

Handbok för Säkra fält- mässiga arbetsplatser E



**The Swedish Defence Materiel
Administration's Handbook on Safe
Field-based Workplaces**

H SÄK FÄLTM ARB E

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This English edition is a translation of the Swedish edition (Handbok Säkra fältmässiga arbetsplatser, M7762-000961). In case of difficulties with regard to interpretation, the Swedish version applies.

FÖRSVARETS MATERIELVERK



Kristin Strömberg
Chief Technical Officer

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PREFACE

PURPOSE AND SCOPE

To increase confidence in the technical systems used for training, during exercises and in action, FMV has compiled the relevant laws and regulations as well as experiences that deal with safe structures in safe field-related workplaces, for example, functional containers, tents and vehicle-mounted cabins and also for temporary personnel facilities. This is to avoid, where possible, illness and accidents caused by the design of these types of workplaces in a military environment.

This manual is based on the Armed Forces' approach to system safety and is based on the methods set out in the Armed Forces' Handbook on System Safety (H SystSäk E). To ensure that the tolerable risk level set out by the requirements is achieved, both general construction-based requirements and management requirements in H SystSäk E, as well as more specific demands of field-based workplaces are included in this manual. The use of a balanced combination of these requirements is recommended.

This manual is aimed mainly at those who procure, modify or hire field-based workplaces for the Armed Forces.

APPLICATION OF FMV MANUAL SAFE FIELD-BASED WORKPLACES

The handbook Safe Field-Based Workplaces (H SäkFältmArb E) has a different legal status from those of the regulations. Its applicability to the acquisition, modifying and hiring of technical systems is regulated by the authority's own design organisation. The requirements set out in the manual are not obligatory although it recommends that certain of the requirements should be treated as mandatory. The manual indicates the appropriate requirements to be used for finding safer design solutions as well as providing background information, references and recommendations based on requirements based on military activities. The requirements can be reformulated to be better suited to the current technical system.

The handbook Safe Electrical Products and Systems (H SEPS E), that deals with electrical safety in the field, must always be applied in parallel with this manual.

Standards usually contain documented examples of gained experience. To follow standards is not obligatory and a reference to a standard should be seen as a recommendation to fulfil directions or EC regulations or directives. Certain directives, however, contain references to a specific standard which must be followed. Where FMV orders require a supplier to observe a certain standard, then it is mandatory that the standard is followed

Experience shows that there can be conflicting standards between the various technical areas. Such situations must be dealt with case by case.

READING INSTRUCTIONS

Readers who are unfamiliar with system safety activities should refer to the Armed Force's Handbook on System Safety (H SystSäk E, Part 1: M7739-352031 and Part 2: M7739-352032). For requirements related to electrical safety in the field, refer to the Handbook on Safe Electrical Products and Systems (H SEPS E, M7762-001001). For weapon and ammunition requirements refer to the FMV Weapon and Ammunition Safety Manual (H VAS E 2012, M7762-000881) and for software requirements, refer to the Handbook for Software in Safety-Critical Applications (H ProgSäk E, M7762-000621).

H SäkFältmArb E is a complement to H SystSäk E and can be read and applied independently but it contains references to the text of H SystSäk E in some sections. H SäkFältmArb E, H SEPS E, H VAS E and H ProgSäk E should be applied in parallel for some functions and subsystems. In some cases the Vehicle Safety Manual E (H FordonSäk E, M7762-000991) provides additional guidelines on requirements for, for example, vehicle mounted huts, the design of doors, hatches and chairs as well as emergency evacuation, safety belts and communications between huts and vehicles.

TEXT CONVENTIONS

Chapter 4 contains the proposed requirements that can apply to the procurement of technical systems. The sections begin with the facts of the requirements and some explanatory text. References are made to laws, regulations or other relevant information. The manual uses the following colour codes for the requirements:

Recommended (mandatory) requirement

Optional requirement

The requirements in the manual are numbered as follows 5.402.03 where:

- 5 Prefix requirements in H SäkFältmArb E
- 402 Chapter 4, Section 2
- 03 Serial number in the section

SUGGESTIONS FOR IMPROVEMENTS

Comments on and suggestions for improvements to H SäkFältmArb E are sent to:

Försvarets materielverk

Systemsäkerhet

SE-115 88 Stockholm

SWEDEN

1.1 PURPOSE

When working in a variety of field conditions, the appropriate design of the workplace and hygienic conditions are essential for a good working environment to make the soldier and the unit valuable in combat. The handbook proposes requirements to achieve this, even if the specific military requirements which apply to technical systems in the military environment for training, practice and tasks make it more difficult to meet the technical requirements for achieving a favourable working environment. As battle effectiveness and safety can be in conflict with each other, efforts are made to create the best balance between a good and healthy working environment and the necessary battle effectiveness.

The purpose of this handbook is to provide guidelines in the design of active-service workplaces and personnel areas located in containers, functional containers, huts, tents and other types of shelters for use in military environments whether they are free standing or are loaded onto a carrier. For passenger accommodation in vehicles, airplanes, helicopters, ships and submarines, the requirements in this handbook apply so long as they do not conflict with other regulations.

1.2 APPLICATION

The legislation may allow exemptions for military technical systems and products as well as for military activities. AFS 2009:2, *Workplace Design* makes an exemption for both plant-based workplaces, including connecting routes, and staff facilities intended for the armed forces, normally used only in war or emergency conditions, and for workplaces in field exercises. Note, however, that legislation for lighting, noise and warning signs is always valid, even in unfinished spaces. This exemption does not apply to the work environment rule stating that workers must be

protected against illness and accident. Protection against illness and accident should be provided to armed forces personnel in the same way as it is provided for all other workers in the community.

This handbook defines a workplace under field conditions as:

- A weatherproof work station fitted especially for administrative work including communications between two such workplaces, to allow tasks to be carried out continually by one person for more than 59 minutes.
- Weatherproofed staff areas. Air locks that control climate, prevent the ingress of soil or the indoor levels of light and sound, are therefore exempted.

The design of the working environment and of methods of working for all types of maintenance in the workplace and its environs are covered by the ordinary system safety work.

This handbook complements the legislation based on military requirements placed on the design of common military workplaces in the field. For specific activities, such as medical care or laboratories, the specific requirements for design of the workplace stated in various, regulations and statutes apply.

For the definitions of container, functional container, shelter, hut, tent, communications link and air lock, see *Section 2.2, Definitions*.

1.3 TO SELECT REQUIREMENTS

The requirements in this handbook are guidelines for safety and constitute partly constructive prerequisites for a project (*Chapter 3*) and support for the project when (deciding the status) of requirements (*Chapter 4*).

The requirements in *Chapter 3* are guidelines to determine the extent that activities are implemented depending on the nature of the project. It is the responsibility of the internal standards authority to decide which of these activities are appropriate and determine to what extent they are implemented.

The requirements in *Chapter 4* (specification support) are marked in either light or dark purple. It is recommended that requirements marked in dark purple are included in the specification. All the requirements in this chapter, however, contain the word "shall" so that they can be easily included into the specification. Note that not all requirements are appropriate to all types of work places in the field and each project has to choose requirements based on the selected weatherproofing activities to be carried out. This also applies to the selection of requirement levels, that is, whether to use either "shall" or "should" for each requirement.

1.4 INTERNATIONAL APPLICATIONS

In the development of this handbook, EU regulations and directives and international standards have been taken into account which means the handbook is deemed to be totally appropriate even for international purchasing. Development projects placed with foreign suppliers must follow the same system safety activities as are followed by Swedish suppliers.

When purchasing fully developed systems from abroad, always ensure that the information and documentation is available so that an evaluation of safety can be performed. In some cases, this documentation has been obtained by the Swedish authorities with which a Memorandum of Understanding (MoU) has been prepared.

1.5 OTHER CUSTOMERS

This handbook is aimed primarily at those who purchase, modify or hire field-related work places for the armed forces. Other agencies, such as National Fortifications (FORTV) and the National Defence Radio Establishment (FRA) can apply selected parts of this handbook.

2 BASICS

2.1 BACKGROUND

The work environment of military technical systems needs to be taken into consideration at an early stage of the design of field-related work places partly because these usually have very limited space and capacity and so the risk of accident can be avoided by good design. In addition, there is a need to create good working conditions conducive to the psychosocial work environment during stressful situations, such as training, exercises and missions. Shortcomings in the performance of workplaces can seriously affect staff efficiency and complicate dealing with such emergencies as fire and evacuation.

AFS 2009:2 *Workplace design* also includes such areas as stairwells, waste disposal areas, stores, changing rooms, cleaning stores, maintenance rooms, fan rooms, lift engine rooms and exercise command rooms as workplaces. Other examples of workplaces are rock shelters, wharfs and radio and telecommunications masts. Also covered by the regulations are stairs and fixed ladders that give access to other devices. Responsibilities for the various areas need to be determined by the collaborating agencies early in the project, for example, where FORTV takes responsibility for the plant and FMV for installing the equipment in it. Ultimately, the Swedish Work Environment Authority can prohibit employers from carrying out work in a property and the property owner can be prohibited from letting a substandard workplace.

The rules for personnel areas apply to all activities except in facilities that are normally used only in war and emergency conditions and for field exercises by the armed forces. This does not imply that all rules can be ignored, they should, where reasonably practicable and economically viable, be followed. Where civilian activities are carried out for the armed forces, using civilian equipment, the rules for personnel areas apply. Personnel areas

can be contained in a hut (functional container) as well as in specially prepared vehicles (shelter). See also the glossary in AFS 2009:2 *Workplace Design*.

The armed forces, in the role of workplace (practitioner), shall conduct a systematic environmental investigation by assessing the risk of accident and ill health and take the necessary measures identified by the investigation. Personnel of the armed forces who have design responsibility shall, through coordination, agreements or special orders, implement system safety tasks to identify, analyse, evaluate and address the risk of accidents so that the minimum set of requirements for a tolerable risk level is identified for what is reasonably practicable and economically viable. Those with the responsibility for technical design must also ensure that inspection and control are carried out adequately and that all the necessary permits for the technical system exist. Before handing over a technical system to the armed forces, risk documentation must be compiled. This will be the basis for systematic environment work during use. The Scope of the risks documentation is described in H SystSäk E.

2.2 DEFINITIONS

In this field, a large number of terms, concepts and acronyms are used and are explained in the Definition and glossary section of the handbook. The definitions and the glossary are drawn mainly from the Swedish Standard and Manual System 2011 (H SystSäk E 2011). Swedish standard and military concepts may differ slightly. Definitions that are solely used in this handbook are specially marked.

The definition of the areas that enable passage between the outdoor environment and the work areas is not included in this handbook.

Field Work Stations

“A weatherproof work space fitted out for permanent administrative work, including communications between two such workplaces, and to allow tasks to be carried out continually by one person for more than 59 minutes, and to provide weatherproof staff areas.”

Source: H SäkFältmArb E

Container

“Transport equipment, constructed to be durable enough to be used repeatedly, especially built to allow the transport of goods by one or more modes of transport without reloading the content, designed to be secured and easily handled, and fitted with load-securing devices to facilitate this and approved under the international Convention for safe containers (CSC) 1972, as amended.”

Source: Transportstyrelsen

Functional Container

“A shelter fitted out with supplies for the workroom or staff areas, and strong enough to be used repeatedly, especially built to enable being transported, designed to be secured and easily handled and equipped with load-securing devices and has the same outer dimensions and load securing points as a container”

Source: H SäkFältmArb E

Shelter

“Forms the weatherproof physical boundaries of a work place and consists of enclosing walls, ceilings and floors with the associated construction details and air lock functions.”

Source: H SäkFältmArb E

Hut

“Shelter fitted out with equipment for the work place or personnel use, strong enough to be used repeatedly, built especially for permanent mounting on the intended platform.”

Source: H SäkFältmArb E

Tent

“A portable shelter made of, for example, leather, canvas or plastic, supported by one or several poles or by a frame and often further supported by ropes attached to pegs in the ground.”

Source: Dictionary reference

Connecting Link

“A route of communication, between two points both indoors and outdoors.”

Source: AFS 2009:2

Air Lock

“A space that ensures the separation between the outdoor and indoor environments, preventing the ingress of soil and the effects of, for example, climate, light and sound.”

Source: H SäkFältmArb E

2.3 EU REGULATIONS AND DIRECTIVES

Relevant EU regulations and directives must be followed before a product is put on the market. A functional container or hut can be subject to CE marking appropriate to one or more EU directives. Where there are electrical installations, low voltage and EMC directives can apply. See *H SEPS E 2015*.

2.4 STANDARDS

Special ISO standards, with requirements on the outer dimensions and mounting points, exist for container and functional containers. ISO standards to meet CSC classification also exist.

A hut that does not meet the ISO standard requirements for outer dimensions and mounting points can, for example, be loaded and secured on a flatbed for further transport. The flatbed shall meet the current transport standards.

2.5 LAWS

Environment Act Chapter 2 § 4 stipulates that adequate precautions should be taken against injury caused by falls, fire, explosion, electric current and so on. Some rules regarding workplaces in the field are found in the Work Environment Act (SFS 1977:1160) and in various detailed regulations to the law of the Swedish Work Environment Authority (AFS). Examples are AFS 2009:2 *Workplace Design*, AFS 2005:16 *Noise* and AFS 1998:5 *Working with computers*.

The Working Environment and Building Laws are not written in isolation. Some technical systems can be constructed based on the National Board of Housing, Building and Planning (BBR) or on knowledge obtained from relevant handbooks. Where work premises are designed to meet a requirement in the building regulations it is also the case that, generally, corresponding requirements for the premises are fulfilled, but there can be exceptions. Work premises shall be assessed depending on the activities being carried out or to be carried out when deemed fit. Some safety issues are controlled by regulations other than those mentioned above and under the supervision of other bodies. Coordination between these regulations may, therefore, be necessary.

Regulations dealing with the dangers of electricity are available in the Work Environment Act, the Electricity Act (SFS 1997:857) and the Law on Electromagnetic Compatibility (SFS 1992:1512) as well as in the Regulations. The authorities responsible for these regulations are the Swedish National Electrical Safety Board and the Swedish Work Environment Authority.

Several rules on the protection against fire hazards are found in the building legislation and its applicable regulations and in the Law and the Regulation on flammable and explosive goods (LBE and FBE) and its relevant rules. Although safety legislation includes rules for protection against fire hazard, the rules for the design of work premises where flammable and explosive goods are handled can be found in the Swedish Rescue Services Agency regulations. A few older regulations of the Explosives Inspectorate are still applicable. Both the Swedish Rescue Services Agency and the Inspectorate of Explosives Regulations will continue to be valid to the Swedish Civil Contingencies Agency (MSB). Additional information on materials is published by the Fire Protection Association, Insurance Sweden and other industry organizations.

Workplaces handling food or drinking water have to follow the regulations issued by the National Food Administration. The requirements dealing with good standards of hygiene that apply to jobs in the health, medical and dental facilities are found in the Health Care Act (SFS 1982: 763) and in Dentistry Ordinance (SFS 1998: 1338). Regulations are also issued by the National Food Administration for other workplaces, and these rules make demands on staff spaces other than those required in AFS 2009:2 *Workplace Design*, which specifies only the minimum requirements for the working environment. The Surgeon General of the Armed Forces has undertaken the supervision of certain activities in the above mentioned work premises.

The Working Environment Act supports the possibility to require improvements in the working environment regardless if a renovation or modification of the existing technical system should be done. This may be necessary in the case of an accident or an emergency or when conducting work according to AFS 2001:1 *Systematic Working Environment Work*.

2.6 TRANSPORT OF MILITARY EQUIPMENT

The civil authorities issue different regulations to govern civil and military activities. The Transport Agency issues regulations governing air, ground and maritime operations. The Work Environment Authority issues regulations regarding work environment. The Armed Forces issues its own regulations or additional rules for military operations and in some cases requirements for the design of technical systems. In many cases, both civil and military regulations are followed in parallel. The Armed Forces also produces safety instructions (Säkl) for training and exercises. Read more in *H SystSäk E 2011 Part 1*.

Below are some considerations for air, land or sea transport.

2.6.1 Transport of military equipment by air

When a confined space, such as a container, is transported by air it can be exposed to a sudden drop in pressure or to extreme temperature changes. Where a container or hut is to be supplied with electric power from the aircraft there may be special power supply and electromagnetic compatibility (EMC) requirements.

2.6.2 Transport of military equipment over land

Additional requirements for, such as, the design of doors, hatches, chairs and requirements for emergency evacuation, safety belts, and communication between the tents and vehicles, are found in *H FordonSäk E*.

2.6.3 Transport of military equipment by sea

A specific CSC classification exists for containers and functional containers that can be stacked during shipping, this is also known as “sea classification”, meaning that approval is given under the International Convention for Safe Containers (CSC). If the container is not CSC rated, the container must go as deck cargo, which can increase the cost of transport.

If external modifications have been made, such as a weakening of the structure, piercing the wall, ceiling or floor or if protrusions are added, CSC classification may be invalidated.

2.7 ELECTROMAGNETIC COMPATIBILITY

FMV is the authority that supervises the application of the EMC Directive (2004/108/EC) of military equipment when the specific requirements are found on the functionality or interoperability. The Swedish National Electrical Safety Board is the regulator for other technical systems and products.

2.8 OTHER REQUIREMENTS

Note that there are special requirements for functional containers or huts that must be protected from compromising emanations against unauthorized interception, called TEMPEST protected. See M7773-001851, BROSCHYR RÖS.

3

ACTIVITIES AND DOCUMENTATION

This chapter describes activities that might have to be carried out on new or modified technical systems and products.

3.1 SYSTEM SAFETY ACTIVITIES

System Safety Activities, such as issuing system approval, are described and implemented according to *H SystSäk E*.

3.2 MEASURING NOISE

Noise is harmful and can cause irreversible hearing damage in as little as a day. Those exposed to noise can, in time, suffer serious hearing loss. Hearing damage can occur even at a level of 80 dBA with continuous exposure of more than eight hours at a stretch. Hearing loss is permanent and cannot be cured. The use of hearing protection may reduce user efficiency and there is a risk that such protection is not always used. Since the hearing protection is of use only when it is always used, the responsibility for its use should not be that of the individual soldier. The primary preventive measure must be to reduce noise at the source.

As the ear can withstand only a limited amount of noise each day, limits for when the level of noise begins to become harmful have been developed. According to AFS (2005:16) *Noise*, the equivalent sound level, that is, the average noise level over an eight-hour working day, should not exceed 85 dBA. Furthermore, the noise level must not exceed 115 dBA and a brief sound burst must not exceed 135 dBA. Harmful noise is a combination of noise exceeding 85 dBA and the time exposed to this noise.

For example, exposure to noise at 100 dBA for 15 minutes is the equivalent of exposure to 85 dBA for eight hours. A soldier exposed to more than 85 dBA at any time during the working day is at risk of damaged hearing. The limits and more information can be found in the Swedish Work Environment Authority's regulations on noise, AFS (2005:16) *Noise*.

5.302.01 Documentation coming from noise measurements shall show that the amount of noise in all workplaces complies with the requirements of the AFS (2005: 16) *Noise* from a given operating profile for the technical system.

Comment: Actual noise measurements may be required.

3.3 CHECKING EVACUATION ROUTES

Evacuation routes should be checked in order to find specific risks where accidents might occur during an emergency evacuation. Furthermore, the time for all staff to be evacuated must be recorded and documented. See also *Section 4.13*.

5.303.01 Requirements for evacuation shall be verified and validated by testing specified test cases.

3.4 DOCUMENTATION

Ventilation systems should be checked and maintained regularly and the procedure should be described in the written operating and maintenance instructions in Swedish according to § 27–28 in AFS 2009:2, *Workplace Design*.

5.304.01 Written operating and maintenance instructions for ventilation systems shall be in Swedish.

Comment: AFS 2009:2 *Workplace Design*, § 27–28.

Alarm devices should be checked and maintained regularly and the procedure should be described in the written operating and maintenance instructions in Swedish according to § 86 of AFS 2009:2 *Workplace Design*.

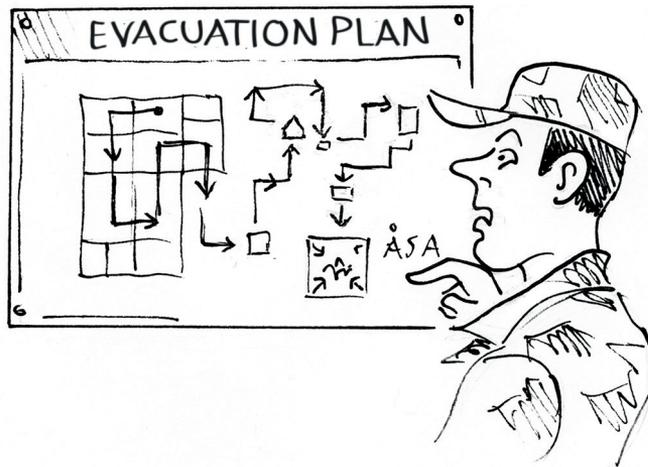
5.304.02 Written operating and maintenance instructions for ventilation systems shall be in Swedish.

Comment: AFS 2009:2 *Workplace Design*, § 86.

If a task requires the user to climb on exterior surfaces for jobs such as preventive maintenance or masking, instructions must be provided.

- 5.304.03** Instructions for climbing on exterior surfaces must exist.
Comment: Images and symbols should primarily be used.

If the areas, such as tents, functional containers and huts are connected, it may be necessary to have an evacuation plan providing a marked assembly point.



- 5.304.04** Evacuation plans with marked assembly points shall be provided.

4

FUNCTION-ORIENTED SYSTEM SAFETY REQUIREMENTS

When working on work premises in the field, an appropriate workplace design and good conditions of hygiene are important prerequisites for a good and healthy working environment that do not affect the physical battle value of the soldier adversely. These conditions also apply to staff areas. The following proposal is to meet the demands to achieve this despite the special needs of technical systems for training, exercises and effort. This manual follows largely the structure of AFS 2009:2, *Workplace Design*.

The requirements below must be rewritten in order to relate to the current technical system.

4.1 LIGHTING

Based on AFS 2009:2, *Workplace Design*, lighting shall be planned, installed, and maintained as well as examined and judged by workers so that the suitability of the different conditions and the vision requirements to the tasks to prevent illness and accidents. The lighting should be positioned so that glare is minimized. A light source colour must be suitable for the task, and therefore may vary according to the type of room: operating room, command centre, laboratory or washroom. The lighting is designed so that the warning signs, emergency stop devices, monitors and other vital function indicators are easy to understand and that the colours can be distinguished. If the business and the tactical behaviour permit, there should always be sufficient daylight and the possibility of an outside view. Certain factors, such as shadows and reflections, can be difficult to predict but these are most easily corrected during verification and validation.

It should be noted that coloured lighting, such as the signature adapted blue-green custom strongly restricts accurate colour reproduction, for example, during map reading. In certain environments, such as hospitals, dentists and laboratories, good colour reproduction is often essential.



The standard SS-EN 12464-1:2011, *Light and lighting – Lighting of workplaces – Part 1: Indoor work places* recommends the lighting strengths for different types of workplaces and work situations.

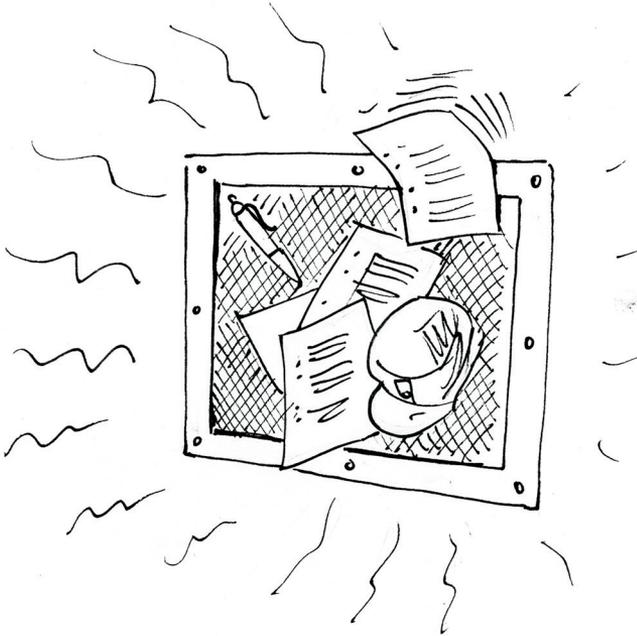
The standard SS-EN 12464-2:2014, *Light and lighting – Lighting of workplaces – Part 2: Outdoor work places* is a planning guide for outdoor lighting that is prepared by the lighting industry in consultation with the Swedish Work Environment Authority and the Swedish Energy Agency. If ultraviolet radiation (UV lamps) is needed in the business rules are issued by the Swedish Radiation Safety Authority, (SSM).

- 5.401.01 Design indoor lighting in accordance with Light and Space - Planning Guide for indoor lighting, Issue 3, Lighting Culture in 2013, which is an application of EN 12464-1: 2011 *Light and lighting - Lighting of work places - Part 1: Indoor workplaces*.
- 5.401.02 Designing outdoor lighting in accordance with EN 12464-2: 2014 *Light and lighting - Lighting of work places - Part 2: Outdoor work places*.
- 5.401.03 The lighting will be designed so that warning signs, emergency stop devices, monitors and other vital functions are easy to understand and that its colour can be easily distinguished.

4.2 AIR QUALITY AND VENTILATION

Work premises and personnel areas require ventilation systems to ensure satisfactory air quality. Ventilation is used partly for air exchange and also to trap air pollutants produced during operations and by personnel. Air pollution can mean anything from gases produced by firearms, humidity from showers, and particles from ordinary body odours. The aim is to keep the level of air pollution low to minimise the impact on the respiratory system, eyes, skin and inner organs. Air quality is not experienced alike by everybody. One way to measure the air quality of the workplace is to measure the level of carbon dioxide. Using this method, however, it may be necessary to find other ways of measuring the levels of powder gases and other air pollutants. In general, air exchange should be about 7 litres/second per person.

Fresh air intakes/AC installations shall be fitted with appropriate air filters to capture harmful particles from, for example, fuel and vehicle exhaust fumes. The requirements for filter classes are found in SS-EN 779:2012. The purpose of the standard is to classify air filters according to their effect while running at the lowest power of filter purification, also referred to as minimum efficiency (ME).



Operations that deal with poisonous substances might need special exhaust ventilation or fume cupboards depending on how dangerous the handled substances are. Air exchange equipment must be arranged to meet the requirements of collective defence against external chemical, biological, radiological and nuclear (CBRN) threats. Functional containers or huts, which have natural ventilation can have ventilation through a roof hatch.

Advice on placing air intakes and air openings are found in “R1 – Guidelines for the specification of the indoor climate” issued by Society of Energy and Environmental Technology. Air inlets on huts should be placed as far as possible from the platforms exhaust outlet.

- 5.402.01 Air exchange shall be at least 7 litres/second per person.
Comment: This refers to premises where air pollution results mainly from the number of personnel present. The carbon monoxide level shall not exceed 1 000 ppm.
- 5.402.02 Air filters for the fresh air intake/AC installations shall be chosen in accordance with SS-EN 779:2012.
- 5.402.03 Collective protection against CBRN threats shall not interfere with general ventilation, exhaust ventilation or fume cupboards.
- 5.402.04 Air inlets on huts shall be placed as far as possible from the platforms exhaust outlet.
- 5.402.05 In premises where air pollution results mainly from the number of personnel equipment shall be provided to measure the level of carbon monoxide.
- 5.402.06 Contamination from processes shall be disposed of as close to the source as possible.

4.3 THERMAL CLIMATE

To assess the impact of climate zones, temperature and moisture conditions according to AECTP-230 (Edition 1) are used. To safeguard that consideration is taken to extreme climates with temperatures below or above temperatures that can occur in Sweden, account must be taken to the radius of action in which Swedish forces are expected to operate.

The human perception of the environmental temperature is governed by many factors, such as air temperature, the mean radiant temperature, air velocity and humidity. The climate can be divided into three areas: cool, neutral and warm. The neutral climate has an air temperature between 10 – 30 °C. In workplaces or personnel areas where the air temperature falls below or exceeds the limits of the neutral climate, special measures might need to be taken or appropriate personnel equipment issued. In

certain locations, such as cold rooms or hot air containers, it is not possible to create a reasonable indoor climate. In office environments, try to maintain a normal air temperature between 20 – 24 °C in winter and between 20 – 26 °C in summer. The minimum air temperature in personnel areas should be at least 20 °C. To ensure normal working movement try to maintain a minimum temperature of 16 °C. Drafts exceeding an air speed of 0,2 m/s should be avoided. See *Section 4.17, Office Areas*.

Workplaces and personnel areas should have an appropriate thermal climate designed for the nature of the activities that are carried out. The work might be light or heavy, involve movement or be sedentary. Workplaces or personnel areas in tents shall, as far as possible and based on tactical requirements, maintain an acceptable temperature. Work stations, which are situated near a door that is often used, can be protected by an air lock.

The Standard SS-EN ISO 7730:2006 gives guidelines and criteria for local thermal comfort.

5.403.01 If the temperature is expected to fall below 16 °C or rise above 26 °C, special measures can be taken, such as the installation of insulation, and/or equipment that heats/cool the air can be employed.

4.4 SOUND AND ACOUSTICS

Noise is often a great hindrance in the working environment and can prevent or complicate communication and mask other desirable sounds. Installations, such as generators, pumps, hydraulic power units, compressors, weapon stations or air conditioning units, in or near functional containers, huts or tents can generate damaging and tiring noise. Installations situated in the workplace should create as little noise as possible. Monotonous noise, even at moderate levels, can make personnel sleepy and less alert.

Noise can also be an indirect cause of accidents because of lessened ability to hear warning signals from, for example, a reversing vehicle.

At the entrance of rooms, in which there is a possibility of harmful noises, there must be a visible sign bearing the symbol for "Ear protection must be used" in accordance with § 34 i AFS 2009:2 *Workplace design*. If several noisy units are located in the same place, it is advisable that all the units can be switched off during maintenance.

Additional regulations and general advice on noise, for example, the recommended exposure values for different working conditions, are found in AFS 2005:16 *Noise* and also more on sound conditions in certain premises are found in the National Board of Housing, Building and Planning regulations.



The requirements for sound levels from fixed installations in functional containers as well as the reduction index for differentiating between interior and exterior constructions are suggested by the Armed Forces as shown below. The requirements apply to functional containers, intended for permanent work that requires concentration and communication, as well as to containers used for habitation.

4 Function-oriented System Safety Requirements

Table 4:1 Requirements for sound reduction

Requirement for sound reduction	Goal (should))	Requirement (shall)
Workplace container: Momentary sound level (fixed) dBA		
• Not TEMPEST protected	45 dBA	55 dBA
• TEMPEST protected	45 dBA	65 dBA
Residential container:		
• Instantaneous sound level (fixed) dBA	35 dBA	45 dBA
• Equivalent sound level (fixed) dBA	30 dBA	40 dBA
Reduction index, at least R_w , dB	55 dBA	45 dBA

Note that the given objectives (goals) and requirements for the equivalent sound levels refer to exposure during rest periods and so on. The sound levels that apply to lightweight containers and similar are for fixed installations in functional containers as well as the reduction index for differentiating between interior and exterior constructions.

4.4.1 Sound levels for workplace containers

The reason for another requirement (65 compared to 55 dBA) for the maximum sound level for TEMPEST/CBRN protected containers is that with modern technology it is difficult to meet the requirement of 55 dBA in this type of container. The requirement of a maximum sound level of 55 dBA from fixed installations is based in part on AFS 2005:16 *Noise*, which states that the equivalent A-weighted sound level should not exceed 55 dB for areas where it is important to be able to converse

4.4.2 Sound levels for residential containers

Residential containers do not normally need to be TEMPEST protected. The stated objectives and requirements are based on containers that are not TEMPEST protected. With current technology, it is difficult to meet the requirement for maximum sound levels for TEMPEST protected residential containers.

It can be difficult to achieve the objects and requirements for a functional container depending on its size and structure in comparison with a residential building. To ensure comfortable sleeping facilities and, therefore, the troops' high combat value, the soldiers' access to undisturbed rest is of great importance.

Table 4:2 Examples of sound requirements from various regulations and recommendations for residential areas

FOHMFS 2014:13, Public health agency general advice on inside noise	
Approximate values of noise causing inconvenience in permanent and temporary living quarters:	
• LAFmax	45 dB
• LAeqT	30 dB
Surgeon General supervision protocol KS 17, 2008-05-26:	
• Barracks, fixed installations	30 dBA
Housing authority building regulations (BFS 1993:57) amendments up to BFS 2010:29 BBR 17.	
For sleeping quarters, rest areas and daily social areas, refer to SS 25267:2015.	
• LpAF-max	35 dB
• LpAeq	30 dB
TSFS 2011:91, Transport agency regulations and general advice on the working environment on warships.	
The highest noise levels for workplaces and recreational areas:	
• Kontinuerligt buller i hamn och till sjöss	60 dBA
• Intermittent buller i hamn	65 dBA

The sound requirement in *table 4:2* apply to the construction of walls, roofs and floors. When choosing windows, doors and hatches select their sound reducing capabilities so that the total sound reduction is no more than marginally affected. This also applies to intrusions by sewage pipes, ventilation ducts and so on.

The requirement for $R'w$ 45 dB sound reduction is based on, among other things, the following:

- With relatively simple and cheap resources $R'w$ 45 dB can be achieved.
- A high $R'w$ value also has a positive effect for thermal insulation that becomes higher, it also, indirectly, has a positive effect on sound. It will be cooler in summer and warmer in winter. The effects of the AC unit can be reduced which in turn reduces noise and the use of energy.
- The container can be used in noisy environments, for example, air fields.

The reduction index for containers meets, among others, the requirements stated in TSFS 2011:91, *The Transport Agency regulations and general advice on the working environment on warships* for accommodation – messes/ward rooms/toilets/showers. Having a relatively high demand on the reduction index is justified because there often are noisy installations outside, for example, generators.

The reduction index for lightweight containers and similar (such as designed for air transport) made of aluminium and composite materials, because of the light weight can be difficult to achieve. If the containers are to be used in a noisy environment where the requirement for sound reduction cannot be met, other measures must be taken.

5.404.01 Warning signals shall be easily distinguished from generated noise.

5.404.02 A visible sign bearing the symbol meaning "Ear protection must be worn" shall be placed at the entrance of rooms or areas in which it is likely harmful noise will be generated.

Comment: AFS 2009:2 *Workplace design*, 34 § also AFS 2008:13 *Signs and signals*.

Comment: The armed forces have an exemption from the requirement to displaying warning signs when it is impracticable according to the Work environment authority CTM 2005/44728.

4.5 ELECTRICAL SYSTEMS, ELECTRICAL SAFETY AND POWER SUPPLY

Systematic electrical safety efforts are essential to the armed forces for guaranteeing a robust and reliable power supply for training, exercises and military effort. The armed forces have, with the support of electrical legislation and deployment requirements, issued guidelines for the organisation's systematic electrical projects. These are described in *Handbook for electrical safety in the Armed forces* (H Elsäk FM).



4.5.1 Electrical safety and power supply

The power supply used for training, exercises and military effort is, in most cases, produced by the armed forces' transportable generating sets. The armed forces have unique electrical systems, installations and equipment. The armed forces' operations in different parts of the world under extreme weather conditions put heavy demands on both personnel and power supply systems. Special requirements for design solutions and the management of technical solutions and products are necessary to protect people, domestic animals and property in the prevailing conditions of the field environment. Standards, therefore, for, for example, electrical installations in domestic or industrial property or on building or demolition sites, are not fully applicable to electrical safety in the field.

Support for the electrical safety requirements of the armed forces, in addition to H Elsäk FM, is available in the *Handbook Safe electrical products and systems* (H SEPS E) 2015 as well as in design rules for armed forces electrical installations in the field, FMEAF.

Some EC directives, for example, the Machinery directive (2006/42/EG), the Low voltage directive (2006/95/EG) and the EMC directive (2004/108/EG), refer to European standards that can be used to achieve the safety level that the EC directive requires.

The national electrical safety board supervises electrical installations, electrical products and electrical fitters.

4.5.2 Training and skills

Under the coordination agreement, between the Defence Equipment Administration (FMV) and the armed forces, FMV has responsibility for the design and system safety for the equipment supplied to the armed forces. The armed forces shall manage equipment following instructions from FMV, using trained personnel. Electrical fitters and electricians are not necessary for the maintenance of electrical products for establishing and maintaining FMEAF. FMV design rules, however, require that fully trained armed forces personnel shall manage FMEAF and connected equipment.

5.405.01 The *Handbook Safe electrical products and systems 2015*, (H SEPS 2015) shall be applied to all electrical installations.

Comment: The handbook gives the requirements for electrical products including appliances, equipment, components and machinery.

4.6 WATER, SEWAGE, COOLING AND HEATING

When working close to heat sources and there is a possibility of receiving burns, there must be access to cold running water close by. Some operations might require immediate access to hand-washing facilities. Requirements on the quality of drinking water are found in National Food Authority's announcement on drinking water SLV FS 2001:30.

Hot and cold pipes must be placed so that the possibility of injury from excessive cold or heat is avoided and they should be insulated to avoid accidental contact.

4 Function-oriented System Safety Requirements

Surfaces having temperatures above 55 °C shall be avoided. Methods for the assessment of human responses to contact with hot or cold surfaces are specified in standards EN ISO 13732-1:2006 and ISO 13732-3:2005. The Building Regulations contain requirements for hot parts of buildings or installations.

To avoid personal injury or damage to equipment, the position and direction of the safety valve on an expansion tank must be watched when it is warming up.

Food storage areas and kitchens which supply drinking water, which is classed as a food, must comply with the basic requirements in the EC regulation 178/2002 *On the general principles and requirements of the food legislation, set out by the European Food Safety Authority dealing with questions of food safety.*

According to the environmental code (1998:808) and the environmental recommendation (1998:899) dealing with environmentally hazardous activities and health protection, it is, among other things, prohibited to discharge waste water into the ground or water without further treatment more than just sludge separation. Several other requirements exist in recommendations for, for example, residential containers and what counts as the different types of inconveniences.

- 5.406.01 Hot and cold pipes shall be placed so that the possibility of hot or cold burns is avoided by their placement or by protection against accidental contact.
- 5.406.02 Surfaces that are easily accessible shall not have a surface temperature that exceeds 55 °C.
- 5.406.03 Expansion tanks shall be placed so that no damage occurs if the safety valve blows.

4.7 FITTINGS AND EQUIPMENT

In workplace design, the fittings and equipment should be chosen and placed so that impact or crooked lifts are avoided. This is especially important in huts that are on different platforms where work continues while being transported, for example, ambulance huts or command positions.

Fittings such as fasteners for shelves or racks for boxes which are fixed to the walls or the floor must be able to withstand vibration while being transported. They must also be designed to withstand the stress caused by an accident or by mine explosions.



The installation of chairs that can swivel and have height adjustment makes it possible for different postures to be adopted for those doing sedentary work. When personnel are working while being transported, all equipment must be secured.

A clearance of 0.6 m is usually sufficient space between fixed and moving parts. Moving parts should always be fitted with touch protection.

See the Work environment authority's direction on ergonomics and the *Handbook Vehicle Safety* (H FordonSäk E).

Ambulance-huts should be designed in accordance with SS-EN 1789:2007 *Medical vehicles and their equipment – road ambulances* + A2:2014.

- 5.407.01 Permanently installed chairs that are used during transport shall comply with the regulations for vehicle seats.
Comment: Height-adjustable head rests must be provided.
- 5.407.02 Safety belts for use during transport shall be provided.
Comment: The recommended requirement for safety belts is in *H FordonSäk E*.
- 5.407.03 All fittings shall have at least two attachment points at least 250 mm apart.
Comment: Intended to reduce the likelihood of fittings flying about when being fired on or when a mine explode.
- 5.407.04 When equipment and personnel are transported together, all equipment shall be secured.
- 5.407.05 Moving parts shall be fitted with touch protection.

4.8 FLOORS, WALLS AND CEILINGS

The room height is calculated from the floor to the ceiling or to the lower edge of the roof beams or roof-mounted equipment. It is desirable that the centre aisle in huts has a room height no lower than 1.70 m and to keep the space above the centre aisle free from corners and edges to avoid knocks. Recommendations for other workplaces and personnel facilities are found in AFS 2009:2, *Workplace Design*.



Floors in functional containers or huts must be stable and not have dangerous changes in level, or holes or slopes. Floors, steps and other surfaces should be designed or coated to minimise the risk of slipping. Floors by fixed work stations might need insulating to avoid unwanted cold feet. The only part of this recommendation that applies to tents, is that the floor is treated to prevent slipping and that it should be insulated against ground chill through the duckboards or similar.

Stainless steel or other suitable coverings can be used for surfaces, such as floors, walls, or ceilings, that might become contaminated thus making it easy to clean and decontaminate them.

The floors in work places or personnel areas where people or objects becoming electrostatically charged is dangerous, should be made of a material that dissipates the charge. This is important especially where flammable liquids are poured, lead batteries are charged, where certain laboratory work is performed and while working with explosive anaesthetic gases.

Advice on protection against static electricity either by earthing or potential equalization is given in the standard SS 421 08 22.

- 5.408.01 The room height in the centre of a hut shall be not less than 1 700 mm.
Comment: The room height should not be less than 2 000 mm.
- 5.408.02 Floors shall be fixed, stable and shall not have dangerous or inconvenient changes of level, holes or slopes.
- 5.408.03 Floors, steps or other surfaces shall be designed or coated to minimize the risk of slipping.
- 5.408.04 In work places or personnel areas where particular danger occurs when people or objects are electrostatically charged, the floor covering shall be made of material that dissipates the electrostatic charge.

4.9 WINDOWS, DOORS AND HATCHES

Doors, hatches and windows that can be opened should be able to be locked automatically in the open position. Hatches and windows that are opened by raising need to be able to be secured so they cannot fall or shut unintentionally. Gates should be able to be released in a way that needs two hands to avoid the risk of being crushed. To minimise the risk of injuries caused by crushing different types of door closing equipment or other types of pinch protection can be used.

Swing doors between different working areas, for example in a field hospital or between a kitchen and the restaurant area, can be fitted with viewing windows to reduce the risk of collisions. If permitted, totally transparent swing doors can be selected.

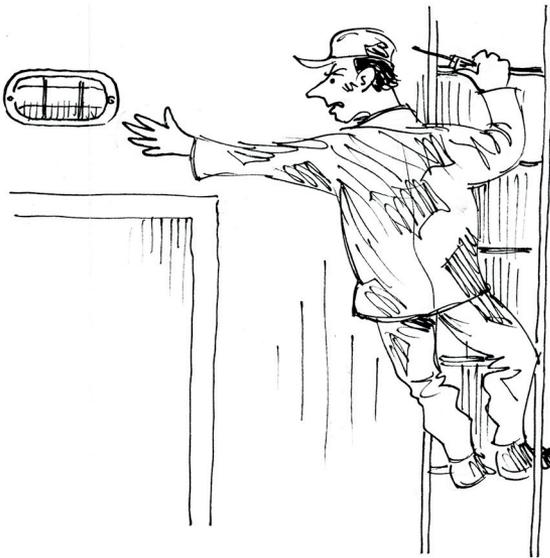
Doors and hatches should be fitted with devices that prevent snow or icicles falling straight down.

- 5.409.01 Doors, hatches and windows that can be opened shall lock automatically in the open position by an self-locking latch.
Comment: Recommended requirements for safety features for doors and hatches are found in *H FordonSäk E*.
- 5.409.02 Hatches and doors that are opened by raising them shall be secured so that they do not fall or shut accidental.
- 5.409.03 Latches for doors, hatches and windows that can be opened shall be released in a way that requires two handed operation.
- 5.409.04 Swing doors between working areas shall be fitted with viewing windows.
- 5.409.05 A device to prevent snow and icicles from falling shall be fitted to doors and hatches.

4.10 STAIRS AND FIXED LADDERS

When working in a hut or a functional container loaded on a platform, there will be a drop to the ground which will require the use of a stepladder, steps, a ladder or some other way of climbing. To ensure safety, the design of such equipment for climbing needs to take into account the necessary angle, the kind of steps, and other measurements that account for the use and the intensity of use of the equipment.

Between doors and descending stairs there must be a landing which is large enough for a normal size person wearing shoes. The first and last steps must be easy to see and should be clearly marked to avoid accidents. Landings, stairs, steps and ladders shall be stable and must not have dangerous changes in height, holes or slopes. Fixed stairs, steps or ladders are always preferable to non-fixed. Stairs with more than three steps can have a handrail fitted to give support and to prevent falls.



Landings, stairs, steps and ladders should be designed or coated to minimize the risk of slipping. It can also be an advantage if the steps are made of grating or similar to minimise the collection of standing water or the build-up of ice and also make removal and fitting easier.

Recommendations for the design of stairs are found in the Swedish standard SIS 91 11 01, *Staircase elements – Basic dimensions*.

- 5.410.01 Between doors and descending stairs there shall be a landing large enough for a normal size person wearing shoes.
- 5.410.02 The first and last steps shall be indicated with a warning sign.
- 5.410.03 Landings, stairs, steps and ladders shall be stable and shall not have inconvenient changes of level, holes or slopes.
- 5.410.04 Landings, stairs, steps and ladders shall be made with non-slip surfaces to prevent slipping.
- 5.410.05 Landing and steps shall be made of grating or similar.

4.11 GOODS INTAKES AND CARGO OPENINGS

There might be a need to be able receive goods at the workplace. On receipt of the goods it should be possible to indicate to the receiver when the unloading is finished. Such indications shall not replace an instruction always to inspect that the goods container is empty before operations are concluded and the transport leaves.

Openings in the floor should be avoided. Where there must be floor openings they must be used only for emergency evacuations.

- 5.411.01 It shall be possible when goods are delivered to indicate to the receiver when the goods have been unloaded.

4.12 PROTECTIVE DEVICES AND EMERGENCY EQUIPMENT

There shall be protection against being trapped in work- and storage places. Inside huts, refrigeration or freezer containers where the temperature can be lower than $-5\text{ }^{\circ}\text{C}$ there shall be a visible light and signalling device that can be easily reached and seen

from the inside of the compartment. It shall be located 0.5 m above the floor and be able to be used to attract attention. It shall be marked “Emergency Signal”. In hot-air containers, workplaces and personnel areas where the temperature can rise above +40 °C there must be an equivalent light and signalling device.

The same requirements also apply to laboratories where dangerous chemical substances or biological agents are handled. In huts or containers that receive direct sunlight and do not have air conditioning, there is a possibility of high internal temperatures but the requirements need be observed mainly in cases where work is being conducted by solitary personnel.

Warning signs are used when the risk of accidents cannot be avoided or sufficiently limited through design measures, for example around radar, antennas or a variety of weapons. Danger areas shall always be clearly marked. Rules for warnings on signs and signal are found in AFS 2008:13 *Signs and signals* and warning signs for protection against electrical hazards are found in the Electrical Safety Authority’s power requirements ELSÄK-FS 2008:1.

Emergency lighting of an adequate strength, placed low down, shall be installed in premises where workers are particularly exposed to danger if the normal lighting fails.

Installation and construction of electrical cables is covered in current building regulations of the national housing board. The standard EN-SS 1838 deals with different types of emergency lighting as well as evacuation signs.

- 5.412.01 Inside premises where the temperature can fall below $-5\text{ }^{\circ}\text{C}$ shall be an easily accessible and visible light and signalling device labelled “Emergency signal”. The alarm signal shall be audible and visible outside the premises and labelled “Emergency cold room”.
- Comment:* Refers mainly to refrigeration of freezer containers or work places where solitary work is done.
- 5.412.02 Inside premises where the temperature can rise above $+40\text{ }^{\circ}\text{C}$ shall be an easily accessible and visible light and signalling device labelled “Emergency signal”. The alarm signal shall be audible and visible outside the premises and labelled “Emergency hot room”.
- Comment:* Refers mainly to hot air containers, saunas or work places where solitary work is done.
- 5.412.03 Inside premises where dangerous chemical substances or biological agents are handled shall be an easily accessible and visible light and signalling device labelled “Emergency signal”. The alarm signal shall be audible and visible outside the premises and labelled “Emergency dangerous substances”.
- 5.412.04 Danger zones shall be clearly marked.
- Comment:* Warning signs shall be permanent.
- 5.412.05 Emergency lighting of an adequate strength, placed low down, shall be installed in premises where workers are especially exposed to the risk of accident if the normal lighting fails.

4.13 ALARMS, EVACUATION AND FIRE PROTECTION EQUIPMENT

The basis for safe evacuation is evacuation routes, alarms that warn of danger and the knowledge of the correct behaviour in an emergency. Evacuation from both stationary and mobile workplaces is necessary in cases of fire, escaping gas, smoke build-up,

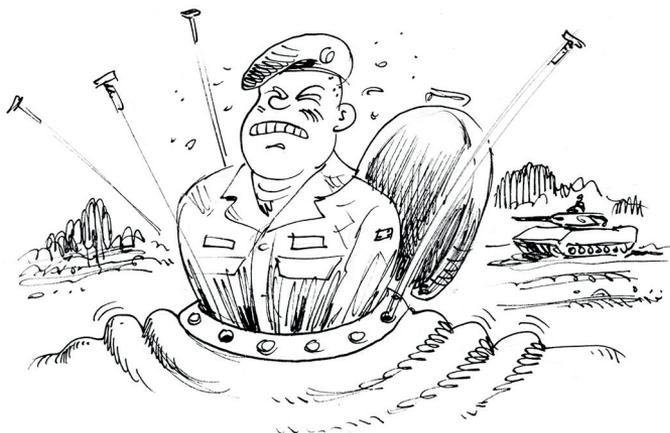
overturning or hostile fire. The number of evacuation routes and their location and capacity must be adapted to a specific workplace's use, the equipment it contains and size as well as the largest number of people that the premises are meant to hold. Normally there shall be at least two evacuation routes going in different directions, but in very small rooms a single route is sufficient. Also the equipment must be placed with consideration to the evacuation routes. Where there is a centrally located evacuation route the normal exit can be used. In field hospitals and where several command centres are connected by passages and air locks, several emergency exits are required. Two emergency routes, in different directions are required when a hut is permanently mounted on a platform.

Doors and hatches must open outwards in the direction of escape. Door handles and handles on hatches used for evacuation should be equipped with signs or other direction markings, such as luminous stickers, if they do not reveal the tactical movements and expose the soldiers' position and increase the likelihood of drawing fire.

An alternative is to place warning notices on the inner frame of the door or on the inside of the door. Evacuation routes that need lighting during evacuation shall be fitted with emergency lighting.

The dimensions of an evacuation route must be such as to make it possible to get in and out while wearing personal protective equipment. A clearance of 0.6 m is usually sufficient for passage between static and moving parts. The requirement in the Swedish standard SIS 1797, *Inspection openings and manholes*, can serve as a guideline in this context.

Special consideration should be given to tent- and container-based field hospitals with people who have both disabilities and lack knowledge of the premises. Evacuation and requirements for evacuation are dealt with in AFS 2009:2 *Workplace design*.



Doors and hatches shall normally be able to be opened from both inside and outside. For tactical reasons, to open doors and hatches from the outside shall be possible only by using a special tool.

Locations for fire extinguishing equipment, which is not activated automatically, shall be marked with signs or stickers. Fire extinguishing equipment shall be easy to use. If necessary, an automatic fire extinguishing system shall be installed. In areas where an automatic fire extinguishing system has been triggered, protective measures must be taken as the released extinguishing agents can cause choking and sickness. Refer to *H FordonSäk E* when choosing firefighting protection and portable fire extinguishers.

Residential or functional containers that are intended to be used for permanent work, such as repair and engineering shops, command centres or health centres as well as cabins loaded onto carriers intended for passenger transport, shall be equipped with two emergency exits, the ordinary door plus another door or hatch. The ordinary door shall open outwards and the emergency exit shall open inwards and shall be easy to open from the inside. Note that the requirement below can conflict with other requirements, for example the requirements dealing with mine protection.

Storage and transport containers that are only occasionally manned do not need two emergency exits. In situations where several containers are combined into a single unit or in situations

where the threat assessment is high, the decision about the requirements for emergency exits are made for each individual case.

In workplaces where chemical substances, escaping gases, lack of oxygen, ionizing radiation or similar constitute risks of accident or health risks, detectors and alarms for signalling an evacuation shall be installed. The alarms must emit a sound or a light or both that can be understood by everyone affected by the danger. The alarm signal must be such that it cannot be confused with ordinary signals emitted by processes and other technical equipment. The alarm must be able to be set off manually. When there is a power failure, the alarm signal must be able to continue for at least 60 minutes.

The alarm shall emit a specific signal between 65 – 110 dBA that can be recognised and understood by everyone exposed to the danger. An exception to the maximum volume of 110 dBA applies to premises where hearing protection is obligatory regardless of the operating conditions and where all concerned have been previously warned. The higher volume must not exceed 115 dBA. The signal level from the alarm shall, under normal circumstances, be in the range between 10 and 25 dBA above the highest level of background noise. Temporary noises that last no more than 30 seconds need not be considered when determining the level of background noise. A lower alarm volume is acceptable in residential containers, but it must not be less than 75 dBA.



Where the background noise level exceeds 100 dBA the alarm system shall be supplemented with an optical alarm. In areas where the noise level is below 100 dBA but audibility is low, the alarm needs to be supplemented by an optical alarm.

- 5.413.01 The premises shall have at least two independent escape routes going in different directions.
Comment: Doors and hatches shall open outwards and be clearly signed.
- 5.413.02 Doors and hatches shall have luminous stickers.
Comment: Alternatively, the inner frame of the door or hatch can have a warning sign.
- 5.413.03 Evacuation alarms shall be installed in workplaces where chemical substances, escaping gases, a lack of oxygen, ionizing radiation or similar can be a cause of accidents or sickness.
- 5.413.04 The alarms shall emit light or sound signals or both which shall be understood by those affected.
Comment: During a power failure the alarm device function shall be maintained for at least 60 minutes.

- 5.413.05 The alarm signal shall not be confused with the ordinary signals emitted by technical equipment in the room.
- 5.413.06 The alarm signal shall also be able to be triggered manually.
- 5.413.07 During a power failure the alarm device function shall be maintained for at least 60 minutes.
- 5.413.08 The sound level of an audible alarm shall be between 65 – 110 dBA and at ear level where people live.
Comment: In certain environments a maximum of 115 dBA is allowed.
- 5.413.09 In sleeping quarters, the alarm sound level shall be at least 75 dBA by the head of the bed.
- 5.413.10 If the background noise level exceeds 100 dBA the audible alarm shall be supplemented with an optical alarm.
- 5.413.11 The choice of firefighting protection and of hand-held fire extinguishers shall be determined by *H FordonSäk E*.

4.14 COMMUNICATION

Tactical conditions usually require that light and sound signatures emitting from work rooms is minimized. Such work rooms often lack windows and have special air locks at the entrances to the room.

Work in the laboratory can require that doors can be locked from the inside so that unauthorized personnel are not accidentally subjected to ill-health due to hazardous substances or ionizing radiation.

Note that huts situated on trailers might not have a connecting link with the driver of the vehicle or vehicle commander.

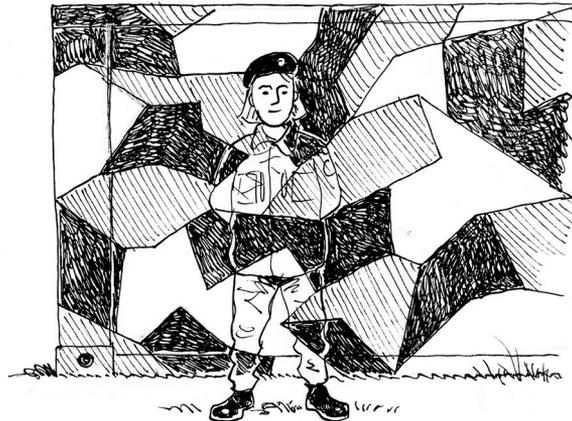
Communications between the cab, the functional container and the outside are of great importance and there should be least two independent methods of communication. It is particularly important that there is contact between the cab of the vehicle and the functional container or hut so that the driver of the vehicle or vehicle commander can keep in contact. One method should be by radio, the other way by physical contact, two-way signal lamps or by a speaking tube.

5.414.01 Personnel in the working space on the carrier shall have two different and independent ways of communicating with the driver and the vehicle commander.

Comment: This refers to huts permanently mounted or functional containers loaded on a carrier.

5.414.02 Personnel in a shelter shall have two different independent ways of communicating with the outside.

4.15 SIGNATURE ADAPTION



Shelters in the field need to customise their signatures by temporary camouflage using nets, cardboard or natural material such as tree branches or bundles of brush wood. Shelters should, as far as practicable, be located in such a way to the surrounding land that camouflaging can be performed with adequate safety against falls. To ensure safety, as far as possible, camouflage should be

fixed to fixed steps or ladders giving access to roofs. When not camouflaging, equipment designed for preventing falls in the form of steps, ladders and railings and so on are to be used. The shelter must have special anchor points for this purpose and these should comply with the requirements of EN 795, but not less than 10 kN. Equipment to prevent falls is not something that service personnel have in their personal equipment but it is something that must be a part of the shelter equipment or the platform equipment. Instructions for camouflaging must always be available.

- 5.415.01 Steps and climbing equipment for climbing on the outside of the shelter shall be available.
- 5.415.02 Anchor points for personal safety equipment shall be provided and shall meet the requirements of EN 795, but not less than 10 kN.
- 5.415.03 Personal safety equipment shall be provided in the shelter's equipment.
Comment: Personal safety equipment shall also be provided in the platform equipment.

4.16 PERSONNEL AREAS

Applicable parts of AFS 2009:2 Workplace design apply to personnel areas, such as changing rooms, wash rooms and showers, toilets, canteens and personal living quarters. The need, however, for slip-resistant floor should be especially considered in areas where water is present on the floor.

- 5.416.01 Floor surfaces likely to be sprayed with water shall be slip-resistant.

4.17 OFFICE AREAS

It is desirable that the workplaces used for administrative work are appropriately designed and have good hygienic conditions. In addition to general lighting, which should be about 500 lux, each work station should have its own lighting. Ventilation should

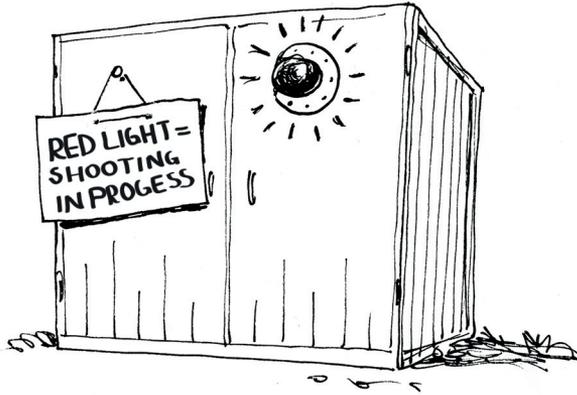
have an air flow of at least 7 litres/second per person and that the air supply is free of pollution. The temperature, in winter, should be between 20 – 24 °C and, in summer, between 20 – 26 °C. Drafts exceeding an air speed of 0.2 m/s should be avoided. Below are the recommendations for different office areas.

The requirements in TSFS 2011:91 *Swedish Transport Agency regulations and general advice on working on warships*, Chapter 4 and AFS 1998:5 *Working with computers* shall be applied when organising the work at the computers.

- | | |
|----------|---|
| 5.417.01 | The minimum office space for a single room shall be 7.0 m ² .
<i>Comment:</i> Rectangular space about 3×2.3 m. |
| 5.417.02 | The minimum office space for a double room shall be 13.0 m ² .
<i>Comment:</i> Rectangular space about 3×4.4 m. |
| 5.417.03 | The minimum office space for a room used by several people shall be 3.6 m ² /person excluding space for aisles and book cases.
<i>Comment:</i> Rectangular space about 2×1.8 m. |

4.18 PRACTICE SHOOTING PREMISES

Work places specially fitted for practice shooting shall have a clearly visible indication that shooting is in progress. This is best done by the use of a red lamp and a sign explaining what the lamp means in the same way that access roads to firing ranges are marked.



5.418.01 Visual warning shall be placed by the doors of practice shooting locations.

Comment: Visual warning signals shall be activated automatically when the practice shooting system/simulator is started.

5 SUMMARY OF REQUIREMENTS, CHECKLISTS

The checklist can be used when developing requirements for technical specifications and operational undertaking specifications, carrying out project evaluations as well as statements in inspection groups, advisory groups and work groups for system safety.

Requirements in dark purple are mandatory requirements and requirements in light purple are optional requirements. The requirements might be reformulated to relate them better to the current technical system. The requirements are described in *Chapter 3* and *4* of this handbook, as well as in *Handbook on System Safety (H SystSäk E)*.

The checklist is available in the digital version on the FMV website. Whether or not the requirement is met or if it is not applicable can be entered in the Requirement Compliance column (Yes/ No/ Not applicable) in the MS Word file.

CHAPTER 3 ACTIVITIES AND DOCUMENTATION

Section 3.2 Measuring Noise

5.302.01 Documentation coming from noise measurements shall show that the amount of noise in all workplaces complies with the requirements of the AFS (2005: 16) *Noise* from a given operating profile for the technical system.

Comment: Actual noise measurements may be required.

Section 3.3 Checking Evacuation Routes

- 5.303.01 Requirements for evacuation shall be verified and validated by testing specified test cases.

Section 3.4 Documentation

- 5.304.01 Written operating and maintenance instructions for ventilation systems shall be in Swedish.
Comment: AFS 2009:2 *Workplace Design*, § 27-28.
- 5.304.02 Written operating and maintenance instructions for ventilation systems shall be in Swedish.
Comment: AFS 2009:2 *Workplace Design*, § 86.
- 5.304.03 Instructions for climbing on exterior surfaces must exist.
Comment: Images and symbols should primarily be used.
- 5.304.04 Evacuation plans with marked assembly points shall be provided.

CHAPTER 4 FUNCTION-ORIENTED SYSTEM SAFETY REQUIREMENTS

Section 4.1 Lighting

- 5.401.01 Design indoor lighting in accordance with Light and Space - Planning Guide for indoor lighting, Issue 3, Lighting Culture in 2013, which is an application of EN 12464-1: 2011 *Light and lighting - Lighting of work places - Part 1: Indoor workplaces*.
- 5.401.02 Designing outdoor lighting in accordance with EN 12464-2: 2014 *Light and lighting - Lighting of work places - Part 2: Outdoor work places*.
- 5.401.03 The lighting will be designed so that warning signs, emergency stop devices, monitors and other vital functions are easy to understand and that its colour can be easily distinguished.

Section 4.2 Air Quality and Ventilation

- 5.402.01 Air exchange shall be at least 7 litres/second per person.
Comment: This refers to premises where air pollution results mainly from the number of personnel present. The carbon monoxide level shall not exceed 1 000 ppm.
- 5.402.02 Air filters for the fresh air intake/AC installations shall be chosen in accordance with SS-EN 779:2012.
- 5.402.03 Collective protection against CBRN threats shall not interfere with general ventilation, exhaust ventilation or fume cupboards.
- 5.402.04 Air inlets on huts shall be placed as far as possible from the platforms exhaust outlet.

- 5.402.05 In premises where air pollution results mainly from the number of personnel equipment shall be provided to measure the level of carbon monoxide.
- 5.402.06 Contamination from processes shall be disposed of as close to the source as possible.

Section 4.3 Thermal Climate

- 5.403.01 If the temperature is expected to fall below 16 °C or rise above 26 °C, special measures can be taken, such as the installation of insulation, and/or equipment that heats/cool the air can be employed.

Section 4.4 Sound and Acoustics

- 5.404.01 Warning signals shall be easily distinguished from generated noise.
- 5.404.02 A visible sign bearing the symbol meaning "Ear protection must be worn" shall be placed at the entrance of rooms or areas in which it is likely harmful noise will be generated.
- Comment:* AFS 2009:2 *Workplace design*, 34 § also AFS 2008:13 *Signs and signals*.
- Comment:* The armed forces have an exemption from the requirement to displaying warning signs when it is impracticable according to the Work environment authority CTM 2005/44728.

Section 4.5 Electrical Systems, Electrical Safety and Power Supply

- 5.405.01 The *Handbook Safe electrical products and systems 2015*, (H SEPS 2015) shall be applied to all electrical installations.
- Comment:* The handbook gives the requirements for electrical products including appliances, equipment, components and machinery.

Section 4.6 Water, Sewage, Cooling and Heating

- 5.406.01 Hot and cold pipes shall be placed so that the possibility of hot or cold burns is avoided by their placement or by protection against accidental contact.
- 5.406.02 Surfaces that are easily accessible shall not have a surface temperature that exceeds 55 °C.
- 5.406.03 Expansion tanks shall be placed so that no damage occurs if the safety valve blows.

Section 4.7 Fittings and Equipment

- 5.407.01 Permanently installed chairs that are used during transport shall comply with the regulations for vehicle seats.
Comment: Height-adjustable head rests must be provided.
- 5.407.02 Safety belts for use during transport shall be provided.
Comment: The recommended requirement for safety belts is in *H FordonSäk E*.
- 5.407.03 All fittings shall have at least two attachment points at least 250 mm apart.
Comment: Intended to reduce the likelihood of fittings flying about when being fired on or when a mine explodes.
- 5.407.04 When equipment and personnel are transported together, all equipment shall be secured.
- 5.407.05 Moving parts shall be fitted with touch protection.

Section 4.8 Floors, Walls and Ceilings

- 5.408.01 The room height in the centre of a hut shall be not less than 1 700 mm.
Comment: The room height should not be less than 2 000 mm.
- 5.408.02 Floors shall be fixed, stable and shall not have dangerous or inconvenient changes of level, holes or slopes.
- 5.408.03 Floors, steps or other surfaces shall be designed or coated to minimize the risk of slipping.
- 5.408.04 In work places or personnel areas where particular danger occurs when people or objects are electrostatically charged, the floor covering shall be made of material that dissipates the electrostatic charge.

Section 4.9 Windows, Doors and Hatches

- 5.409.01 Doors, hatches and windows that can be opened shall lock automatically in the open position by an self-locking latch.
Comment: Recommended requirements for safety features for doors and hatches are found in *H FordonSäk E*.
- 5.409.02 Hatches and doors that are opened by raising them shall be secured so that they do not fall or shut accidentally.
- 5.409.03 Latches for doors, hatches and windows that can be opened shall be released in a way that requires two handed operation.
- 5.409.04 Swing doors between working areas shall be fitted with viewing windows.
- 5.409.05 A device to prevent snow and icicles from falling shall be fitted to doors and hatches.

Section 4.10 Stairs and Fixed Ladders

- 5.410.01 Between doors and descending stairs there shall be a landing large enough for a normal size person wearing shoes.
- 5.410.02 The first and last steps shall be indicated with a warning sign.
- 5.410.03 Landings, stairs, steps and ladders shall be stable and shall not have inconvenient changes of level, holes or slopes.
- 5.410.04 Landings, stairs, steps and ladders shall be made with non-slip surfaces to prevent slipping.
- 5.410.05 Landing and steps shall be made of grating or similar.

Section 4.11 Goods Intakes and Cargo Openings

- 5.411.01 It shall be possible when goods are delivered to indicate to the receiver when the goods have been unloaded.

Section 4.12 Protective Devices and Emergency Equipment

- 5.412.01 Inside premises where the temperature can fall below $-5\text{ }^{\circ}\text{C}$ shall be an easily accessible and visible light and signalling device labelled “Emergency signal”. The alarm signal shall be audible and visible outside the premises and labelled “Emergency cold room”.
- Comment:* Refers mainly to refrigeration of freezer containers or work places where solitary work is done.
- 5.412.02 Inside premises where the temperature can rise above $+40\text{ }^{\circ}\text{C}$ shall be an easily accessible and visible light and signalling device labelled “Emergency signal”. The alarm signal shall be audible and visible outside the premises and labelled “Emergency hot room”.
- Comment:* Refers mainly to hot air containers, saunas or work places where solitary work is done.
- 5.412.03 Inside premises where dangerous chemical substances or biological agents are handled shall be an easily accessible and visible light and signalling device labelled “Emergency signal”. The alarm signal shall be audible and visible outside the premises and labelled “Emergency dangerous substances”.
- 5.412.04 Danger zones shall be clearly marked.
- Comment:* Warning signs shall be permanent.
- 5.412.05 Emergency lighting of an adequate strength, placed low down, shall be installed in premises where workers are especially exposed to the risk of accident if the normal lighting fails.

Section 4.13 Alarms, Evacuation and fire protection equipment

- 5.413.01 The premises shall have at least two independent escape routes going in different directions.
Comment: Doors and hatches shall open outwards and be clearly signed.
- 5.413.02 Doors and hatches shall have luminous stickers.
Comment: Alternatively, the inner frame of the door or hatch can have a warning sign.
- 5.413.03 Evacuation alarms shall be installed in workplaces where chemical substances, escaping gases, a lack of oxygen, ionizing radiation or similar can be a cause of accidents or sickness.
- 5.413.04 The alarms shall emit light or sound signals or both which shall be understood by those affected.
Comment: During a power failure the alarm device function shall be maintained for at least 60 minutes.
- 5.413.05 The alarm signal shall not be confused with the ordinary signals emitted by technical equipment in the room.
- 5.413.06 The alarm signal shall also be able to be triggered manually.
- 5.413.07 During a power failure the alarm device function shall be maintained for at least 60 minutes.
- 5.413.08 The sound level of an audible alarm shall be between 65 – 110 dBA and at ear level where people live.
Comment: In certain environments a maximum of 115 dBA is allowed.
- 5.413.09 In sleeping quarters, the alarm sound level shall be at least 75 dBA by the head of the bed.

- 5.413.10 If the background noise level exceeds 100 dBA the audible alarm shall be supplemented with an optical alarm.
- 5.413.11 The choice of fire-fighting protection and of hand-held fire extinguishers shall be determined by *H FordonSäk E*.

Section 4.14 Communication

- 5.414.01 Personnel in the working space on the carrier shall have two different and independent ways of communicating with the driver and the vehicle commander.
Comment: This refers to huts permanently mounted or functional containers loaded on a carrier.
- 5.414.02 Personnel in a shelter shall have two different independent ways of communicating with the outside.

Section 4.15 Signature Adaption

- 5.415.01 Steps and climbing equipment for climbing on the outside of the shelter shall be available.
- 5.415.02 Anchor points for personal safety equipment shall be provided and shall meet the requirements of EN 795, but not less than 10 kN.
- 5.415.03 Personal safety equipment shall be provided in the shelter's equipment.
Comment: Personal safety equipment shall also be provided in the platform equipment.

Section 4.16 Personnel Areas

- 5.416.01 Floor surfaces likely to be sprayed with water shall be slip-resistant.

Section 4.17 Office Areas

- 5.417.01 The minimum office space for a single room shall be 7.0 m².
Comment: Rectangular space about 3×2.3 m.
- 5.417.02 The minimum office space for a double room shall be 13.0 m².
Comment: Rectangular space about 3×4.4 m.
- 5.417.03 The minimum office space for a room used by several people shall be 3.6 m²/person excluding space for aisles and book cases.
Comment: Rectangular space about 2×1.8 m.

Section 4.18 Practice Shooting Premises

- 5.418.01 Visual warning shall be placed by the doors of practice shooting locations.
Comment: Visual warning signals shall be activated automatically when the practice shooting system/simulator is started.

Appendix 1 Terms and Definitions



The following definitions are used in this handbook. A number of the definitions are defined only in this handbook, these are marked “H SäkFältmArb E”. For other terms, see Centre for Technical Terminology, TNC.

Term	Definition
Active service exercise	Exercises or training in field conditions aimed at personnel and units must be able to operate under war-like conditions within the Swedish Armed Forces. AFS 2009:2
Active service work place	Work premises located in a weather protected area especially equipped for permanent administrative work, including the connection links between two work places, and to perform specified tasks carried out by the same person for more than 59 minutes at a stretch, and weather-protected personnel areas. H SäkFältmArb

Term	Definition
Air lock	<p>A space that ensures the separation between the outdoor and indoor environments, preventing the ingress of soil and the effects of, for example, climate, light and sound.</p> <p style="text-align: right;">H SäkFältmArb</p>
Communication	<p>Communication ('mutual exchange', 'to make common', 'let partake in', 'benefit from', 'notify', 'communal', 'general', 'public'), the transfer of information between people, animals, plants or appliances (for the latter see data communication).</p> <p>Communication requires both a language or a code where information is expressed, and a physical medium by which information is transmitted.</p> <p style="text-align: right;">NE</p>
Connecting link	<p>A route of communication, between two points both indoors and outdoors.</p> <p style="text-align: right;">AFS 2009:2</p>
Container	<p>Transport equipment of a durable construction and so able to be used repeatedly, especially built to enable the transport of goods by one or more means of transport without the need to reload the content, designed to be secured and conveniently handled and fitted with load-securing devices to enable this, and approved under the international convention for safe containers (CSC), 1972, as amended.</p> <p>Transport Agency regulations and general guidance on the transport by sea of packaged dangerous goods (IMDG Code) 2013, 1.2.1 Definitioner</p>
Evacuation route	<p>Road from one fire area to the open air or another safe place.</p> <p style="text-align: right;">AFS 2009:2</p>

Term	Definition
Functional container	<p>A shelter fitted out with supplies for the workroom or staff areas, and strong enough to be used repeatedly, especially built to enable being transported, designed to be secured and easily handled and equipped with load-securing devices and has the same outer dimensions and load securing points as a container.</p> <p>H SäkFältmArb</p>
Hut	<p>Shelter fitted out with equipment for the work place or personnel use, strong enough to be used repeatedly, built especially for permanent mounting on the intended platform.</p> <p>H SäkFältmArb</p>
Light intensity	<p>Ratio between the light that falls on a surface and the size of the surface (lumen/m^2), expressed in lux ($\text{lux} = \text{lumen/m}^2$)</p> <p>AFS 2009:2</p>
Noise	<p>Undesirable noise, includes both noises that are damaging to hearing and disturbing noises.</p> <p>AFS 2009:2</p>
Personnel area	<p>Wardrobe space, dressing room, drying room, laundry room, shower room, toilet, wet room, rest room, wet room, on-call room, waiting rooms and sleeping accommodation.</p> <p>AFS 2009:2</p>
Shelter	<p>Forms the weatherproof physical boundaries of a work place and consists of enclosing walls, ceilings and floors with the associated construction details and air lock functions.</p> <p>H SäkFältmArb</p>

Bilaga 1 Terms and Definitions

Term	Definition
Temporary work-place	Each work location inside a shelter where the work is carried out permanently by the same person for at least 59 minutes. H SäkFältmArb
Tent	A portable shelter made of, for example, leather, canvas or plastic, supported by one or several poles or by a frame and often further supported by ropes attached to pegs in the ground. Dictionary reference
Work place	All interior or exterior places where work is done, whether continuously or temporarily. AFS 2009:2
Work premises	An interior area that houses one or more work stations for permanent work. AFS 2009:2

Appendix 2 Abbreviations

The following acronyms and abbreviations are used in the handbook.

Acronym/abbreviation	Explanation
AFS	The Swedish Work Environment Authority's statute book (statutes)
BBR	The Swedish Housing Authority's Building Regulations
CBRN	Chemical, Biological, Radiological and Nuclear
DR FMEAF	Design rules for the Swedish Armed Forces electrical structures in the field
ELSÄK-FS	The Swedish National Electrical Safety Board's collected regulations
EMC	Electromagnetic compatibility
H Elsäk i FM	The Swedish Armed Forces Handbook on Electrical Safety in the Armed Forces
H SystSäk E	The Swedish Armed Forces Handbook on System Safety
H FordonSäk E	The Swedish Armed Forces Handbook of Vehicle Safety
H SEPS E	The Swedish Armed Forces Handbook on Safe Electrical Products and Systems
SFS	Swedish statute book
TNC	The Swedish Centre for Technical Terminology

Appendix 3 References

Title, document

AECTP-230 (Edition 1), *Climatic Conditions*

Work Environment Authority (SFS 1977:1166) with amendments

Work Environment Act (SFS 1977:1160) with amendments

AFS 2009:2 *Workplace design (amendments up to 23rd April 2013)* National regulations on workplace design and general advice on the application of regulations

AFS 2008:13 *Signs and signals*

AFS 2005:16 *Noise*

AFS 2001:1 *Methodical working environment tasks*

AFS 1998:5 *Working with computers*

AFS 1981:14 *Protection against injury by falling*

DR FMEAF, *Design rule for the Swedish Armed Forces electrical installations in a field environment*, 13FMV127-6:1, issue 1.0, 2013-12-18

Light and space – Planning Guide for interior lighting, 3rd edition, Culture of Light 2013

EU Regulation 178/2002 *The general principles and requirements on food law, established by the European Food Safety Authority setting out procedures for food*

The Electricity Act (SFS 1997:857)

Electromagnetic compatibility (EMC) (SFS 1992:1512)

H SystSäk E 2011, del 1, M7739-352031

H SystSäk E 2011, del 2, M7739-352032

H FordonSäk E 2015, M7762-000991

H SEPS E 2016, M7762-001001

Title, document

FoHMFS 2014.13, *General advice on interior noise*

The environmental code (1998:808)

Environmental regulation (1998:899)

LIVSFS 2011:3 Regulations about amendments to the Food Administration regulations (*SLVFS 2001:30*) on drinking water

TEMPEST brochure – Compromising emanations – generation, production, method of protection requirements, requirements. M7773-001851 (utg. 2009)

SIS 1797, *Inspection hatches and manholes*

SIS 91 11 01, *Elements of stairs – basic dimensions*

SLVFS 2001:30, *National food agency announcement on drinking water* (Se LIVSFS 2011:3)

SS 421 08 22, *Potential equalisation in the presence of combustible gases*

SS-EN 12464-1:2011, *Light and lighting – Lighting workplaces – Part 1: Workplace interiors*

SS-EN 1789:2007, *Medical vehicles and equipment – road ambulances*

SS-EN 1838:2013, *Lighting – Emergency lighting*

ISO 13732-3:2005, *Ergonomics of the thermal environment – Methods for the assessment of human responses to contact with surfaces – Part 3: Cold surfaces*

SS-EN ISO 13732-1:2008, *Ergonomics of the thermal environment – Methods for the assessment of human responses to contact with surfaces – Part 1: Hot surfaces (ISO 13732-1:2006)*

SS-EN ISO 7730:2006, *Technical environment ergonomics – analytical determination and assessment of thermal comfort using the PMV and PPD indexes and the local thermal comfort criteria (ISO 7730:2005)*

Title, document

SS-EN 779:2012, *Maintenance – Air filters – assessment of performance*

TSFS 2011:91, *Transport Agency regulations and general advice for working on warships*

Appendix 4 List of Tables

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Project Manager

Lars Lange, FMV

Subject Experts

Yngve Sahlin, AB Långeggen

Translation

Lars Sjögren, Combitech AB

Illustrations and cover

Stefan Gustafsson, UTBLICK MEDIA I HALLAND AB

Mats Lundgren, Combitech AB

Original

Mats Lundgren, Combitech AB

Digital edition

Mats Lundgren, Combitech AB



Swedish Defence Materiel Administration
SE-115 88 Stockholm, Sweden

M7762-001011

