

NB: Unofficial translation,  
legally binding only in Finnish and Swedish

**Ministry of the Interior Decree**

**on the Technical Requirements for Civil Defence Shelters and the**

**Maintenance of the Equipment in Civil Defence Shelters**

(506/2011)

**Chapter 1**

**General provisions**

Section 1

*Technical requirements for civil defence shelters and the maintenance in the equipment of civil defence shelters*

- (1) In addition to what is provided in the Rescue Act (379/2011), the owner of the building shall ensure that the requirements concerning the technical properties of the civil defence shelter and the maintenance of the equipment in the civil defence shelter are met.
- (2) Separate provisions regarding the technical requirements for civil defence shelters and the maintenance of the equipment of civil defence shelters shall be issued by Ministry of the Interior decree.
- (3) of Separate provisions on the requirements for the equipment in civil defence shelters, the marking of the equipment and the information and instructions supplied with the equipment shall be issued by government decree.

**Chapter 2**

**Civil defence shelter facilities**

Section 2

*Shelter space*

- (1) The room height of the shelter space of the civil defence shelter shall be at least 2.3 metres. At beams and ducts, the unobstructed height of the shelter space may be 2.0 metres.
- (2) If a category S1 civil defence shelter made of reinforced concrete is built with a shelter space of more than 90 square metres, it shall be divided into at least two compartments using a reinforced concrete wall. The walls may have the openings required for normal use.

Section 3

*Airlock room*

- (1) A category S1 civil defence shelter made of reinforced concrete shall have an airlock room or an airlock tent. The airlock room shall measure at least 2.5 square metres. A floor surface area of at least 2.5 square metres shall be allocated for the airlock tent.
- (2) A category S2 civil defence shelter made of reinforced concrete may be equipped with one airlock room measuring at least 4 square metres.

- (3) Each accessway of a bedrock civil defence shelter shall have an airlock room measuring at least 4 square metres.

#### Section 4

##### *Toilets*

A civil defence shelter shall have a dry toilet cabin and a dry toilet fixture for every 20 square metres of the shelter space.

#### Section 5

##### *First-aid room and infirmary*

First-aid and infirmary facilities amounting to at least 10 per cent of the surface area of the civil defence shelter shall be provided in the immediate vicinity of the airlock room of a bedrock civil defence shelter and a category S2 civil defence shelter made of reinforced concrete.

#### Section 6

##### *Plant rooms and the control room*

The plant rooms and other technical facilities of a bedrock civil defence shelter and a category S2 civil defence shelter made of reinforced concrete shall be separated from the rest of the shelter by at minimum lightweight partition walls. In a bedrock civil defence shelter, a floor surface area at least 7 square metres located in the vicinity of the plant room shall be allocated for the control room.

#### Section 7

##### *Exits*

Category S1 and S2 civil defence shelters made of reinforced concrete shall, in addition to an accessway, also have at least one emergency exit, while bedrock civil defence shelters shall in addition to an accessway, also have at least two emergency exits.

### **Chapter 3**

#### **Excavation and structures**

#### Section 8

##### *Location of a bedrock civil defence shelter*

- (1) In the rock mechanical calculations, the bedrock thicknesses shall be dimensioned for pressure loads. The rock mechanical calculations shall be made if the spans are large or the bedrock conditions demanding.
- (2) The dimensioning of the bedrock ceiling shall be calculated on the basis of a blast load of 600 kN/m<sup>2</sup> that has an even impact on the bedrock surface.
- (3) The table format thicknesses may be deviated from if the strength of the bedrock structure can be ascertained using smaller thicknesses than those used in the table formats. In the dimensioning based on table formats, the internationally accepted definition based on the Q-classification for rock mass quality categories shall be used. Good rock mass quality shall be used as the starting value for the dimensioning based on table formats.

- (4) For the length of the shelter space, the bedrock ceiling and wall thicknesses shall amount to the half diagonal of the shelter width or intersection; they shall, however, amount to at least 8 metres. In all protection categories, the columns between two caverns shall have a thickness of at least 5 metres and the thickness of the bedrock floor shall be at least the same as that of the ceiling.
- (5) The ceiling and wall thicknesses of the tunnels outside the civil defence shelter shall amount to at least half the width of the tunnel; they shall, however, amount to at least 4 metres.

Section 9  
*Excavation of the bedrock shelter*

The excavation shall be carried out as cautious blasting at the airlock room and for the length of at least 2 metres on both sides of the blast wall for the length of the tunnel's diameter.

Section 10  
*Bedrock reinforcements*

- (1) An annealed steel net shall be installed in the sprayed concrete layer of the bedrock ceiling or else the concrete mass shall contain steel fibres.
- (2) The bolting of the shelter ceiling shall be in accordance with the following minimum requirements:

Thickness of the bedrock ceiling	Proportion of bolting of the ceiling's surface	Maximum distance between 25 mm bolts
more than B	0.003 %	4.0 m
B-B/2	0.008 %	2.5 m

Section 11  
*Splinter protection*

- (1) The combined thickness of the structures providing protection against splinters in category S1 civil defence shelters made of reinforced concrete shall amount to at least 200 mm when made of reinforced concrete or 30 mm when made of steel.
- (2) In category S2 civil defence shelters made of reinforced concrete, the combined thickness of the structures providing protection against splinters shall be at least 250 mm when made of reinforced concrete or 30 mm when made of steel.
- (3) In bedrock civil defence shelters, the combined thickness of the structures providing protection against splinters shall be at least 400 mm when made of reinforced concrete or 50 mm when made of steel.

Section 12  
*Pressure loads*

- (1) In a category S1 civil defence shelter made of reinforced concrete, the ceiling, the walls and the floor subjected to pressure loads shall, in addition to normal loads, also be dimensioned for a blast load of 100 kN/m<sup>2</sup>. The structures of the emergency exit corridor and the structures securing

the door opening and the ceiling of the emergency exit route shall, in addition to normal loads, also be dimensioned for a collapse load of 25 kN/m<sup>2</sup>.

- (2) In an underground shelter or a comparable category S2 reinforced concrete shelter, the ceiling, walls and floor subject to pressure load shall, in addition to normal loads, also be dimensioned for a blast load of 200 kN/m<sup>2</sup>.
- (3) The walls of a surface shelter or a comparable category S2 reinforced concrete shelter shall be dimensioned for a blast load of 400 kN/m<sup>2</sup>.
- (4) The walls around a bedrock civil defence shelter and the blast walls of the fresh and exhaust air ducts shall be dimensioned so that they can withstand a blast load of 300 kN/m<sup>2</sup>.

The structures of the airlock rooms, the separate dampening spaces, the shielded accessways, the splinter protection, and the emergency exit corridors intended for use as the emergency exit routes as well as the fresh air and exhaust air ducts located outside the blast walls shall be dimensioned so that they can withstand a load of 100 kN/m<sup>2</sup>.

- (5) All structures exposed to pressure loads shall be dimensioned for a recoil coefficient amounting to one third of the pressure load.

The impacts of the pressure loads generated by the blast doors and hatches, the shut-off devices and the valves receiving the pressure loads on the shelter envelope shall be multiplied by 1.5.

### Section 13 *Impact loads and other loads*

- (1) The structures of a category S1 civil defence shelter made of reinforced concrete shall be dimensioned for an impact load coming from a random direction and that amounts to at least twice the mass of the structure of the civil defence shelter.
- (2) The structures of a category S2 reinforced concrete shelter and a bedrock civil defence shelter shall be dimensioned to withstand impact loads in accordance with the following formulas:  
1) vertically for load of  $q_v = (1 \pm n_v)(g + q) + q_l$   
2) horizontally for a load of  $q_h = \pm n_h g$
- (3) In the formula,  $g$  is the dead load of the structure,  $q$  the sum of the long-term undampened loads that have an impact during sheltering and that are in accordance with the regulations on the loading of the structures, and  $q_l$  the long-term loading resulting from the devices equipped with ground shock isolators.
- (4) One third of the service load of the intermediate floor shall be considered. The loads shall have a partial safety factor of 1. The values of the coefficient  $n$  of category S2 bedrock and reinforced concrete shelters shall be as follows:

		Category S2 reinforced concrete shelter	bedrock shelters
Shelter excavated in the bedrock	$n_y$	3	4
Shelter excavated in the soil	$n_y$	2	-
Shelter excavated in the bedrock	$n_h$	2	3

Shelter excavated in the ground	n <sub>h</sub>	1	-
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#### Section 14

##### *Classification and reinforcement of the structures*

- (1) The reinforced concrete structures of category S2 shelters and bedrock civil defence shelters shall be built in accordance with the structural class 1 of the Finnish Building Code, and S1 category civil defence shelters in accordance with structural class 2 of the Finnish Building Code, using at least grade C25/30 concrete. The uniform elongation requirement for the reinforcement shall be 5 per cent.
- (2) Steel bars measuring at least 8 mm and not more than 20 millimetres shall be used as the main and secondary reinforcement for the slabs and walls. In the structures dimensioned for pressure and collapse loads and in the floors laid on the ground, the centre-to-centre distance of the reinforcement bars in both directions shall not exceed 150 mm in the inner surface of the structure and 300 mm in the outer surface of the structure.
- (3) In bent structures, the cross-section of the reinforcement shall, in both directions and separately on both surfaces, be at least 0.17 per cent of the statically combined concrete cross-section.
- (4) A single net placed in the middle may be used in slabs laid on the ground.
- (5) In addition to the reinforcement, the ceiling of a civil defence shelter made of reinforced concrete shall also have a steel net attached to the main reinforcement or a waved steel sheet attached to the concrete.
- (6) In beams and structures dimensioned as slabs, the main reinforcement shall be supported and anchored to the forces of the tensile stress.

### **Chapter 4**

#### **Ventilation**

#### Section 15

##### *Ventilation system*

- (1) At least 2.7 dm<sup>3</sup>/s of pre-filtered air shall flow into the civil defence shelter through the pressure valve for each square metre of shelter space and during filtering the volume shall be at least 0.9 dm<sup>3</sup>/s; the air flow shall be such that the air is evenly distributed throughout the civil defence shelter.
- (2) The ventilation unit shall remain operational independent of an electricity supply.
- (3) It shall be possible to maintain an overpressure of at least 50 pascal in the shelter.
- (4) The ventilation of the civil defence shelter shall be designed so that toxic substances can be filtered from the air supplied to the shelter.
- (5) The ventilation of a category S1 civil defence shelter shall be designed so that it is possible to install in the ventilation unit in question the equipment necessary for detecting and identifying toxic substances.

- (6) The ventilation of category S2 and bedrock civil defence shelters shall also be designed so that toxic substances can be detected and identified from the air supplied for the shelter.
- (7) Category S2 civil defence shelters made of reinforced concrete and bedrock shelters shall have separate exhaust air and fresh air ducts so that the distance between the fresh air duct and the exhaust air duct is at least 10 metres.
- (8) Category S1 civil defence shelters made of reinforced concrete shall be designed so that, in addition to the shelter space, a floor surface area of at least 1.5 square metres is allocated for each ventilation unit. In category S2 civil defence shelters made of reinforced concrete and in bedrock civil defence shelters, the ventilation unit shall be placed in the plant room referred to in section 6 of this Decree.

#### Section 16

##### *Cooling of the bedrock civil defence shelter*

The specific area of the cooling surfaces facing the shelter space of a bedrock civil defence shelter shall be at least 2.4 square metres per person.

### **Chapter 5**

#### **Water, sewer, electricity and communications equipment**

#### Section 17

##### *Water supply and sewers*

- (1) The water supply point of a category S1-civil defence shelter made of reinforced concrete may be located outside the shelter within its immediate vicinity. In category S1 civil defence shelters made of reinforced concrete and in bedrock civil defence shelters, the water supply point shall be inside the shelter.
- (2) If the water supply point is located inside the civil defence shelter, there shall be a provision for storing at least 15 litres of drinking water for each square metre of shelter space. Otherwise there shall be a provision for storing at least 40 litres of drinking water for each square metre of shelter space.
- (3) There shall be a wash basin and a floor gully at the water supply point of the shelter space.
- (4) The waste management of the civil defence shelter shall be arranged in an appropriate manner.

#### Section 18

##### *Electricity and lighting*

- (1) The civil defence shelters shall be connected to an electricity supply network. They shall be equipped with their own distribution boards, which are connected to the distribution cabinet or the riser room with a separate riser. Bedrock civil defence shelters shall have their own distribution cabinets that are connected to the electricity distribution network with a separate supply line.
- (2) Civil defence shelters may be equipped with a backup power supply.

- (3) All rooms and passageways of bedrock civil defence shelters and category S2 civil defence shelters made of reinforced concrete shall be equipped with permanent lighting, the necessary number of wall sockets and backup lighting. The backup lighting shall be divided into the main backup lighting and emergency lighting. The emergency lighting of category S1 civil defence shelters may be arranged using lighting that is connected to the ventilation unit.

#### Section 19

##### *Communications equipment*

The civil defence shelter shall have a technical system, which allows for the use of mobile communications or a telephone point that is connected to the telephone network as a separate connection or as a parallel connection of a telephone connection already available in the building.

### **Chapter 6**

#### **Maintenance of the equipment in the civil defence shelter**

#### Section 20

##### *Maintaining the equipment in operational condition*

- (1) The equipment of the civil defence shelter shall be inspected and serviced at least every 10 years so that it can be ensured that remains in operational condition.
- (2) An inspection report containing equipment-specific entries on the inspections shall be made for the inspections covering the functioning of the equipment. The inspection report shall be presented to the rescue authority on request.

### **Chapter 7**

#### **Miscellaneous provisions**

#### Section 21

##### *Wall sleeves*

The openings and wall sleeves made in the envelope shall meet the durability and tightness requirements laid down for civil defence shelters and it shall be possible to close them from inside the civil defence shelter.

#### Section 22

##### *Entry into force*

This Decree enters into force on 1 July 2011.