environment.		
1.404.010 T	Fuzing systems **shall** be designed and documented in such a manner as to facilitate an effective production control and quality inspection.		
1.404.011 T	All constituent materials **shall** be selected and combined such that no effects detrimental to safety occur during the life of the fuzing system, e.g. as a result of corrosion, mechanical fatigue, mutual interference, or insufficient chemical stability resulting in the formation of copper azide for example.		
1.404.012 T	All explosives **shall** be encapsulated and/or be fixed so that they remain intact when subjected to specified environmental severities.		
1.404.013 T	The initiator in the ignition system **shall not** inadvertently be triggered by a specific external environmental factor such as electrical, mechanical or climatic.		

Req.no	Content	Fulfilled	Remarks
1.404.014 T	The safe separation distance/time **shall** be established with regard to warhead effect and intended tactical use. Refer also to requirements *1.301.014 T* and *1.401.028 T*. *Comment:* Three different cases can be identified: a. The safe separation distance is so great that the risk to friendly forces is tolerable in the event of a burst occurring when that distance has been reached. No evasive action is assumed. b. The safe separation distance is shorter than in case a. above owing to tactical reasons. Evasive action or taking cover is assumed. c. The safe separation time is sufficiently long to allow for leaving the danger area. See definition of safety distance/time in *Appendix 1 Definitions*.		
1.404.015 T	Fuzing systems should be designed so that a failure in the system results in a fail-safe state. *Comment:* This requirement can lead to a degradation of any deactivation or self-destruction function.		
1.404.016 T	Fuzing systems should be designed such that incorrect assembly of safety-critical parts is not possible.		
1.404.017 T	The possibility of final assembly of, or installing, a fuzing system when armed **shall** be prevented. This is achieved when at least one of the following conditions are met. a. It **shall** be so designed that during manufacture it is not be possible to complete the assembly of an armed fuzing system. b. It **shall** be so designed that installing a fuzing system when armed on the ammunition is not possible. c. It **shall** be equipped with an indicator which clearly indicates whether the fuzing system is armed or safe. *Comment:* Arming may have occurred without being detected as a result of incorrect assembly during manufacture or maintenance, or because the SAI/SAU was not returned to its safe state after final testing.		

Req.no	Content	Fulfilled	Remarks
1.404.018 T	If there is a requirement for system testing after manufacture (AUR testing), functions for reliable testing **shall** be built into the fuzing system so that tests can be carried out in a safe manner.		
1.404.019 T	Fuzing systems **shall** be designed so that maintenance, upgrading, in-service surveillance, disposal and destruction can be carried out safely. *Comment:* Necessary instructions etc. for dismantling has to be prepared during the development work.		
1.404.020 T	The composition and integration of the booster should be such that it does not detonate or deflagrate before the main charge when subjected to heating (e.g. by fire).		
1.404.021 T	Well-proven components should be used.		
1.404.022 T	Arming **shall** occur, at the earliest, when the safe separation distance/time is reached.		
1.404.023 T	The arming process should be as simple as possible.		
1.404.024 T	The arming process should be functionally and physically separated from other processes in the system.		
1.404.025 T	Inadvertent arming **shall** be prevented by at least two mutually independent safety features. *Comment:* The safety features can be: a. mechanical safety features in an interrupter, b. mechanically operated electric switches, c. relays, d. semiconductor switches.		
1.404.026 T	If a system with only two safety features is used, both **shall** be mechanical.		

Section 4.4.2.2 Requirements regarding testing

Req.no	Content	Fulfilled	Remarks
1.404.027 T	Constituent components and subsystems that are vital to the safety of the fuzing system **shall** undergo separate safety qualification (type testing).		
1.404.028 T	Fuzing systems **shall** undergo safety qualification as specified in FSD 0213, STANAG 4157 or equivalent. *Comment:* Safety-critical functions should be monitored during testing and be inspected after testing.		
1.404.029 T	Testing **shall** be performed at a safety level at which arming is not permitted. *Comment:* Safety level, in this case, means the stress level which exceeds, by an acceptable margin, the most severe level reached during transport, operation, ramming or the firing/launch process. Testing is intended to verify requirement *1.404.037 T*. See also comment to requirement *1.404.039 T*.		
1.404.030 T	The choice of materials in a fuzing system **shall**, if it is considered necessary, be verified by testing that demonstrates with acceptable probability that no effects detrimental to safety occur during the life of the fuzing system. Refer also to requirements *1.202.002 T*, *1.202.003 T* and *1.202.004 T*.		
1.404.031 T	Testing **shall** be performed to demonstrate whether the design used for encapsulation of the explosives meets the stipulated requirements. *Comment:* With this testing, dimensions, compacting pressure and other properties are selected within their respective tolerance range such that the probability for failures is considered to be highest. Testing is to be performed in the environment (within the operating range of the fuzing system) that is considered to be the most unfavourable from a safety aspect.		

Req.no	Content	Fulfilled	Remarks
1.404.032 T	Testing **shall** be performed to verify that the fuzing system does not initiate within the safe separation distance/time owing to passage through mask, impact with the sea surface, contact with the seabed, broaching, or collision with objects. *Comment:* The concept of 'inherent safety' is used for torpedoes.		
1.404.033 T	Testing **shall** be performed to establish the distance or time from launch or equivalent at which the transmission safety feature arms. If there are other safety features in the explosive train, they **shall** be removed prior to testing.		
1.404.034 T	Testing **shall** be performed to verify that the fuzing system does not initiate in flight or after deployment after the arming process is completed as a result of the environmental stress specified in the requirement specification for the object. *Comment:* This requirement applies primarily to ammunition with a split danger area.		
1.404.035 T	Fuzing systems **shall** be designed to enable the required functional testing to be performed safely.		

Section 4.4.2.3 Requirements for systems with access to application-specific environmental factors

Req.no	Content	Fulfilled	Remarks
1.404.036 T	Fuzing systems should be designed so that safety is not dependent upon operating procedures.		
1.404.037 T	Arming **shall** only be possible during use. *Comment:* The lower limit for arming must exceed, by a good margin, the maximum stress level experienced during operation, transport and other relevant environmental conditions.		

Req.no	Content	Fulfilled	Remarks
1.404.038 T	Arming **shall** only take place if two mutually independent, application-specific, environmental conditions are satisfied, provided that reasonable such conditions are available. *Comment:* Examples are stated below of environmental conditions that can be used to activate arming and/or as sources for arming energy: a. acceleration, b. angular acceleration, c. spin, d. sensing of launching/mine-laying device (e.g. barrel bore-ride). This is not considered as a good condition, but may be accepted, e. dynamic pressure, f. drag (via a turbine or parachute for example), g. hydrodynamic and hydrostatic pressure, h. lanyards, i. back pressure. All conditions to be considered before the most suitable are selected.		
1.404.039 T	If only one realistic environmental condition is available, or two dependent conditions, there **shall** be at least one manual operation (such as removal of a safety pin) required for arming prior to loading/launching. *Comment:* When safety relies entirely on one environmental condition after the manual operation has been performed, a major effort must be made to verify practically and theoretically that this condition cannot occur inadvertently after the manual operation, such as if a shell is dropped during loading.		
1.404.040 T	A manual operation or safety pin **shall** also block the function controlled by the only available environmental condition.		
1.404.041 T	At least one of the safety features **shall** lock the interrupter during the arming phase until the munition has left the launcher/laying device.		

Req.no	Content	Fulfilled	Remarks
1.404.042 T	In systems with one or more unique application-specific environmental conditions available, at least one of these **shall** be used. At least one of the safety features **shall** be removed after the launcher/release device has been cleared and the safe separation distance has been reached.		

Section 4.4.2.4§Requirements for systems without access to unique application-specific environmental factors

Req.no	Content	Fulfilled	Remarks
1.404.043 T	If a fuzing system requires human intervention to start the arming process, there **shall** be a device that provides unambiguous indication of whether the system is in the safe state.		
1.404.044 T	During mechanical deployment of ammunition (such as when laying mines with a minelayer) the arming **shall** take place at the earliest when the mine leaves the laying device.		
1.404.045 T	Fuzing systems **shall** be designed such that the packaged ammunition and fuzing systems remain safe during storage, transport, handling and use. This applies until the point in time when the ammunition is deployed, or when the fuzing system or initiator is installed and arming or activation is performed in accordance with the specified operating instructions.		
1.404.046 T	Incorrect installation of a fuzing system should not be possible.		
1.404.048 T	At least two different and almost simultaneous manual operations **shall** be required for arming to take place. *Comment:* These manual operations should be sequential, i.e. carried out in a predefined order.		
1.404.049 T	Electric ignition energy **shall not** occur in the firing circuit until after the specified arming delay or safe separation time has elapsed.		

Req.no	Content	Fulfilled	Remarks
1.404.050 T	Fuzing systems **shall** be equipped with a device which, after arming, provides sufficient safety time for the operator to leave the danger zone.		
1.404.051 T	The probability of incorrect connection of fuzing systems to explosives, signal and spotting charges owing to a mistake, clumsiness or carelessness **shall** be taken into account.		
1.404.052 T	In cases where safety is based on operational procedures, operating instructions **shall** accompany the packaging or the ammunition.		
1.404.053 T	The fuzing system and components of the fuzing system **shall** be designed such that installation of the initiator can be performed as the final operation in the readiness procedure.		
1.404.054 T	An intentional manual operation, such as removing a safety pin, **shall** be necessary before initiation of the warhead can take place. *Comment:* The safety pin is to be designed so that it is not inadvertently removed during normal handling of the ammunition.		
1.404.055 T	The initiation device for demolition charges **shall** be designed so that the connected system can be disassembled safely after connection and be re-used if so stipulated.		
1.404.056 T	When the application permits, fuzing systems for demolition charges should incorporate an interrupter that is remotely controlled from the initiation device.		
1.404.057 T	Time fuzes should incorporate an interrupter that arms after the fuze is set and after personnel have taken cover. The initiation device is armed when the interrupter is removed from the explosive train. *Comment:* Where application-specific environmental conditions are available (such as hydrostatic pressure for underwater time fuzes) they have to be used. For other time fuzes manual time-delayed arming, for example, can be used.		

Req.no	Content	Fulfilled	Remarks
1.404.058 T	Ignition cables **shall** be long enough to enable connection of the initiation device without it being necessary for personnel to be inside the danger area of the warhead.		
1.404.059 T	If requirement *1.404.057 T* cannot be met, the initiation device **shall** incorporate a time function that provides a delay in arming of sufficient duration to enable the operator to leave the danger area or take cover.		
1.404.060 T	Initiation devices should be designed so that the risk of ignition failure is minimised. *Comment:* Consequently, it should be equipped with a continuity tester and an indicator to show that it can deliver sufficient ignition energy.		
1.404.061 T	To minimise the risk of inadvertent initiation, initiation devices **shall** be designed so that at least two manual operations are required to enable firing.		
1.404.062 T	There **shall** be at least one mechanical/galvanic interrupter in the firing circuits of initiation devices. *Comment:* The output on the initiation device can also be short-circuited up to the moment of firing (e.g. by one or more electromechanical switches).		

Section 4.4.2.5 Neutralisation, deactivation, recovery and disposal

Req.no	Content	Fulfilled	Remarks
1.404.063 T	Firing capacitors **shall** be equipped with duplicate discharge (bleeder) circuits. At least one of these circuits **shall** be physically located as close to the firing capacitor as possible.		
1.404.064 T	The leakage resistance of firing capacitors, or for grounding in twin conductor systems, **shall** be as low as the system permits.		

Req.no	Content	Fulfilled	Remarks
1.404.065 T	Fuzing systems incorporating a deactivating function **shall** contain a device that indicates in an unambiguous way whether the system is safe.		
1.404.066 T	Deactivation **shall** provide at least the same level of safety as when the system was initially in safe mode.		
1.404.067 T	Deactivation should not require special tools.		
1.404.068 T	Deactivation should remove all initiation energy.		
1.404.069 T	The fuzing system should be designed such that deactivation/neutralisation is not prevented by a malfunction in any part of the fuzing system that is not used for deactivation/neutralisation.		
1.404.070 T	If clearance for disposal or recycling is intended the fuzing system **shall** be designed for subsequent safe handling.		

Section 4.4.2.6 Requirements of International Law

Req.no	Content	Fulfilled	Remarks
1.404.071 T	Land mines **shall** have a self-destruction, neutralisation or deactivation function that renders the mine safe after a certain time. This function can be automatic or remotely controlled.		
1.404.072 T	Drifting mines **shall** have fuzing systems that ensures that the mine is rendered safe one hour after deployment at the latest.		
1.404.073 T	Moored mines **shall** be neutralised as soon as the mine is no longer moored.		
1.404.074 T	Torpedoes **shall** be neutralised if they do not hit the target.		

Req.no	Content	Fulfilled	Remarks
1.404.075 T	For ammunition with submunitions, these **shall** meet the requirements of the "Convention on Cluster Munitions". *Comment:* The definition of Cluster Munitions includes all ammunition with explosive submunitions under 20 kilograms weight. Ammunition is explicitly excluded from the definition of cluster munitions which, "in order to avoid indiscriminate effect over a surface", has the following five characteristics: • the ammunition consists of less than ten explosive submunitions, • each explosive submunition weighs more than four kilograms, • each explosive submunition is designed to detect and strike a single target, • each explosive submunition has an electronic self-destruct mechanism, • each explosive submunition is equipped with electronic deactivation.		
1.404.076 T	Submunitions **shall** be equipped with auto-destruction. *Comment:* See requirements in *Clause 4* of the Convention's definition in requirement *1.404.075 T* above.		
1.404.077 T	Submunitions **shall** be equipped with a neutralisation/sterilisation function which renders the submunition safe after a certain period of time.		

Section 4.4.3 Mechanical subsystems

Req.no	Content	Fulfilled	Remarks
1.404.078 T	The interrupter **shall** prevent the booster charge in the fuzing system from initiating in the event of an inadvertent initiation of the explosive train before the interrupter.		
1.404.079 T	The interrupter **shall**, in the safe position, be locked by at least two independent safety features.		

Req.no	Content	Fulfilled	Remarks
1.404.080 T	The interrupter in an explosive train should, before arming, remove the sensitive explosive (out-of-line) from the explosive train.		
1.404.081 T	Each of the safety features **shall** individually retain the interrupter in the safe position.		
1.404.082 T	Safety features in an interrupter should lock directly into the interrupter, not via any linkage or similar device.		
1.404.083 T	Testing **shall** be performed to establish that an interrupter remains locked in the safe position with sufficient margin when subjected to the most severe load (Compare the environmental specification) when only one safety feature is installed. The safety features are to be tested separately.		
1.404.084 T	Testing **shall** be performed to establish that explosives located after the interrupter are not initiated by the detonator while the safety device is in the safe state. *Comment:* The following is to be taken into consideration: • the critical thickness of a mechanical barrier, • the critical charge quantity and compacting pressure of a detonator located before the interrupter, • the critical gap and dimensions etc. of gas passages through or around the interrupter. The term 'critical' denotes the value when transmission in some form takes place. Testing can be supplemented by calculations.		
1.404.085 T	Testing **shall** be performed to determine at which point transmission is achieved when the interrupter is gradually moved from safe to armed position. Dimensions **shall** be chosen within each tolerance range so as to facilitate transmission. Between safe position and the limit position for transmission, any ejection of fragments, deformation or fragmentation **shall** not entail a risk of injury. *Comment:* For interrupters with an instantaneous arming motion, testing can be performed in fewer positions (at least one) between safe and armed positions.		

Section 4.4.4 Electrical subsystems

Req.no	Content	Fulfilled	Remarks
1.404.086 T	Fuzing systems should not be capable of accumulating sufficient energy to initiate the warhead within the safe separation distance/time.		
1.404.087 T	Connector pins in external connectors connected to an EED should be semi-enclosed.		
1.404.088 T	The casing of an external connector should make contact and provide electromagnetic shielding before the pins engage.		
1.404.089 T	The shielding of ignition cables should be connected to the casing of the connector around the complete circumference of the cable. *Comment:* This is particularly important with the casing of an EED to obtain good high frequency protection. The connection pins in a connector should not be used to connect shields.		
1.404.090 T	The switch that finally connects an EED to the electric supply should be located as close to the initiator as possible.		
1.404.091 T	The lead/leads between the switch and the EED **shall** be shielded from external electromagnetic fields and be protected against static electricity.		
1.404.092 T	The capacitance across the switch should be kept sufficiently low to prevent initiation by electrostatic discharge.		
1.404.093 T	Twin conductors should be twisted.		
1.404.094 T	If one pole of an EED is grounded, the ground path should be as short as possible to the shield that surrounds it.		
1.404.095 T	Ignition cables **shall not** be located in the same shield as other conductors.		
1.404.096 T	An EED **shall** be tested according to FSD 0112, STANAG 4560 or equivalent.		

Req.no	Content	Fulfilled	Remarks
1.404.097 T	Fuzing systems containing EEDs **shall** be system tested in accordance with FSD 0212, STANAG 4157or equivalent.		
1.404.098 T	EED used in fuzing systems with an in-line explosive train intended for warheads **shall** have an ignition voltage of at least 500 V.		
1.404.099 T	When two electric signals are used for arming at least one of them **shall** be dependent on a continuous current supply.		
1.404.100 T	If the current supply ceases before arming is completed the fuzing system **shall** be neutralised or deactivated.		
1.404.101 T	In a system where the arming process is controlled by electrical safety features, at least two of them **shall** be in the form of an interruption from the current supply.		
1.404.102 T	Fuzing systems in which arming is performed by connecting the circuit to earth/ground (single conductor system) should be avoided.		
1.404.103 T	Arming **shall not** occur as a result of plausible short circuits such as short circuits between adjacent leads in harnesses, in connectors, on PCBs and in integrated circuits.		
1.404.104 T	Arming **shall not** occur as a result of a plausible interruptions caused by, for example, soldering defects, oxidised connector surfaces, or cracks in PCBs or substrates.		
1.404.105 T	For systems with only semiconductors as safety features, at least three independent ‘closings’ **shall** be required at system block level for arming. *Comment:* The closings are best actuated by different signal levels.		

Req.no	Content	Fulfilled	Remarks
1.404.106 T	A system containing only semiconductors **shall not** be able to arm as a result of static failures in the safety features (failure mode either closed or open), which can mean that at least one of the safety features requires a dynamic signal. *Comment:* The dynamic signal must be of such a nature that it cannot reasonably occur inadvertently.		
1.404.107 T	The safety analysis of a fuzing system **shall** be performed by at least one independent party. For system solutions with semiconductors only, the analysis should be performed by at least two independent parties. *Comment:* A special system safety function within the company that designed the system can be considered to be an independent party.		
1.404.108 T	A fuzing system with an in-line explosive train intended for warheads **shall** be initiated only by a signal that is unique and cannot be emulated by any undesired internal or external signal. *Comment:* Usually only high power systems (such as EFI) are used in systems containing only electronic fuzes.		
1.404.109 T	Charging of a firing capacitor or equivalent should only be started after the safe separation distance/time has been reached.		
1.404.110 T	The voltage of a firing capacitor or equivalent **shall** be below the lower initiation voltage (maximum-no-fire) until the arming distance/time is reached. *Comment:* This is analogous to the conventional case with one interrupter that moves slowly and enables transmission in the explosive train at some point before final position. Complete arming is achieved when the voltage of the firing capacitor reaches the minimum-all-fire level of the electric igniter.		

Section 4.4.5 Electronic and software controlled subsystems

Req.no	Content	Fulfilled	Remarks
1.404.111 T	All safety-critical functions in electronic circuits **shall** be implemented in firmware or hardware.		
1.404.112 T	It **shall not** be possible to easily change the software after it has been installed in the circuit.		

Section 4.4.5.1 Radioactive impact

Req.no	Content	Fulfilled	Remarks
1.404.113 T	Data in firmware **shall not** be able to be changed by any environmental impact which the system can otherwise withstand. Environmental impact includes the effects of radiation.		

Section 4.4.5.2 Redundancy

Req.no	Content	Fulfilled	Remarks
1.404.114 T	If all safety features are implemented with logic circuits, at least two of these **shall** be implemented with different types of logic circuits.		

Section 4.4.5.3 Unused features and environmental durability

Req.no	Content	Fulfilled	Remarks
1.404.115 T	The component manufacturer's specifications and recommendations **shall** be followed. *Comment:* The requirement may for example be verified by minutes from completed design reviews.		

Section 4.4.5.4 Risk of short circuits

Req.no	Content	Fulfilled	Remarks
1.404.116 T	The design **shall** be such that the likelihood of short circuits occurring at circuit board level is minimised. *Comment:* The use of lead-based solder is in conflict with the RoHS Directive.		

Section 4.4.5.5 Competence of the supplier

Req.no	Content	Fulfilled	Remarks
1.404.117 T	At least two people at the manufacturer **shall** in detail be familiar with the functionality of the hardware and software, as well as what tests that have been carried out on the system.		

Section 4.4.5.6 Service life of stored information

Req.no	Content	Fulfilled	Remarks
1.404.118 T	The content of the memory circuits **shall** have a service life that with a margin exceeds the system's projected service life if reprogramming (Refresh) is not possible. *Comment:* Service life relates to both how long a memory cell can retain its information in the current operational profile (measured in years), and the number of write operations that can be performed on each individual memory cell.		

Section 4.4.5.7 Power supply

Req.no	Content	Fulfilled	Remarks
1.404.119 T	The power supply for the logic system that implements safety features **shall** be designed so that a fault in the power supply does not result in one or more safety features being removed.		

Section 4.4.5.8 System restart, RESET

Req.no	Content	Fulfilled	Remarks
1.404.120 T	The system **shall** assume a safe state at disturbances in the power supply and at start and stop.		

Section 4.4.5.9 Self-test

Req.no	Content	Fulfilled	Remarks
1.404.121 T	After start, a self-test **shall** be carried out which verifies the function and condition of as many safety-critical components as possible with regard to time and performance requirements.		

Section 4.4.5.10 Program flow control, Watch Dog Timer (WDT)

Req.no	Content	Fulfilled	Remarks
1.404.122 T	Programmable circuits **shall** have a monitoring function that puts the system in a safe state if the program execution is disrupted.		

Section 4.4.5.11 *Software*

Req.no	Content	Fulfilled	Remarks
1.404.123 A	Software development **shall** be carried out systematically and in accordance with a recognised standard or manual. The choice of developing standard **shall** be presented and justified.		
1.404.124 A	For safety-critical systems, software and development methodology **shall** be reviewed by an independent third party. *Comment:* An independent auditor may be a person in the same company that developed the software, but who was not involved in the development.		

Req.no	Content	Fulfilled	Remarks
1.404.125 T	Configuration control **shall** be implemented for all developed software and the revision identification can preferably be included as a constant in the program memory or as a label on the circuit board.		
1.404.126 T	Software for safety-critical systems **shall** be designed and documented so that it is possible to analyse its function.		
1.404.127 T	The developed software **shall** be tested extensively. The choice of test method shall be documented and justified.		
1.404.128 T	Software in safety-critical systems **shall** be as straightforward as possible.		
1.404.129 T	Interrupts **shall not** be able to cause stack overflow, disruptions to the program execution, inadvertent changes to variables, or a non-deterministic behaviour.		
1.404.130 T	The program execution **shall** be deterministic. *Comment:* An example of a deterministic system is a state machine where each new state is predictable and only depends on the current state and input signals.		
1.404.131 T	All interrupt vectors **shall** be defined and the vectors that are not used **shall** lead to a safe state, such as RESET.		
1.404.132 T	Registers that are important for the function **shall** be verified during operation.		
1.404.133 T	If an error is detected during a self-test or during operation, a planned action **shall** be available and performed.		
1.404.134 T	All input signals to the processor **shall** be assessed for reasonability.		
1.404.135 T	Code that will never be used, so-called dead or dormant code, **shall not** be present.		

Req.no	Content	Fulfilled	Remarks
1.404.136 T	Unused memory space **shall** be programmed with code so a jump to such space results in a safe state, e.g. a restart.		
1.404.137 T	All indexed memory operations **shall** be checked so that the index assumes permitted values.		
1.404.138 T	One, two or three bit errors **shall not** be able to lead to dangerous malfunction in the software, for example arming of an ignition system.		
1.404.139 T	Arming **shall** require that a sequence is executed where the previous state is a necessary condition for the subsequent arming condition to be executed.		

Section 4.4.6 Subsystems with wave-borne signals

Req.no	Content	Fulfilled	Remarks
1.404.140 T	In systems with wave-borne signals the probability of unauthorized arming/influence **shall** be sufficiently low with regard to the field of application.		
1.404.141 T	If a signal outside the ammunition is used for arming, the fuzing system **shall** verify the signal before arming takes place.		

Section 4.4.8.9 Propulsion devices

Req.no	Content	Fulfilled	Remarks
1.404.142 T	There **shall** be a transmission safety device in the explosive train of propulsion devices if inadvertent initiation of the propelling charge leads to activation of the fuzing system in the warhead. *Comment:* Guidelines as to when the transmission safety device must exist in other cases, for example when an inadvertent initiation can cause great harm, can be found in STANAG 4368.		

Req.no	Content	Fulfilled	Remarks
1.404.143 T	The electric igniter in the propulsion device **shall** be sufficiently insensitive so as not to be initiated leading to inadvertent initiation by any radiated interference or static electricity. *Comment:* The aim must be that an electric igniter can be subjected to a current of 1 A and a power of 1 W for a minimum duration of five minutes. An analysis of the safety of the complete safety and arming system must, however, as a rule be carried out.		
1.404.144 T	The explosive in a booster charge after an interrupter, or in an initiator in a system without an interrupter, should not be more sensitive than the explosives in the propelling charge.		
1.404.145 T	It should be possible to install the fuzing system into a propulsion device as late as possible before operation.		
1.404.146 T	It should be possible to check easily whether the fuzing system is installed in a propulsion device.		
1.404.147 T	The fuzing system should be easily accessible for replacement.		
1.404.148 T	The fuzing system **shall** be designed so that normal firing takes place within the specified time-frame (i.e. abnormal delay is prevented).		

Section 4.5.2 Joint requirements for packaging for ammunition

Req.no	Content	Fulfilled	Remarks
1.405.001 T	The packaging **shall** be able to withstand the tests and meet the requirements set out in the UN Recommendations on the Transport of Dangerous Goods - Manual of Test and Criteria. *Comment:* The requirements relate to selection of materials, packaging design, marking and labelling, etc.		

Req.no	Content	Fulfilled	Remarks
1.405.002 T	The packaging **shall** protect the ammunition against the environments to which it is predicted that the system will be subjected throughout its life. These environments are stated in the environmental specification. *Comment:* Requirements governing the protective properties of the packaging can be related to the inherent resistance of the ammunition. Furthermore, the packaging must not create an environment the ammunition cannot withstand.		
1.405.003 T	Constituent materials in the packaging **shall** be selected and combined so that effects detrimental to safety do not occur. *Comment:* Such effects can, for example, be caused by corrosion, incompatibility or instability.		
1.405.004 T	Packaging should be designed to prevent mass detonation. *Comment:* This requirement can be achieved by adequate separation of the explosive units as well within a packaging as between packaging.		
1.405.005 T	Packaging should be designed such that the consequences of an inadvertent initiation of the constituent explosive is limited. *Comment:* In the event of a fire a propulsion device, for example, can create a 'gun effect' if the package is in the form of a metallic tube.		
1.405.006 T	The design of, and materials for, packaging **shall** be selected to prevent detrimental effects from handling and storage environments.		
1.405.007 T	When re-using packaging it **shall** be ensured that they from a safety aspect are equivalent to new ones.		
1.405.008 T	When selecting materials for packaging, consideration **shall** be given to the applicable regulations for recycling.		
1.405.009 T	The prescribed material recycling symbols **shall** be marked on constituent components.		

Section 4.5.3 Common requirements for ammunition in packaging

Req.no	Content	Fulfilled	Remarks
1.405.010 T	Packaging and their contents **shall** be F-classified ("F-coded") in accordance with IFTEX.		
1.405.011 T	Packaging and their contents **shall** be classified in accordance with the UN classification.		
1.405.012 T	Packaging and their content **shall** be provided with distinct and durable markings in accordance with applicable regulations governing transport and storage to enable rapid and safe identification of the contents.		
1.405.013 T	If it follows from the REACH Regulation (EC No. 1907/2006) that the supplier must provide a safety data sheet, this **shall** be attached to the audit documentation. *Comment:* Reference to requirement *1.401.008 A*. The safety data sheet must be designed in accordance with REACH (EC No 1907/2006). The classification should be in accordance with CLP (EC No 1272/2008). The safety data sheet must be written in Swedish, with the following accepted exceptions: if the chemical product is not placed on the Swedish market and does not have a Swedish safety data sheet, the safety data sheet must be written in English.		