

## NATURE AND LANDSCAPE MANAGEMENT STANDARDS

SPECIAL MEASURES FOR  
SPECIES PROTECTION

**LIVESTOCK HERD PROTECTION  
AGAINST LARGE CARNIVORE  
ATTACKS**

SPPK E  
02 006: I.  
REVISION  
2021

**SERIES E**

Ochrana hospodářských zvířat před útoky velkých šelem

Schutz von Nutztieren gegen große Raubtiere

This standard describes different preventive measure for livestock herd protection against large carnivore attacks.

### References:

Empfehlungen zum Schutz von Weidetieren und Gehegewild vor dem Wolf [online]. In: . Bad Godesberg, 2019, p. 14 [cit. 18 November 2019]. ISBN 978-3-89624-267-9. Available from: <https://www.bfn.de/fileadmin/BfN/service/Dokumente/skripten/Skript530.pdf>

ALIF, Ziva. Will €500 Bounty on Wolves reduce Livestock Predation? See the wildest paces in Europe [online]. [cit. 18 November 2019]. Available from: <https://wilderness-society.org/will-e500-bounty-on-wolves-reduce-livestock-predation/>

ANTAL, V., Milan BAROŠ, Marianna ČERTÍKOVÁ, CIBERA Juraj, DÓCZY Jozef, FIND'Ō Slavomír, KAŠTĚR Peter, KROPIL Rudolf, LUKÁČ Juraj, MOLNÁR Ladislav, PAULE Ladislav, RIGG Robert, RYBANIČ Rastislav, ŠRÁMKA Štefan . PROGRAM STAROSTLIVOSTI O VLKA DRAVÉHO (Canis lupus) NA SLOVENSKU [online]. In: . Banská Bystrica, 2016, p. 115 [cit. 18 November 2019]. Available from: <http://www.soprs.sk/files/PS-o-vlka-draveho-na-Slovensku.pdf>

Abschlussbericht zum Projekt „Durchführung von Herdenschutzmaßnahmen in der Weidetierhaltung in Baden-Württemberg“ [online]. [cit. 20 April 2020]. Available from: [https://baden-wuerttemberg.nabu.de/imperia/md/content/badenwuerttemberg/themen/praktischernaturschutz/abschlussbericht\\_herdenschutz.pdf](https://baden-wuerttemberg.nabu.de/imperia/md/content/badenwuerttemberg/themen/praktischernaturschutz/abschlussbericht_herdenschutz.pdf)

Miteco – španělské Ministerstvo pro ekologickou transformaci a demografickou výzvu [online]. [cit. 14 January 2020]. Available from: [https://www.miteco.gob.es/es/biodiversidad/temas/conservacion-de-especies/ce\\_silvestres\\_resolucion\\_lobo\\_ovino\\_tcm30-201439.pdf](https://www.miteco.gob.es/es/biodiversidad/temas/conservacion-de-especies/ce_silvestres_resolucion_lobo_ovino_tcm30-201439.pdf)

ROSSI, Aleksandra, Brice AMAND, Benoid GRANDMOUGIN and Pierre STROSSER. Les moyens de protection des troupeaux domestiques contre le loup dans les nouveaux contextes de prédation [online]. In: . 2012, p. 89 [cit. 18 November 2019]. Available from: [http://www.auvergne-rhone-alpes.developpement-durable.gouv.fr/IMG/pdf/acteon\\_loup\\_contextes\\_nouveaux\\_et\\_mesures\\_rapport\\_final\\_version\\_2.0.pdf](http://www.auvergne-rhone-alpes.developpement-durable.gouv.fr/IMG/pdf/acteon_loup_contextes_nouveaux_et_mesures_rapport_final_version_2.0.pdf)

ŠTIKA, Jaroslav. Salašnictví na Moravském Valašsku ve světle literárních pramenů do poloviny 19. století. Etnografia Polska 5, 1961, p. 87.

### Related bibliography:

Doporučená optimální opatření pro ochranu hospodářských zvířat před vlky [online]. In: p. 7 [cit. 18 November 2019]. Available from: [https://www.opzp.cz/files/documents/storage/2019/08/29/1567063229\\_Doporuceni\\_ochranna\\_opatreni\\_vlk\\_OPZP.pdf](https://www.opzp.cz/files/documents/storage/2019/08/29/1567063229_Doporuceni_ochranna_opatreni_vlk_OPZP.pdf)

Blättler, L., Find'ŏ, S., 2019: Jak pastevečtí psi chrání stáda. Metodická příručka pro ochranu stád pomocí pasteveckých psů. Metodika AOPK ČR upravené vydání, 43 pp. (Available from: <https://www.ochranaprirody.cz/publikacni-cinnost/publikace/jak-pasteveci-psi-chrani-stada/>)

Metodická pomůcka pro vyjasnění kompetencí v problematice územních systémů ekologické stability zveřejněná ve Věstníku MŽP č. XXII (2012) (Available from: [https://www.mzp.cz/web/edice.nsf/39EF155AA2F7C4E4C1257A7900286995/\\$file/Vestnik\\_8\\_2012.pdf](https://www.mzp.cz/web/edice.nsf/39EF155AA2F7C4E4C1257A7900286995/$file/Vestnik_8_2012.pdf))

Metodika Ochrana biotopu vybraných zvláště chráněných druhů velkých savců (Available from: [http://uap.nature.cz/documents/metodika\\_B\\_ZCHD\\_20200131.pdf](http://uap.nature.cz/documents/metodika_B_ZCHD_20200131.pdf))

Act no. 114/1992 Coll. on Nature and Landscape Protection, as amended.

Decree no. 395/1992 Coll., executing some provisions of Czech National Council Act no. 114/1992 Coll. on Nature and Landscape Protection, as amended.

Decree no. 500/2006 Coll. on Territorial analytical documents, spatial planning documentation and methods of record-keeping on spatial planning activities, as amended.

Act no. 115/2000 Coll. on Compensation for Damages Caused by Selected Specially Protected Animals.

Act no. 246/1992 Coll. on Protection of Animals from Cruelty.

Act no. 183/2006 Coll. on Spatial Planning and Building Rules, as amended (Building Act).

ČSN EN 60335-2-76 ED.3 (361050) – Czech national standard – Electrical appliances for household and similar purposes - Safety - Part 2-76: Special requirements for energy sources for electric fences.

The standard specifies technical requirements for design of electric fences, methods of their testing and safe use and design. The important aspect for the present standard is the maximum permitted output parameters:

- the repeating pulse rate must not exceed 1 Hz;
- the **pulse length** in the 500  $\Omega$  component of **normalized load** must not exceed 10 ms;
- for **energy sources limited by energy**, the energy/pulse in the 500  $\Omega$  component of **normalized load** must not exceed 5 J;
- for **energy sources limited by current**, the **output current** in the 500  $\Omega$  component of **normalized load** must not exceed, for **pulse lengths** longer than 0.1 ms, the value specified by the characteristic curve shown in Figure 103 (1000 mA for pulse length 10 ms).

**Standard development:**

Developed by the Czech University of Life Sciences for the NCA CR in 2019-2020

**Expert review:**

Institute of Animal Science, Ing. Radko Loučka, CSc.

**Authorial collective:**

Ing. Aleš Vorel, Ph.D, Ing. Pavel Žďárský, Ing. Naděžda Šebková, Ph.D, František Groessl, RNDr. Jindřiška Jelínková, Ph.D., Ing. Václav Tomášek, Mgr. Tomáš Krajča, Mgr. Barbora Černá, DiS.

**Drawings:**

Jiří Šeda

Documentation for the standard development is available in the NCA CR library.

Standard approved on .....

RNDr. František Pelc  
Director of NCA CR

## Table of contents

1 PURPOSE AND CONTENTS OF THE STANDARD, TERMINOLOGY INDEX .....	5
1.1 Standard purpose .....	5
1.2 Legal framework .....	5
1.3 Terminology index .....	7
2 BASIC METHODS OF SECURING LIVESTOCK AGAINST ATTACKS OF LARGE CARNIVORES .....	8
2.1 Organisation of grazing, breeding and work .....	8
2.2 Protection by people and guardian dogs .....	8
2.3 Technical measures.....	9
3 FENCING.....	9
3.1 Fencing height .....	9
3.2 Electric fence .....	10
3.2.1 Electric fence pulse generator and earthing.....	10
3.2.2 Multirow portable electric fencing.....	11
3.2.3 Conductive mesh .....	11
3.2.4 Electric fence for livestock protection against bear attacks .....	11
3.3 Fixed fencing, enclosure .....	12
3.3.1 Fixed fencing made of wire mesh.....	12
3.3.2 Multirow fixed electric fencing.....	12
3.3.3 Combined fixed fencing design.....	12
3.4 Optical barriers .....	12
3.4.1 Tape / cable above electric fence .....	13
3.4.2 Flags.....	13
3.5 Burrowing protection .....	13
3.5.1 Electric conductor.....	13
3.5.2 Lying wire mesh .....	13
3.5.3 Additional burrowing precautions.....	13
3.6 Wolf jump protection – double fencing.....	14
3.7 Herd protection measures for snow cover .....	14
3.8 Gates.....	14
3.8.1 Fixed gates .....	14
3.8.2 Conductive gates .....	14
3.8.3 Crossings.....	14
4 SHEEPYARDS .....	15
4.1 Fixed sheepyard.....	15
4.2 Mobile sheepyard.....	15

5	WARNING AND INFORMATION SIGNS .....	15
5.1	Electric fence warning sign .....	15
5.2	Information signs on use of livestock guardian dogs .....	16
5.3	Information signs for crossing pastures.....	16
6	LIVESTOCK GUARDIAN DOGS.....	16
6.1	Important qualities of livestock guardian dogs .....	17
6.2	Number of livestock guardian dogs per herd .....	17
7	BEEHIVE PROTECTION AGAINST BEAR ATTACKS .....	17
7.1	Electric fence .....	17
7.2	Mechanical prevention of bear access to beehives .....	17
8	OTHER TEMPORARY MEASURES .....	18
8.1	Scarers .....	18
ANNEX I: DRAWINGS .....		19
	List of drawings.....	19
	Drawings .....	20

# 1 Purpose and contents of the standard, terminology index

---

## 1.1 Standard purpose

The standard describes recommended protective measures based on measures verified in practice and implemented successfully in the CR and in Europe. The measures described represent effective protection of livestock herds against attacks of wild species of large carnivores, which are returning to Czech landscape. The standard focuses on preventive security of sheep, goat and cattle herds from attacks of grey wolves and brown bears. The defined preventive measures for herd protection can also be used for protecting livestock against attacks of the European lynx, but existing experience shows that effective protection against the lynx can only be achieved by closing herds into sheepyards or sheds for the night. In addition, the standard contains recommended measures to secure beehives against brown bear attacks.

Protection of herds against attacks of large carnivores in areas of potential presence of the grey wolf (Map gallery – Input for OP ENV – Presence of the grey wolf, <https://mapy.nature.cz>) and the brown bear (mountains of Moravskoslezské Beskydy, Javorníky, Hostýnsko–Vsetínská hornatina and Vizovická vrchovina and Bílé Karpaty) should primarily comply with parameters for protection against bear attacks, because it covers protection against wolf attacks as well.

The standard is the foundation for financing of preventive measures from public funds to secure livestock herds against attacks of large carnivores (notably the grey wolf and the brown bear).

## 1.2 Legal framework

### **Act no. 114/1992 Coll. on Nature and Landscape Protection and Decree no. 395/1992 Coll., implementing certain provisions of the Act**

The Act and the Executive Decree classify large carnivore species (grey wolf, brown bear, European lynx) as specially protected animal species. The Decree classifies the grey wolf and the brown bear among critically endangered and the European lynx among severely endangered.

### **Act no. 246/1992 Coll. on Protection of Animals from Cruelty**

Breeders are required to take measures necessary to prevent escape of livestock (Section 11, Para. 2) and, when keeping livestock outside buildings, to provide adequate protection from unfavourable weather, predators and risks to health of the animals kept (Section 12a), Para. 4). The standard defines methods that can achieve the highest possible protection against attacks of wolves and bears on sheep, goats and cattle.

### **Act no. 115/2000 Coll. on Compensation for Damages Caused by Selected Specially Protected Animals**

The standard defines options for securing sheep, goats, cattle and bees against attacks of grey wolves and brown bears. The defined fencing parameters **are not a requirement** for approval of a claim for indemnities on livestock pursuant to the Act.

### **Act no. 183/2006 Coll. on Spatial Planning and Building Rules**

The standard also specifies options for effective protection of livestock herds using various types of fencing. From the point of view of the Building Act, fencing is considered a built structure.

Fencing is typically subject to the issue of a **zoning decision** (Section 76 et seq. of the Building Act), or, if conditions specified by the Act are met, the acquisition of a **zoning approval** (Section 96, Para. 1 and 2, item (a) in conjunction with Section 103, Para. 1, item (e), point 14 of the Building Act). In exceptional cases, some fencing plans require neither the project location decision nor the zoning approval (see Section 79, Para. 2, item (f) in conjunction with Section 79, Para. 3 of the Building Act). However, that applies only to fencing up to 2 m in height that does not adjoin publicly accessible roads or public spaces and is **located in built-up or developable areas**. If the plan requires earth works or

landscaping, the building owner is required to find out about the existence of any underground technical infrastructure and provide for its protection (Section 79, Para. 4 of the Building Act).

Construction of fencing in the landscape must not restrict passability of the territorial system of ecological stability (TSES). Plans (built structures in particular) must not be located in biocentres if they contradict their primary function. Biocorridors have to be protected in particular in order to maintain their passability. Generally speaking, the TSES must not be burdened with any new structures or impassable fencing or enclosures, and forestry and agriculture are only permissible if they do not reduce the ecological stabilisation functions of the TSES.

Specific limits and rules arise from spatial planning documentation in force. Any change to the functional uses of areas included in the TSES requires the statement of an applicable nature protection authority.

**Decree no. 500/2006 Coll. on Territorial analytical documents, spatial planning documentation and methods of record-keeping on spatial planning activities, as amended.**

The Nature Conservation Agency provides layer 36b titled Biotopes of selected specially protected large mammal species (Map gallery – Spatial analytical information, <https://mapy.nature.cz>).

If any structures (permanent or temporary) are planned in a biotope, such as an enclosure, fence for game or farm animals, pasture area, etc., each such plan requires assessment by the locally applicable building authority and nature protection authority from the point of view of its impact on internal connectivity of the biotope to judge whether it may hinder migration and free passage of large mammals.

### 1.3 Terminology index

**Electric fence** – a fencing system using electric pulses. It comprises a power supply and a set of conductors.

**Sheepyard** – a delineated secured area into which grazing animals are driven typically for the night.

**Enclosure** – fixed, permanent fencing.

**Fencing** – a technical structure delineating a grazing area, of permanent or temporary design, including electric fences. (= grazing enclosure, enclosure)

**Sheepdog** – a breed of dog used for handling a herd (mustering and transfer of sheep and goat herds), not for their protection.

**Livestock guardian dog** – a large breed of dog used exclusively for herd protection (= guardian dog).

**Shepherd** – a herdsman, herder, guardian of grazing animals.

**Earthing** – a conductive connection of an electric distribution line with the earth.

**Conductor** – a metallic material in the form of a wire of different diameters used either on its own or as part of a plastic carrier (conductive tape, conductive cable).

**Conductive gate** – a set of a plastic handle with an integrated spring and conductor, allowing the closing/opening of an entrance into fencing with an electric fence.

**Pulse generator** – an electronic device generating high-voltage pulses into an electric fence or a separate conductor.

## **2 Basic methods of securing livestock against attacks of large carnivores**

---

Large carnivore attacks on livestock have to be tackled reasonably by effective herd security. Many farmed areas are located in economically marginal mountain and submontane territories, which may be permanently populated by large mammals. It is therefore necessary to restore traditional methods of preventive herd protection.

They are:

- Changes to organisation of grazing, breeding and work (e.g., dividing a large pasture into several smaller ones, simple driving of herds to different pastures or driving them into sheepyards or other secured areas for the night).
- Guarding of herds by people (shepherds) and/or livestock guardian dogs.
- Technical safeguards or devices that make carnivore attacks impossible or discourage them (fencing, sheepyards, scarers).

Combinations of the above measures are recommended. Selection of measures and their combinations depend on local conditions and many factors.

Any preventive measures, particularly in areas newly populated by large carnivores, are the most effective if implemented ideally by all the agricultural entities active in the area. If fencing is insufficiently secured, large carnivores may quickly learn to overcome this protection method.

### **2.1 Organisation of grazing, breeding and work**

2.1.1 Organisation of grazing is one traditional method of securing herds against large carnivore attacks. If grazing animals are present in a single pasture long-term, including at night (known as continuous grazing; see standard SPPK D 02 003 Grazing), the probability of a large carnivore attack increases. The basic prerequisite for successful protection of herds is their more frequent transfer, driving in and locking in for the night (including, as the case may be, during bad weather or in high-risk periods) in fixed sheds or sheepyards (see chapter 4) or in smaller and better secured pastures. Extensive pastures can be divided into smaller ones and grazing animals can be transferred in a rotary fashion depending on the grazing intensity. The effectiveness of this measure increases with the presence of livestock guardian dogs. Sheepdogs are used for easier herd handling.

2.1.2 For cattle, change in organisation of grazing, breeding and work with the herd is the basic prerequisite for herd protection. In principle, it involves gathering pregnant mothers in better secured winter grounds/pens/pastures or in sheds, where the mothers stay with the young for the time when the young are the most vulnerable. The measures can be implemented with a view to conditions and organisation of each herd (synchronisation of rutting, separately kept bulls, calving times). Where herds are guarded by livestock guardian dogs, consideration to the cattle breed and the dogs' socialization with the herd.

### **2.2 Protection by people and guardian dogs**

2.2.1 A proven measure for livestock herd protection against large carnivore attacks is the supervision of a human shepherd. Active human presence at the herd discourages large carnivores. The shepherd protects the herd particularly at night and in the morning, when the attacks are the most frequent, and accompanies the grazing herd if it grazes freely. It is also recommended to use a shepherd immediately after a large carnivore attack, before other protective measures can be introduced.



- 2.2.2 Work dogs assist the shepherd in working with the herd. Livestock guardian dogs are there for guarding them and guarding the herd autonomously, and sheepdogs for easier herd handling. Permanent presence of at least two livestock guardian dogs with the herd is the most effective, natural and suitable method known for protecting livestock. Livestock guardian dogs in combination with fencing types defined below provide up to 95% herd protection from large carnivore attacks (80% fencing and 15% livestock guardian dogs). See chapter 6 for more about livestock guardian dogs.

## 2.3 Technical measures

- 2.3.1 Technical measures used for securing livestock herds against large carnivores refers primarily to various types of fencing, ideally in combination with electric voltage.
- 2.3.2 Their use differs according to the site, pasture characteristics and livestock species. Well-built and maintained fencing is the first prerequisite for protecting a grazing herd. The basic classification of fencing types is specified in the standard “Grazing” (SPPK D 02 003), chapters 5.1 Fixed fencing, 5.2 Mobile fencing. Specifications for fencing in areas with presence of the grey wolf and the brown bear are made in the present standard.
- 2.3.3 Most effective prevention comprises a combination of technical measures and the presence of a shepherd or livestock guardian dogs and organisation of work, particularly grazing.
- 2.3.4 Effective additions to fencing include various acoustic, light and odour effects, which might successfully discourage large carnivores from attacking. These devices are most effective if they are activated when the carnivore approaches the fencing with animals and if the intensity of sensory stimuli in the large carnivore exceeds its tolerance threshold. However, large carnivores may get used to some of these effects, which is why they have to be changed from time to time (see chapter 8).

## 3 Fencing

---

Fencing is the basic element in grazing-type livestock farming. Common fencing systems are designed to keep the grazing animals inside the delineated space and prevent their escaping outside the fenced area. The basic fencing types can be described as fixed (permanent) and mobile (temporary, portable); see SPPK D02 003 Grazing. However, requirements for changes to fencing design have to be taken into account in areas with presence of large carnivores. Another purpose of fencing is to reduce and complicate access of predators to livestock, or to discourage carnivores completely from attempting to access it, ideally to prevent the access.

Fencing should not be close (at least 4 m is recommended) or directly connected to “jump aids” (e.g., elevated areas, tree stumps, hay bales, sheds) either inside or outside the enclosure. Pasture areas have to be completely functionally fenced, i.e., the fencing must shut off access to the pasture even from waterside if it adjoins the pasture. Access of large carnivores to fenced areas via a watercourse has to be prevented by physical barriers or technical measures so that the function of electric fencing is not disrupted even with variable water level in the watercourse (e.g., live metal chains suspended in the watercourse connected via a water switch or electric fence conductors placed on floaters on the water surface, etc.).

### 3.1 Fencing height

- 3.1.1 The minimum height of fencing for livestock herd protection against large carnivore attacks is 120 cm (with the exception of fencing for male goats, where the minimum height is 150 cm; see Standard SPPK D 02 003 Grazing). At the same time fencing against bear attacks has to be sufficiently robust and mechanically resilient (see chapter 3.2.4).

- 3.1.2 In areas with increased attack frequency, the appropriate height is at least 140 cm. Thus, existing fencing mostly has to be suitably complemented and optically increased to the required minimum height in conjunction with its technical capacity and design.
- 3.1.3 The basic fencing types and their recommended parameters are shown in the table below.

Fencing type	Multirow, portable electric fencing (chapter 3.2.2)	Conductive mesh (chapter 3.2.3)	Fixed fencing made of wire mesh (chapter 3.3.1)	Multirow fixed electric fencing (chapter 3.3.2)
Number of cables/=conductors	5	-	-	5
Minimum height	120 cm	120 cm	120 cm	120 cm
Burrowing protection	Bottom conductor 15-20 cm above ground.	Fastened to the ground with pegs.	Additional outer conductor 15-20 cm above ground.	Bottom conductor 15-20 cm above ground.
Optical barrier	Cable with flags or tape 10-20 cm above fence (need not be live).			

- 3.1.5 Well-installed and maintained fencing is the first prerequisite for protecting a grazing herd. However, fencing alone cannot guarantee impenetrability and it is quite advisable to complement it with additional protective elements – particularly the presence of livestock guardian dogs or shepherds (see chapter 6) or active scaring (see chapter 8).

## 3.2 Electric fence

An electric fence system comprises a generator of electric pulses and a set of conductors of the fence itself, delineating the circumference of the grazing area. An electric fence can be used as portable fencing (with several conductive wires or a conductive mesh), where the wires are fastened via insulators either to fixed stable posts or to plastic pickets (which are also a part of conductive meshes). Electric wires or tapes can be used as a structural element or an addition to fixed fencing. When the area has been grazed or at the end of the grazing season, the electric wires or meshes can be removed to make the landscape passable.

Fencing including an electric fence has to be **checked daily** for signs of damage, bending, sufficient tightness and full voltage coverage. Vegetation around and under the fence has to be mown with a view to the growth rate to prevent contact between vegetation and conductors leading to loss of voltage, thus loss of fence effectiveness.

### 3.2.1 Electric fence pulse generator and earthing

- 3.2.1.1 The pulse generator is a piece of electric equipment sending short high-voltage pulses into the fence. The power supply is a 230 V grid connection or a battery (can be charged using a solar panel). Correct functioning of the pulse generator depends on its sufficient earthing and length.
- 3.2.1.2 The basic criteria for selection of the electric fence pulse generator are the fence location and length and the species and category of animals for which it is intended. The longer the fence, the stronger the electric power supply. Other considerations include surrounding vegetation, quality and conductivity of wires used, which might reduce the voltage in the fence. The fence should not touch any vegetation – grass, branches, etc.

- 3.2.1.3 The selected electric fence type should provide a maximum possible voltage of 5-7 kV in the fence (at least 3.5 kV) with a maximum permitted output pulse energy of 5 J.
- 3.2.1.4 The condition of the pulse generator and the voltage have to be checked daily, because the effectiveness of the electric fence depends on its functionality and output directly.
- 3.2.1.5 Well-made earthing is a prerequisite for correct functioning of electric fences (Fig. 1). The stronger the fence and the drier the soil, the higher the requirement for good earthing. The voltage loss through earthing must not exceed 0.2–0.5 kV. The basic earthing system for a strong electric fence pulse generator should comprise at least 3 earthing rods. Depending on the soil composition and moisture on the site, the basic system can be expanded by adding more earthing rods to achieve the required earthing quality (Fig. 2). The required length of each earthing rod, ideally galvanised, is at least 1 m.

### **3.2.2 Multirow portable electric fencing**

- 3.2.2.1 Electric fencing can be built using portable plastic pickets (with lugs for fastening conductors), fibreglass reinforced plastic, metal or wooden pickets that delineate the circumference of the grazing area (Fig. 3). Spacing between posts, typically 3-6 m, is always variable depending on site conditions. Metal posts are recommended for protection against bear attacks.
- 3.2.2.2 Insulators are fastened to posts in several rows (heights). Conductors in the form of wires, conductive cables or tapes are inserted in the insulators. Depending on the fencing height, at least 5 vertical rows of conductors have to be used, with the bottom conductor no higher than 15-20 cm above ground. The three lowest conductors are spaced 15-20 cm apart. The other conductors are spaced 20-30 cm apart.
- 3.2.2.3 No hollows or depressions may be located under the fencing conductors that would make it possible to crawl underneath them. Adjustment of post spacing is necessary to keep a constant distance between the bottom conductor and the ground.

### **3.2.3 Conductive mesh**

- 3.2.3.1 Conductive meshes are used commonly as temporary portable fencing primarily for keeping sheep and goats (Fig. 4). It consists of horizontal rows of conductive cable and vertical rows spaced 15 or 30 cm apart made of a non-conductive material. The supporting system comprises plastic props (pickets), typically spaced 3.8 m apart, on which the mesh is fastened. The reinforced bottommost horizontal row is not conductive as it is in contact with the ground. The spacing of the horizontal rows is variable and increasing upwards in the range of 10-20 cm.
- 3.2.3.2 For reinforcement of conductive mesh structure, selected types may use plastic straps in the vertical rows instead of non-conductive cables; the former is stronger and helps the mesh better follow uneven terrain (conductive mesh with reinforcement).
- 3.2.3.3 No hollows or depressions may be located under the conductive mesh that would make it possible to crawl underneath it. Where the unevenness is small, it is sufficient to fasten the mesh to the ground using non-conductive fastening pegs. Where the ground is very uneven, the fence has to be routed so as to follow the terrain shape.

### **3.2.4 Electric fence for livestock protection against bear attacks**

Protection against bear attacks may employ:

- multirow portable fencing with wooden or metal posts (chapter 3.2.2),
- conductive mesh with reinforcement (chapter 3.2.3.2), with necessary reinforcement or support to plastic props on which the mesh is fastened,

- or a combined fixed fencing design (chapter 3.3.3).

Maximum attention to mechanical resilience of each of the types chosen is necessary. To increase the effectiveness, a vertical extension in the form of reinforcing bars and other conductors spaced at least 20-30 cm apart can be added up to a total height of 150 cm, and presence of livestock guardian dogs can be provided.

### 3.3 Fixed fencing, enclosure

The basic components of permanent fixed fencing are wooden, plastic, concrete or metal posts firmly connected to the ground, ideally with added corner reinforcing structures. Post spacing (3-8 m) is variable depending on site terrain conditions; the flatter the area, the closer to 8 m the spacing can be.

The fencing structure itself comprises wire mesh or multirow fixed bars; see the characteristics below.

#### 3.3.1 Fixed fencing made of wire mesh

3.3.1.1 Knotted wire mesh is fastened to posts; it presents the mechanical barrier against carnivore access<sup>1</sup> (Fig. 5). The bottom of the wire mesh is fastened to the ground with pegs or to a conductive wire. No hollows or depressions may be located under the wire mesh that would make it possible to crawl underneath it. The fencing technical execution has to take this fact into account. The fencing has to be checked for damage regularly.

3.3.1.2 Wire mesh fencing has to be complemented with protection against burrowing (see chapter 3.5), ideally in the form of an electric conductor (see chapter 3.5.1). In combination with an optical barrier (see chapter 3.4), these measures increase the fencing resilience.

#### 3.3.2 Multirow fixed electric fencing

Multirow fixed fencing is usually designed as mechanically resilient fencing combined with an electric fence (Fig. 6). At least five rows (heights) of insulators are fastened to posts. The insulators carry conductors in the form of tapes, cables or metal wires. The bottommost conductors must not be higher than 15-20 cm above ground. The three lowest insulators are spaced 15-20 cm apart. The two topmost ones are spaced 20-30 cm apart. The fencing conductors have to be sufficiently tight so that animals cannot stretch them easily apart and crawl between them. No hollows or depressions may be located under the fencing that would make it possible to crawl underneath it. It is tightened using tighteners and springs. If necessary, equal wire spacing is provided by using a suitable spacer or a wooden lath fastened to the conductors.

#### 3.3.3 Combined fixed fencing design

Another suitable fixed fencing type (Fig. 7) is a combination of lower wire mesh (e.g., 90 cm) complemented at the top with several rows of conductive wires to keep the required fencing height (chapter 3.1) and adhere to the principles specified in chapters 3.2 and 3.3.

### 3.4 Optical barriers

Optical barriers are used primarily to discourage wolves from jumping or climbing over fences. They

---

<sup>1</sup> It is advisable to pay attention to the wire mesh design. Commonly used farm supply wire mesh is made of soft steel wire with a knot type known as twist lock, which permits the vertical wires to slide along the horizontal ones. Sheep are capable of making gaps in this mesh by themselves, without any wolf or boar attacks. Due to this shortcoming, we recommend wire mesh made of high-performance steel wire and using firm knots at the intersection of the vertical and horizontal wires.

can be used as an addition to fencing, **not on their own**. They may also serve as quick emergency help after an attack. They are only temporary measures and their effectiveness requires more time-consuming work on frequent replacements. However, they can also help highlight fencing for wild game, particularly near crossings by the forest, etc. (Fig. 8).

### 3.4.1 Tape / cable above electric fence

Tape or visible cable is stretched 10-20 cm above the fence to heighten it optically. It is typically fastened (tied, hooked, etc.) to fencing posts. Fencing effectiveness is increased if it is supplied with electrical voltage.

### 3.4.2 Flags

3.4.2.1 Flags (scare flags) are fabric or plastic bands (blue or blue and white to be visible by wolves) placed so as to hang about 30-50 cm apart on a cable or wire stretched at a height of 120 cm. The loose ends of the bands extend to about 20-30 cm above ground. This type of optical barrier can be considered temporary only. The carnivore gets used to the scare flags sooner or later; therefore, the flag type or colour has to be changed approx. every 4 weeks.

3.4.2.2 A cable with shorter flags can be added over fixed fencing or electric fence (Fig. 8).

## 3.5 Burrowing protection

### 3.5.1 Electric conductor

The electric fence conductor extending about 10-20 cm outside fencing in the expected attack direction increases fencing resilience. The conductor runs no higher than 15-20 cm above ground (for electrical parameters, see chapter 3.2.1). Insulators in which the conductor is placed are mounted on fencing posts (Fig. 9). The measure has to be checked daily for damage. Vegetation around and under the fence has to be mown periodically and repeatedly to prevent contact between vegetation and conductors leading to loss of voltage, thus loss of fence effectiveness. This is the **most effective form of protection** against burrowing or crawling under the fence, as the carnivore associates any attempt to overcome it with a negative experience (electric discharge).

### 3.5.2 Lying wire mesh

3.5.2.1 Fencing burrowing protection can be improved by bending a section of at least 40 cm (ideally 60 cm) of wire mesh and laying in on the ground outside the fencing (Fig. 10); the total wire mesh width depends on the existing fencing type. Fencing with burrowing protection should form an L shape. The bent and lying section of the wire mesh has to be attached to the ground using anchors or hooks (ideally 50 cm deep).

3.5.2.2 The measure reduces maintenance of grass vegetation inside the strip. The measure has to be checked daily.

### 3.5.3 Additional burrowing precautions

3.5.3.1 To fortify the ground as protection against burrowing or to level ground depressions and unevenness near sheepyards or gates, large stones, a concrete foundation or logs laid along the sheepyard can be used.

3.5.3.2 In permanent installations (fixed fencing and sheepyards) that use knotted wire mesh or fixed meshes, burrowing can be prevented by laying the bottom section of the mesh into the ground at least 40 cm deep. The effectiveness of this measure, too, can be increased by an outer electric conductor (chapter 3.5.1).

### 3.6 Wolf jump protection – double fencing

In areas with steeply sloping ground or uneven surface, it is ideal to use two rows of fencing. These can be two electric fences (conductive mesh, multirow portable fencing; Fig. 11) or a combination of fixed fencing (chapter 3.3.1, 3.3.2) and electric fence. A strip at least two metres wide is left between the first, inner fence (towards grazing livestock) and the second, outer fence (Fig. 11). Electric fence always has to be on the outside. A similar protection method can be used for protection of night areas, winter areas or sheepyards; the strip between the electric fence and the sheepyard itself can be up to 10 m wide, and livestock guardian dog(s) should be stationed in this area (see chapter 6.2).

### 3.7 Herd protection measures for snow cover

- 3.7.1 Logically, thicker snow cover reduces the effectiveness of fencing built for the grazing season. In areas with thick snow cover, this has to be taken into account and permanent fencing around areas used for winter outdoor stay of livestock have to be heightened adequately.
- 3.7.2 The layer of snow in contact with a live conductor will affect the functioning of the electric fence. Snow or rime on a conductor acts as an insulator, neutralizing the effect of the electric pulse. For such situations, it is advisable to design winter paddock fencing so that live conductors nearer the ground can be deactivated individually as the snow cover increases.

## 3.8 Gates

### 3.8.1 Fixed gates

A gate is made of wood or metal. Its minimum height is the same as for fencing (see chapter 3.1). A gate has to have a locking mechanism so that no animal can open it by simply pushing it (Fig. 12). The gate design and installation should prevent crawling under; as necessary, a gate can be complemented with electric fence conductors, burrowing protection (see chapter 3.5) or an optical barrier (see chapter 3.4).

### 3.8.2 Conductive gates

A conductive gate is made of several rows of conductors matching the arrangement on the fencing and connected to the electric fence in the same way as the rest of the fencing (Fig. 13). Its minimum height is the same as for fencing (see chapter 3.1). The gate conductor can be a wire, cable, tape, metal springs or elastic conductive cable. The spacing and conductor height parameters are specified in chapters 3.2.2 and 3.3.2, and the voltage parameters in 3.2.1. No hollows or depressions may be located under the gate that would make it possible to crawl or burrow underneath it.

### 3.8.3 Crossings

If fencing has to be kept passable using busier service roads or hiking trails, simple and functional crossings have to be established in the fencing, accompanied with information or warning signs (see chapter 5). The design of such crossings has to be sufficiently simple, without the need to install locking mechanisms requiring human operation. If a herd is guarded by livestock guardian dogs, crossing of the fencing cannot be permitted.

## 4 Sheepyards

---

A sheepyard is a delineated secured area of diverse form into which grazing animals are driven typically for the night. Fixed sheepyards are built in dry areas near dwellings or farm buildings, mobile sheepyards are suitable for so-called free (Carpathian) grazing method or midway between pastures so that the herd can be moved to the sheepyard for the night. A mobile sheepyard is usually shifted almost every day to prevent destruction of vegetation inside it; this contributes to pasture fertilization (see standard SPPK D02 003 Grazing). Generally, the sheepyard size has to match the herd size. It is advisable to designate 0.8–1.2 m<sup>2</sup> per sheep.

To ensure maximum protection of grazing animals, it is recommended to design security measures preventing large carnivores getting physically close to the sheepyard. The ideal method is to place an electric conductive mesh outside the sheepyard at a distance sufficient for livestock guardian dogs to run in the space between.

### 4.1 Fixed sheepyard

Wooden or metal posts carry knotted or welded wire mesh, fixed metal mesh or various metal or wood panels. The fixed sheepyard height is at least 200 cm (Fig. 14). It can be a roofed shelter or a brick or wooden building. Sheepyards that are not brick or wooden buildings have to have measures against burrowing (concrete foundation, large stones, logs along the perimeter, etc.) and at least one added electric conductor above the sheepyard wall. Protection against bears requires an additional security feature against climbing (an electric wire along the sheepyard perimeter 100 cm above ground with 5 kV voltage and 5 J of output pulse energy). A sheepyard can be complemented with a top cover (sheet steel, wooden elements).

### 4.2 Mobile sheepyard

This is a temporary night-time protection for sheep in a free (Carpathian) grazing system. The sheep graze by day, protected only by a livestock guardian dog and a shepherd, and driven for the night into a mobile – portable – sheepyard. The sheepyard structure can be dismantled, or is fitted on wheels to enable transfer. The structure is wooden or metal, possibly comprising elements ideally 4-5m (to 3-6 m) long and at least 120 cm tall. The structure frame carries knotted wire mesh, fixed steel mesh, metal fencing panel, wooden fencing or wooden walls (Fig. 15). Alternatively, the sheepyard is assembled from all-metal or all-wooden panels. With this sheepyard type, it is necessary to place an electric conductive mesh 10 m outside the sheepyard, at least 120 cm tall, and let at least one livestock guardian dog in the area between the sheepyard and the conductive mesh (see chapter 6), or various scarers activated automatically by movement inside the in-between area, extending up to several metres outside the area (see chapter 8.1).

## 5 Warning and information signs

---

### 5.1 Electric fence warning sign

Fencing includes plastic or metal signs of minimum dimensions of 10 x 20 cm of yellow colour, well fastened to the fencing. The warning sign says: “CAUTION! Electric fence”, accompanied with an electric fence symbol. Requirements for the sign appearance are detailed in ČSN EN 60335-2-76. The signs are installed at fence access points, such as driveways and hiking trails. Outside such area, warning signs are typically installed every 100 m. Alongside roads, trails and areas with frequent human presence, it is advisable to place signs at the start and then every 50 m.

## 5.2 Information signs on use of livestock guardian dogs

Plastic or metal signs of minimum dimensions of 10 x 20 cm of white or yellow colour, well fastened to the fencing, or larger signs fastened on separate posts. The sign says: “CAUTION! Pasture guarded by livestock guardian dogs. Do not enter the enclosure! Do not feed the dogs! Risk of injury!” The sign has an accompanying warning image. Depending on the site, it is advisable to include the warning in English or German. The signs are installed at fence access points, such as driveways and hiking trails and, most importantly, on gates and entrances. Outside such area, signs are installed at least every 100 m. Alongside roads, trails and areas with frequent human presence, they are installed at the start and then at least every 50 m. The purpose of such installation is to clearly inform the public on how to behave near pastures guarded by livestock guardian dogs.

## 5.3 Information signs for crossing pastures

5.3.1 Any crossing of an enclosed pasture where sheep is grazing has to be marked with an information sign. The sign should contain instructions on how to behave while crossing. In particular:

- entry to the pasture is only possible via designated points (gates);
- dogs must be kept on a leash;
- minimize movement outside the path crossing the pasture;
- travel on the path quietly, do not shout or make noises;
- do not follow or chase after grazing animals.

5.3.2 Crossing of pastures with the presence of livestock guardian dogs **is not possible**. For information signs, see chapter 5.2.

## 6 Livestock guardian dogs

---

The following dog work categories work with herds:

- a) Livestock guardian dogs – their task is to guard the herd against carnivore attacks and strangers. They work autonomously based on early socialization with the herd (from the age of two months) and on inborn aptitude (see chapter 6.1). Examples of suitable livestock guardian dog breeds used the most commonly in the Czech Republic are the Pyrenean Mountain Dog, Spanish Mastiff and Kangal Shepherd Dog. In cultural landscape with free-moving people, it is generally necessary to prefer breeds that keep their distance from strangers.
- b) Sheepdogs – their task is handling the herd. They have an inborn instinct to run around the herd and keep it together. These dogs facilitate human handling of the herd and are trained. They work by day under the leadership of a human shepherd. The typical representative of sheepdog breeds used for work with herds is the Border Collie.

When using dogs of both the work categories, it is necessary to familiarize the guardian dogs with the sheepdogs in a controlled manner to prevent conflict or undesirable imitation of behaviours. Livestock guardian dog pups are added to the herd, where sheepdogs start working at a later age (about 8 months or older) to prevent their closer affiliation with the guardian dogs than with the herd. A guardian dog’s priority has to be the livestock herd, not a dog pack.



## 6.1 Important qualities of livestock guardian dogs

- 6.1.1 A livestock guardian dog is loyal to the herd. It stays within or in the immediate vicinity of the herd. It does not run away from or try to leave the herd. It guards 24 hours a day and warns of danger by barking. It never leaves the enclosure or fenced area, but always stays with the herd. It must not chase after or hurt livestock or disturb it from grazing, resting, giving birth or other activity.
- 6.1.2 Livestock guardian dogs undergo no special training; their job (guarding the herd) is inherited, grounded in socialization with the livestock, which they tend to protect as members of their own pack (family). They respond to basic commands only (come to their owner when called and undergo basic veterinary treatment, such as mandatory vaccination).

## 6.2 Number of livestock guardian dogs per herd

For a herd of up to 100 heads of livestock, it is advisable to have at least two guardian dogs. At least one extra guardian dog should be added for approx. every 100 additional heads. The number of dogs depends on the site (landscape configuration). Guardian dogs work better if there is more of them in the pasture, and they form a hierarchy after some time.

## 7 Beehive protection against bear attacks

---

### 7.1 Electric fence

- 7.1.1 Electric fence comprises either conductive cables regularly spaced vertically and fastened to posts (see chapter 3.2.2) or an electric conductive mesh (see chapter 3.2.3). The total height of the electric fence should be 170 cm, with a spacing of 20-30 cm between the cables (Fig. 16). The bottom cable has to be installed no more than 20 cm above ground, and the posts have to be strong, e.g., wooden or metal (not plastic or fibreglass reinforced plastic).
- 7.1.2 The electric pulse generator has to be sufficiently strong and can be combined with a solar charger and a good-quality car battery with slow depletion (in areas without access to grid power supply). It is also advisable to use lightning protection, available in some generators. Its parameters should provide at least 5 kV voltage and at least 5 J output.
- 7.1.3 The beehives inside the fence have to be at least 1 m from the fence axis and farther away from trees, so that the bear cannot climb into the fenced area via a tree and a branch.

### 7.2 Mechanical prevention of bear access to beehives

- 7.2.1 This method of beehive protection comprises primarily cages: the beehive has to be secured with custom-welded bars on all sides.
- 7.2.2 The cage can be made from rebar or reinforcing mesh, with the thickness of the perimeter wires (rebar) comprising props and struts being 25 mm, spaced no more than 1 m apart. The thickness of wires comprising the cage walls is at least 10 mm (reinforcing mesh).
- 7.2.3 Beehive walls have to be at least 1 m behind the bars (sides and top) and bars are also needed at the bottom. The mesh spacing is no more than 15 cm. The ceiling part also has to be robust and well reinforced to carry at least 300 kg. The joints have to be very strong; no wall may be prone to lifting or warping. It is advisable to fasten the cage with ground screws at least 60 cm long at every corner, without using permanent anchors (concrete, adhesive, asphalt, etc.).

## 8 Other temporary measures

---

### 8.1 Scarers

- 8.1.1 These are devices that create an illusion of human activity. With a sensor, the device recognizes movement near the enclosure (similarly to a camera trap) and activates light effects (short-term light, flashing), acoustic effects (human voice playback, sounds of shooting, dog barking, etc.) or their combination. These effects create an illusion of human or dog presence, thus unsettling the predator and discouraging it from moving towards the livestock (intending to attack them).
- 8.1.2 Scarers can be used as an addition to fencing, particularly sheepyards, not on their own.
- 8.1.3 Scarers have to be relocated randomly to support the illusion of irregular human activity.
- 8.1.4 It is necessary to change the set of effects during a grazing season to prevent the predator getting used to the light and sound combination.

## **Annex I: Drawings**

---

### **List of drawings**

- Fig. 1 Earthing (chapter 3.2.1)*
- Fig. 2 Reinforced earthing (chapter 3.2.1)*
- Fig. 3 Multirow portable electric fencing (chapter 3.2.2)*
- Fig. 4 Conductive mesh (chapter 3.2.3)*
- Fig. 5 Fixed fencing made of wire mesh (chapter 3.3.1)*
- Fig. 6 Multirow fixed electric fencing (chapter 3.3.2)*
- Fig. 7 Combined fixed fencing design (chapter 3.3.3)*
- Fig. 8 Optical barriers – Flags and tape (chapter 3.4)*
- Fig. 9 Burrowing protection – Electric conductor (chapter 3.5.1)*
- Fig. 10 Burrowing protection – Lying wire mesh (chapter 3.5.2)*
- Fig. 11 Jump protection – Two rows of electric fences (chapter 3.6)*
- Fig. 12 Fixed gate (chapter 3.8.1)*
- Fig. 13 Conductive gate (chapter 3.8.2)*
- Fig. 14 Fixed sheeppark (chapter 4.1)*
- Fig. 15 Mobile sheeppark (chapter 4.2)*
- Fig. 16 Beehive protection against bear attacks – Electric fence (chapter 7.1)*

**Drawings**

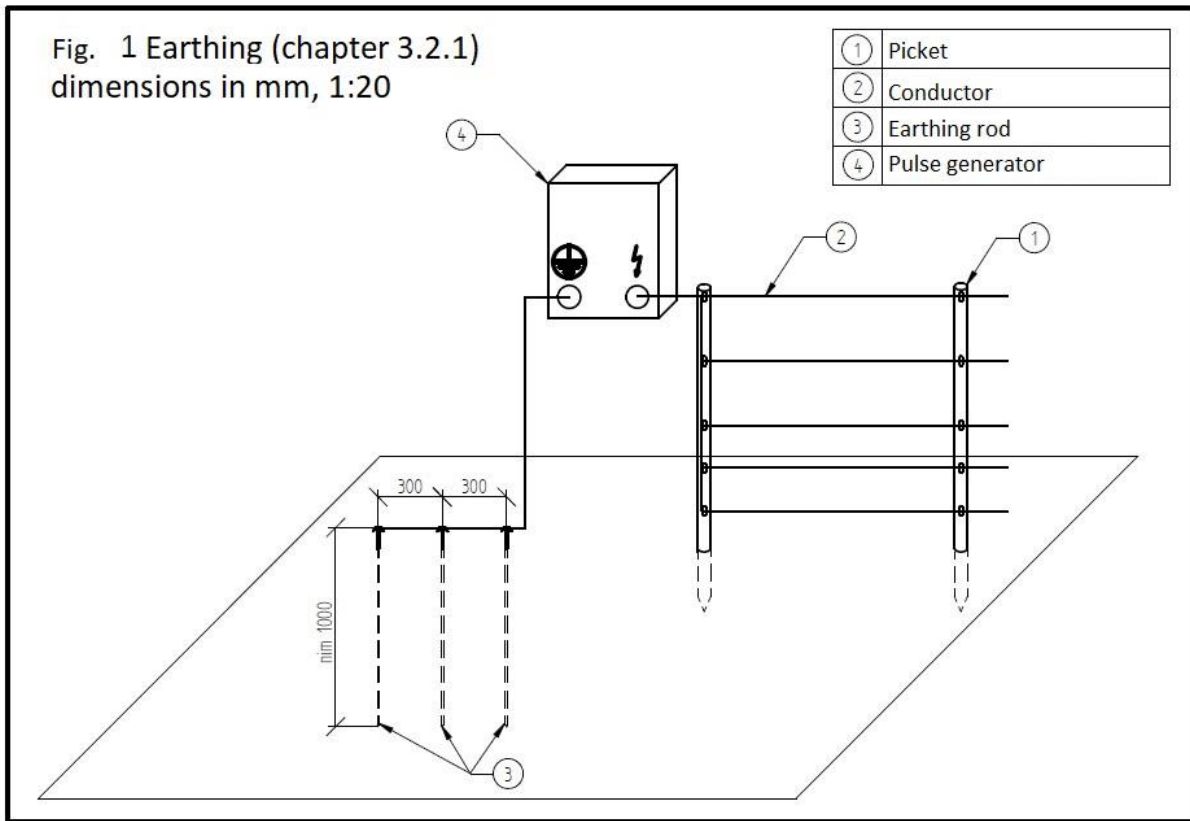
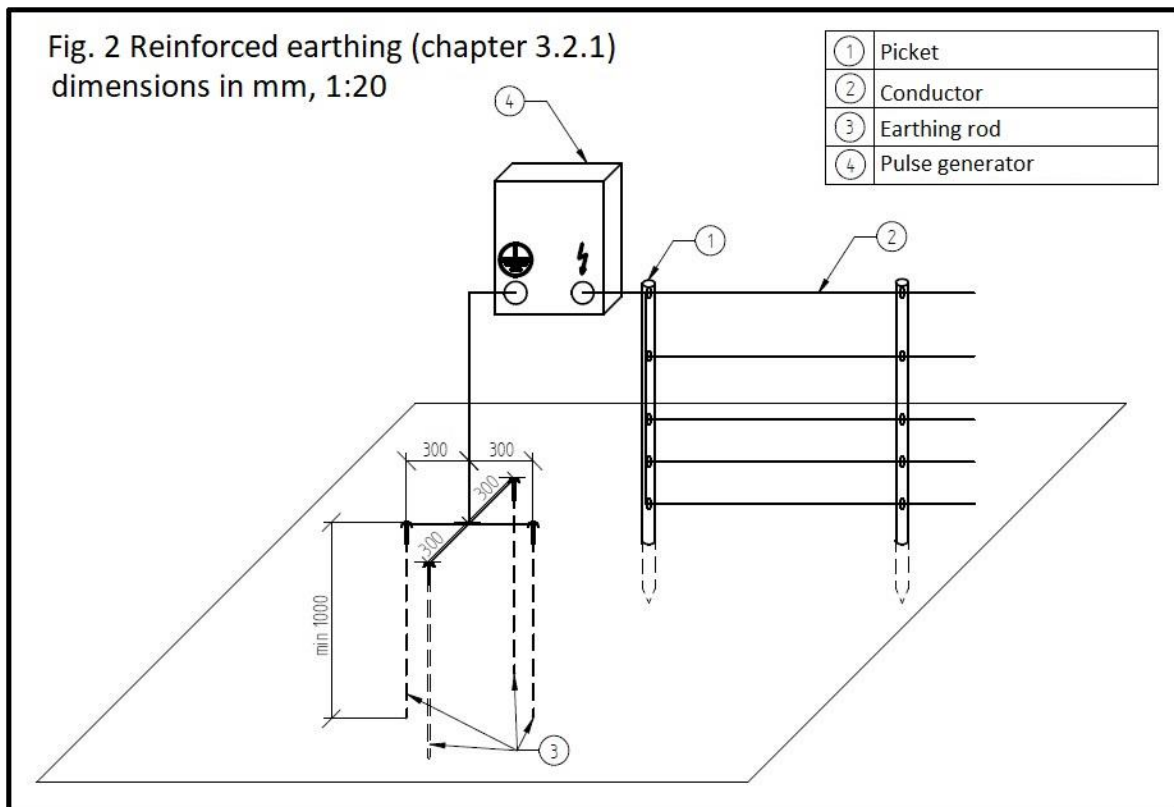


Fig. 1 Earthing (chapter 3.2.1)

Fig. 2 Reinforced earthing (chapter 3.2.1)



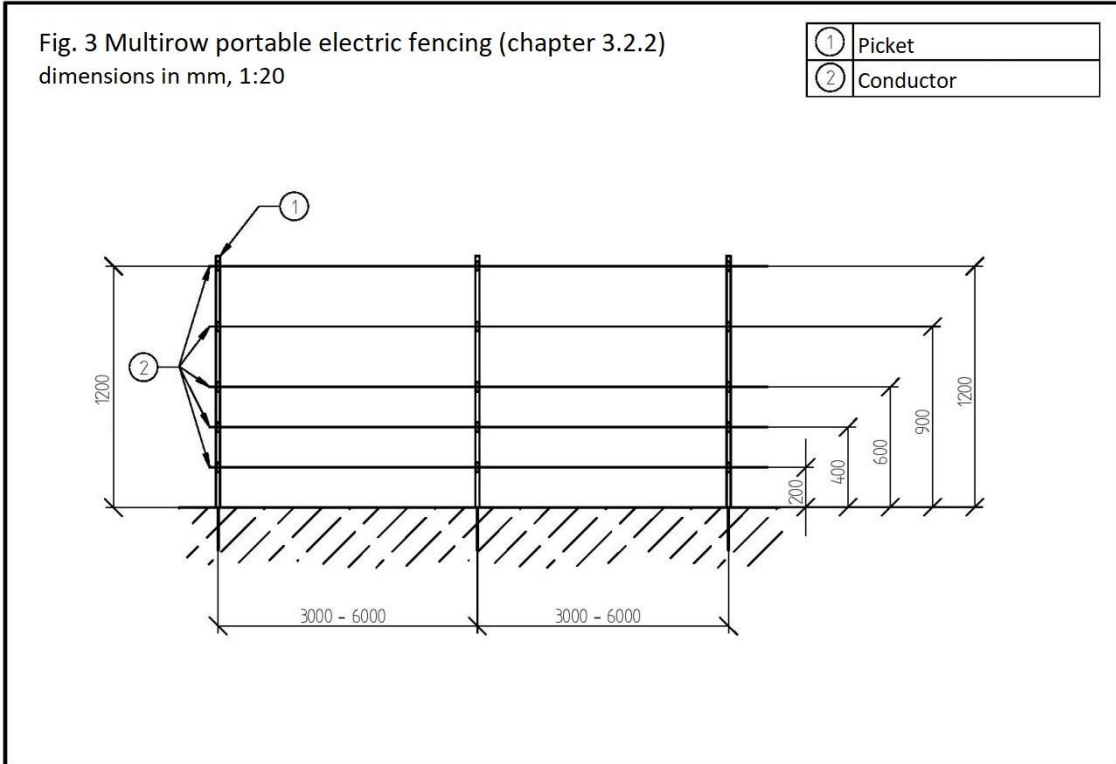
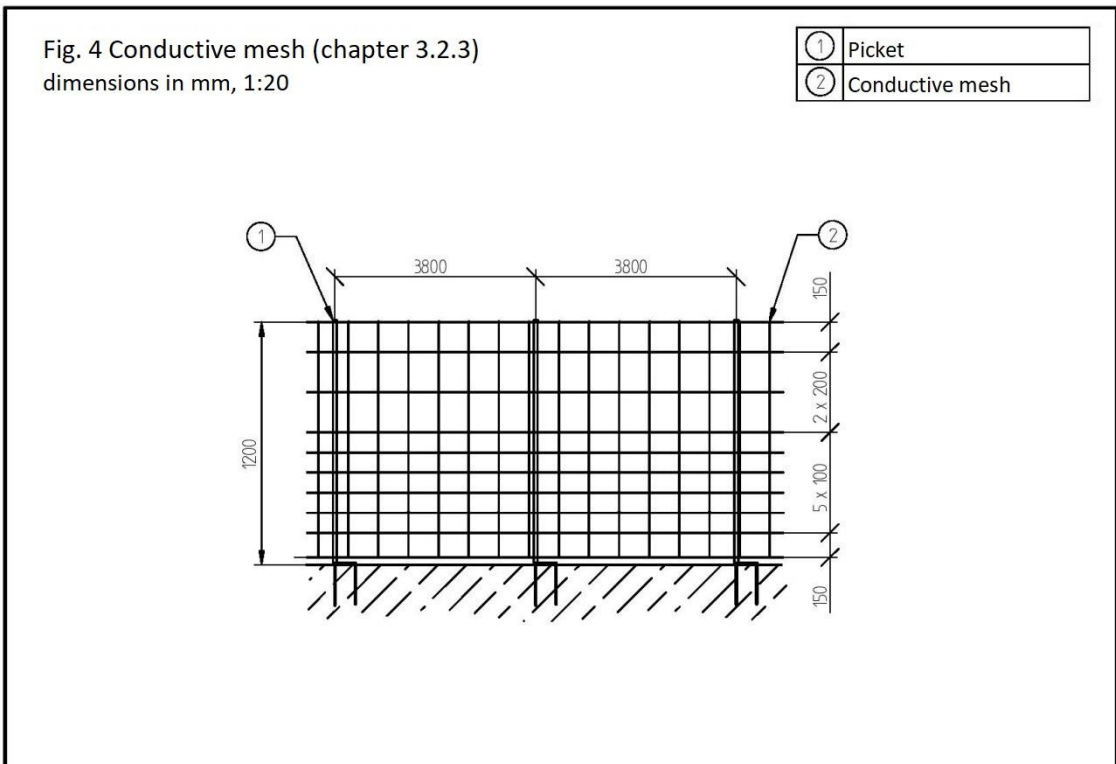


Fig. 3 Multirow portable electric fencing (chapter 3.2.2)

Fig. 4 Conductive mesh (chapter 3.2.3)



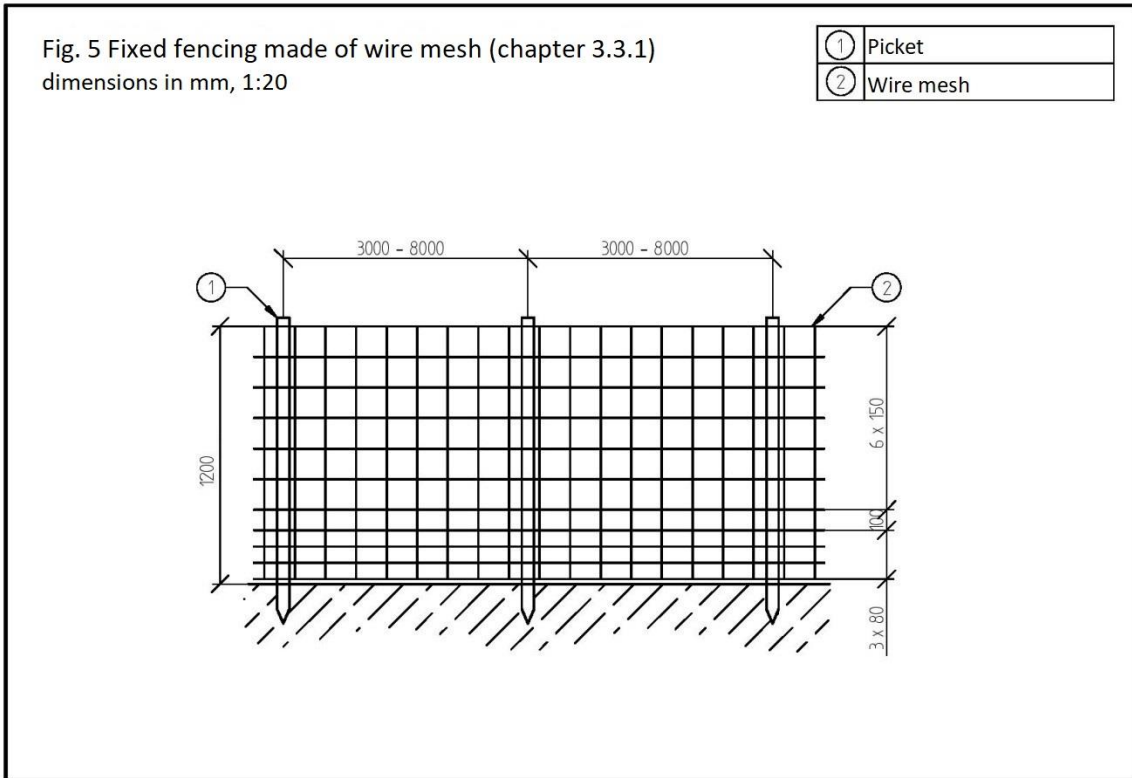
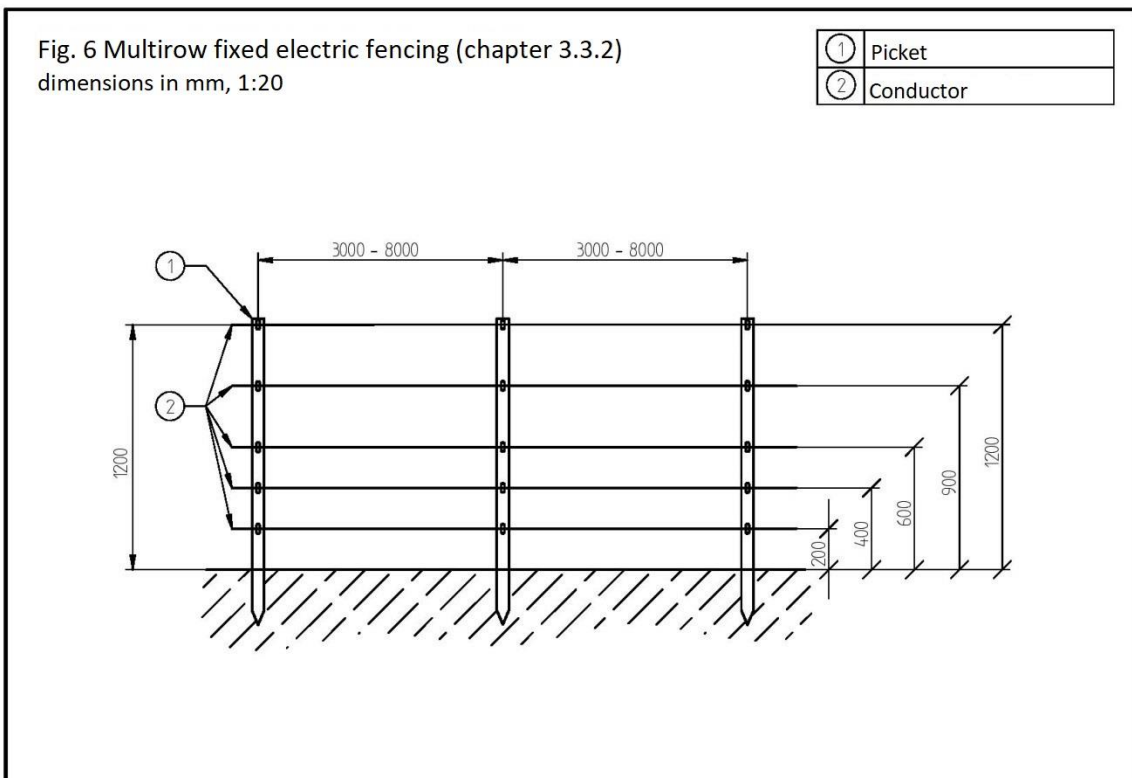


Fig. 5 Fixed fencing made of wire mesh (chapter 3.3.1)

Fig. 6 Multirow fixed electric fencing (chapter 3.3.2)



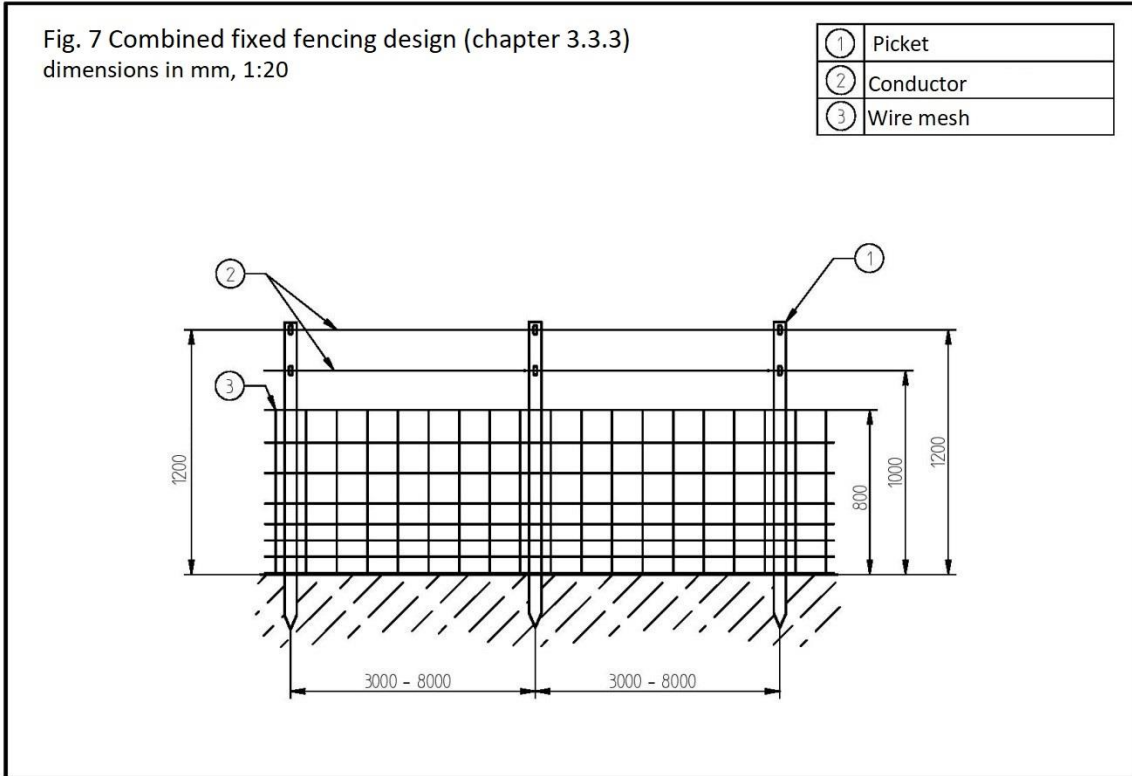
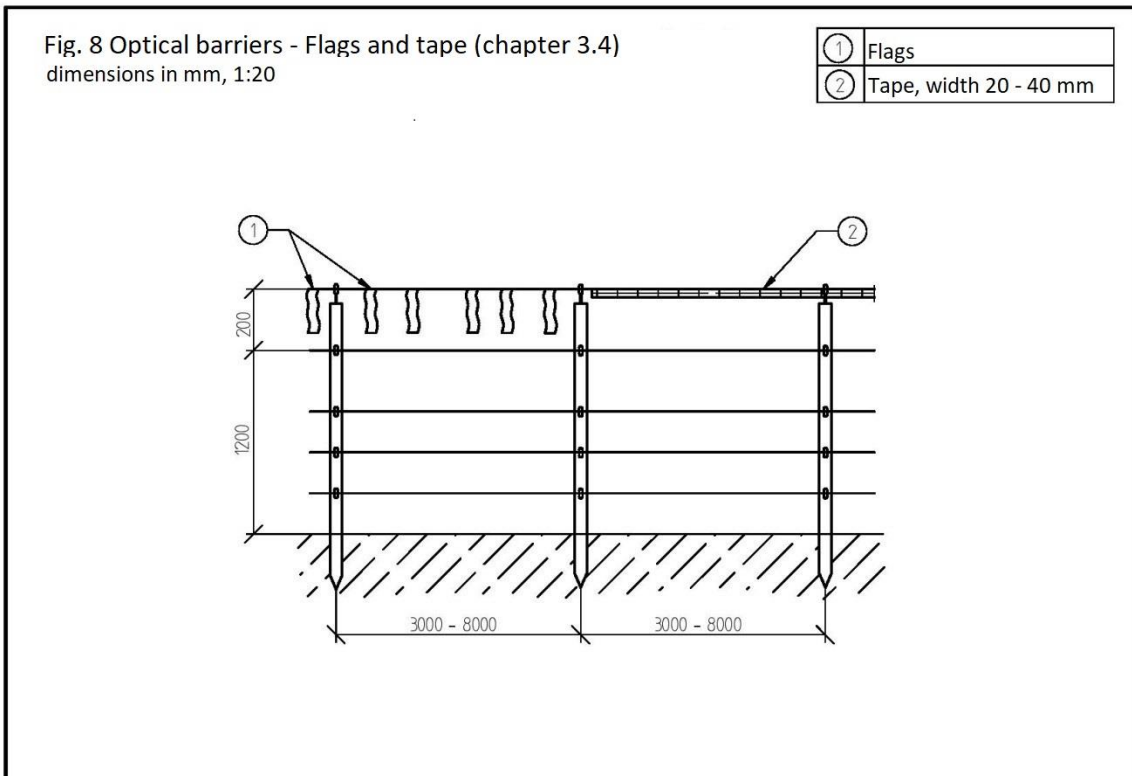


Fig. 7 Combined fixed fencing design (chapter 3.3.3)

Fig. 8 Optical barriers – Flags and tape (chapter 3.4)



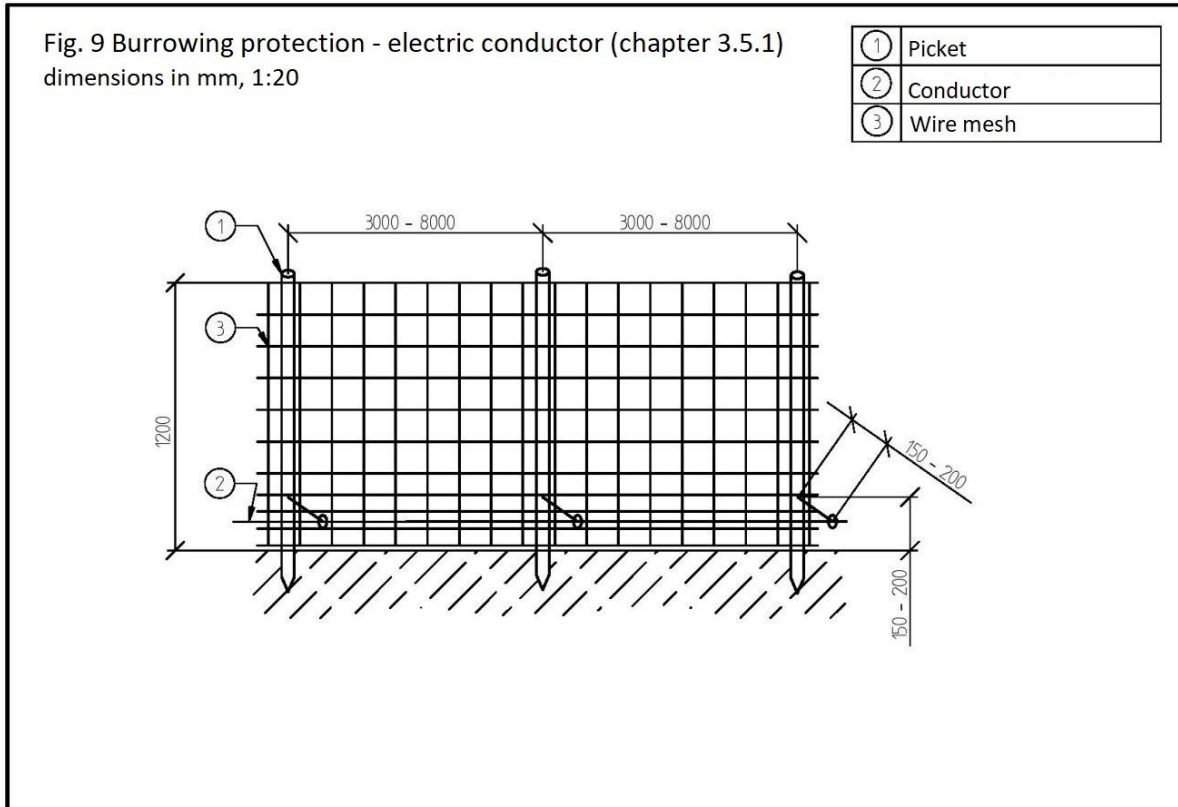
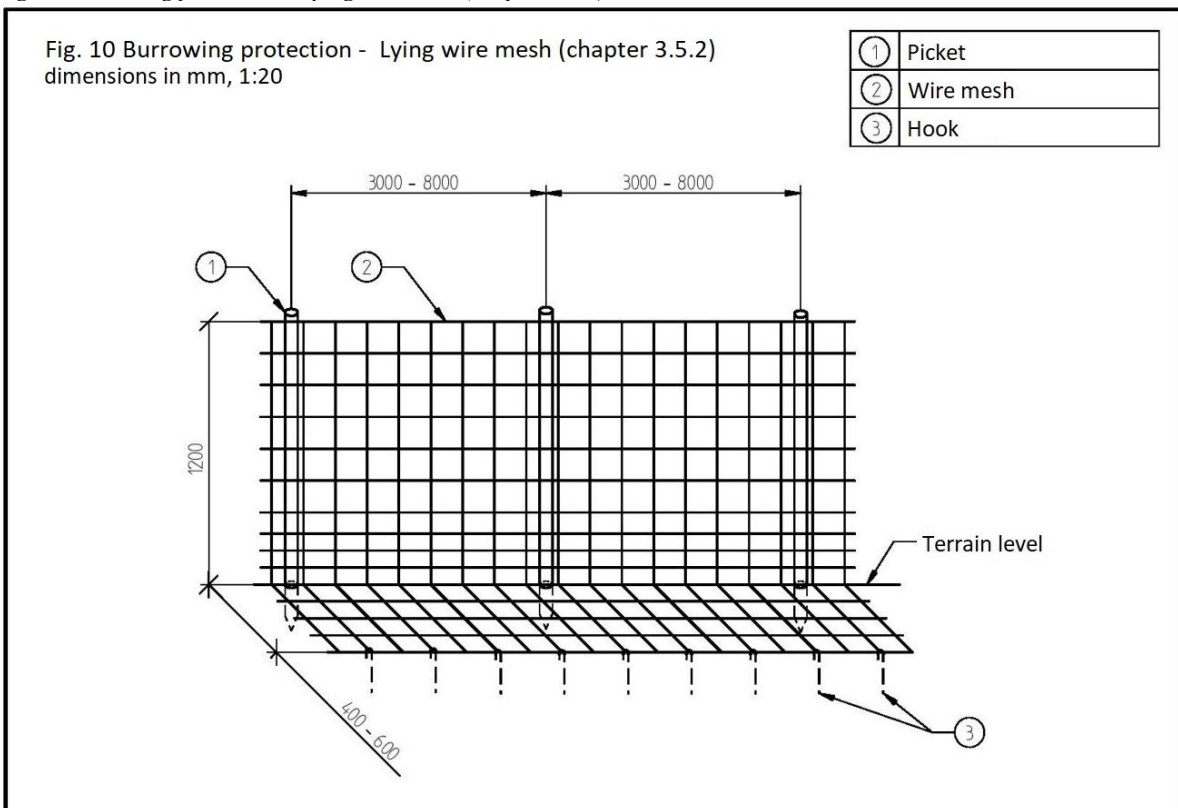


Fig. 9 Burrowing protection – Electric conductor (chapter 3.5.1)

Fig. 10 Burrowing protection – Lying wire mesh (chapter 3.5.2)





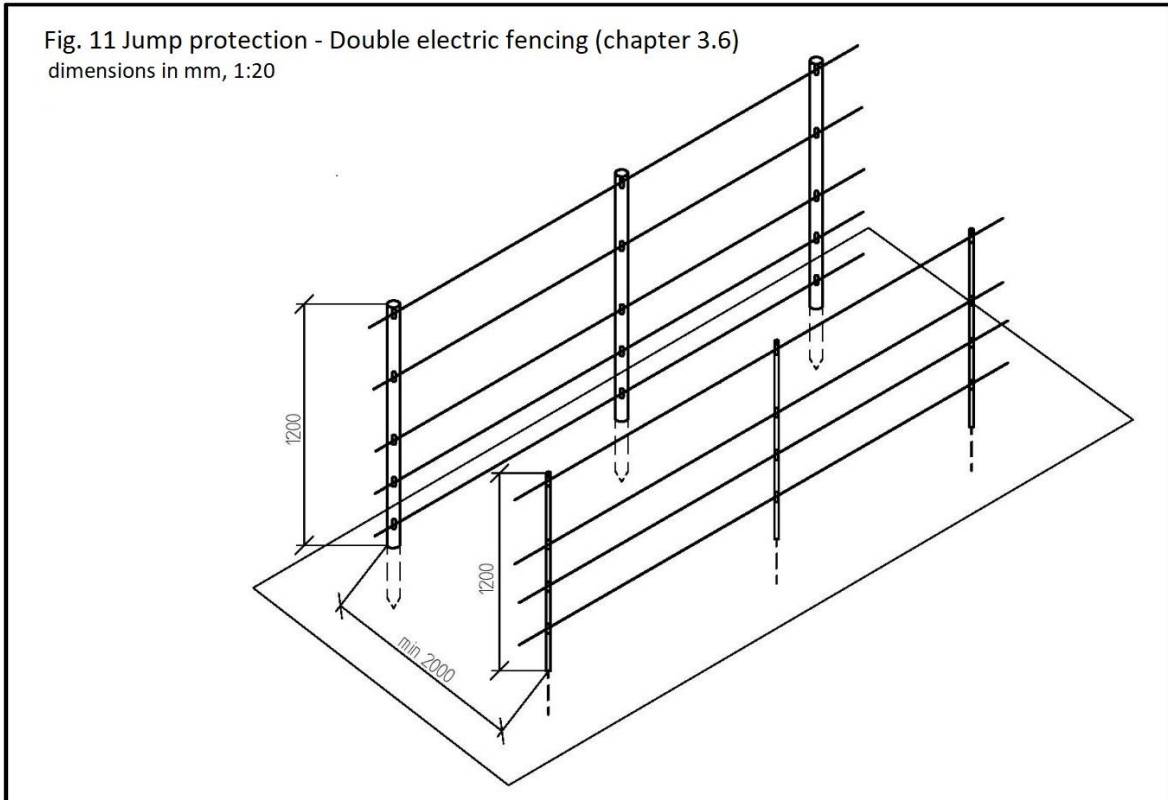
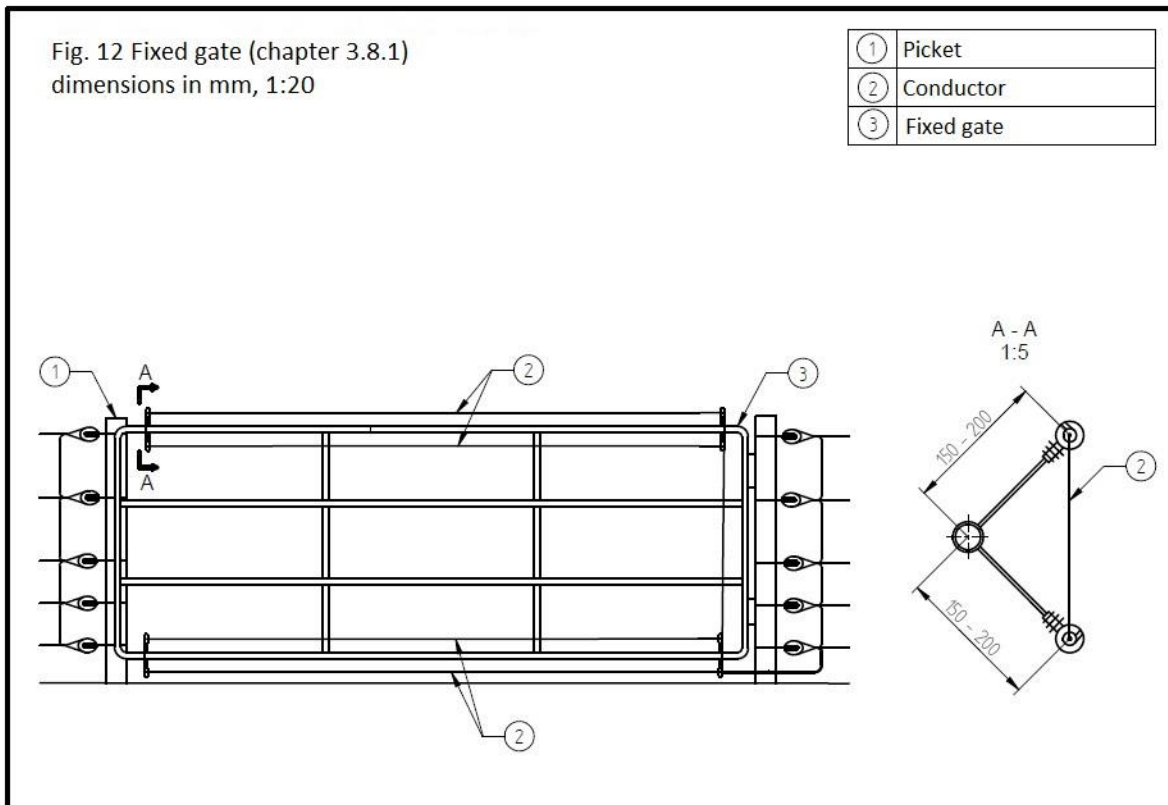


Fig. 11 Jump protection – Two rows of electric fences (chapter 3.6)

Fig. 12 Fixed gate (chapter 3.8.1)



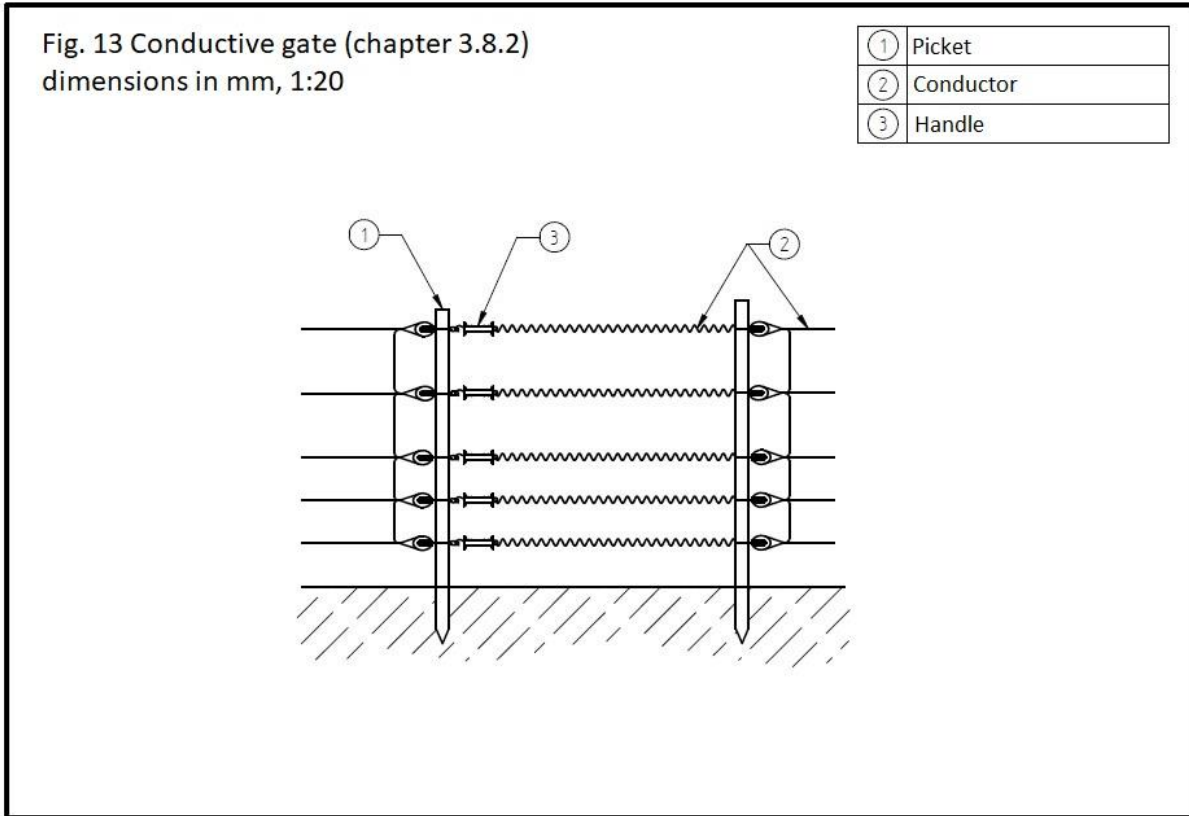
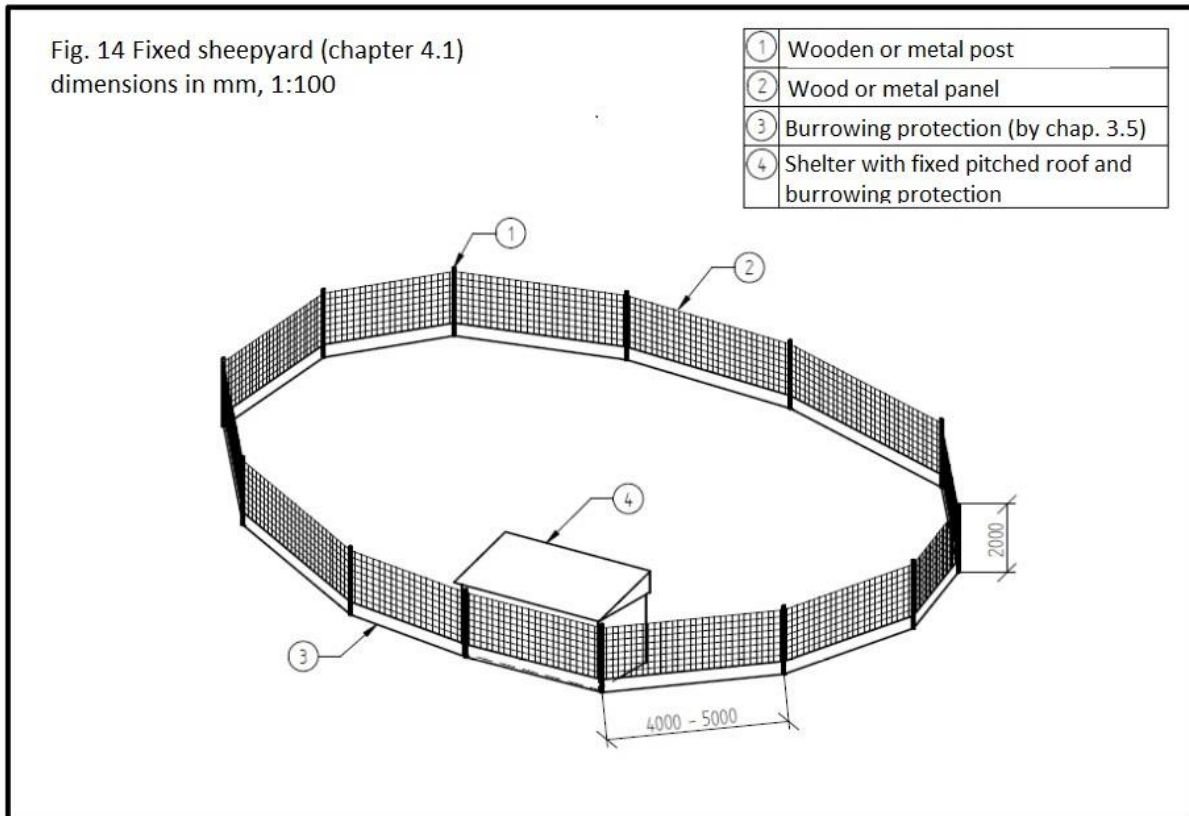


Fig. 13 Conductive gate (chapter 3.8.2)

Fig. 14 Fixed sheeppen (chapter 4.1)



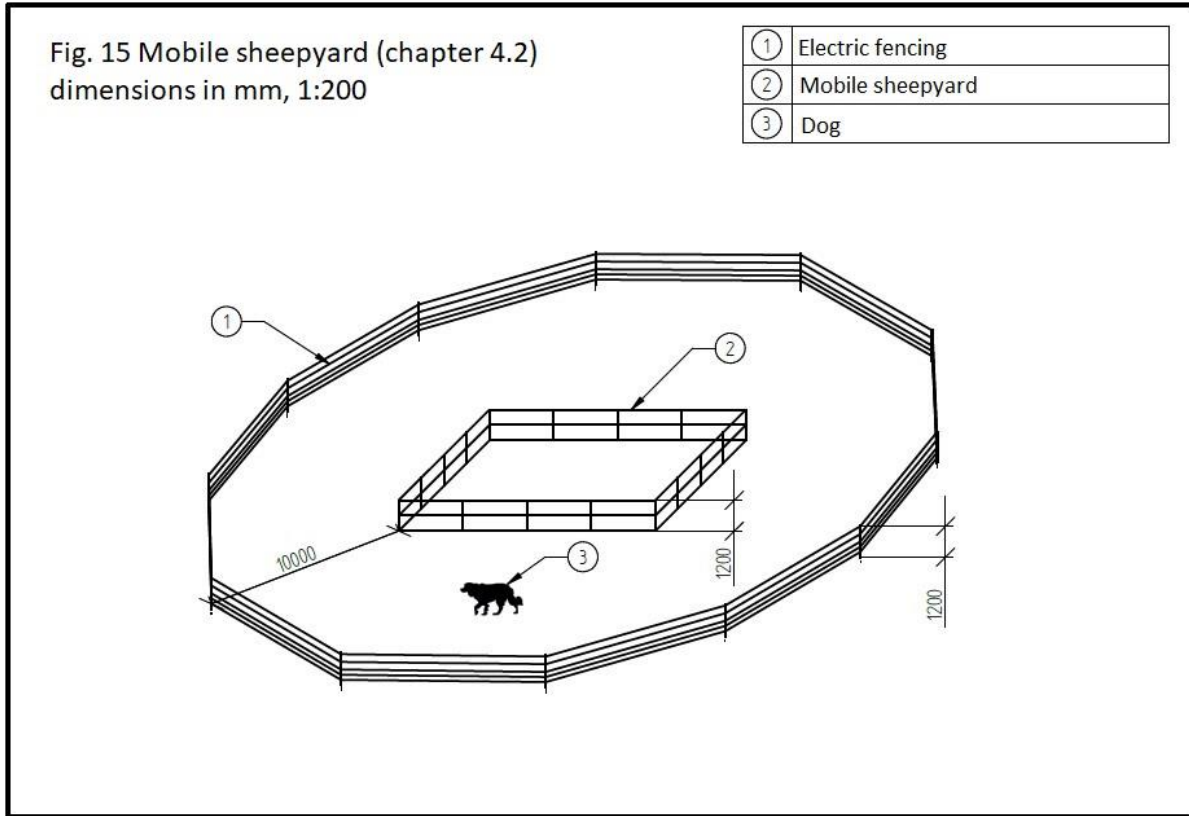
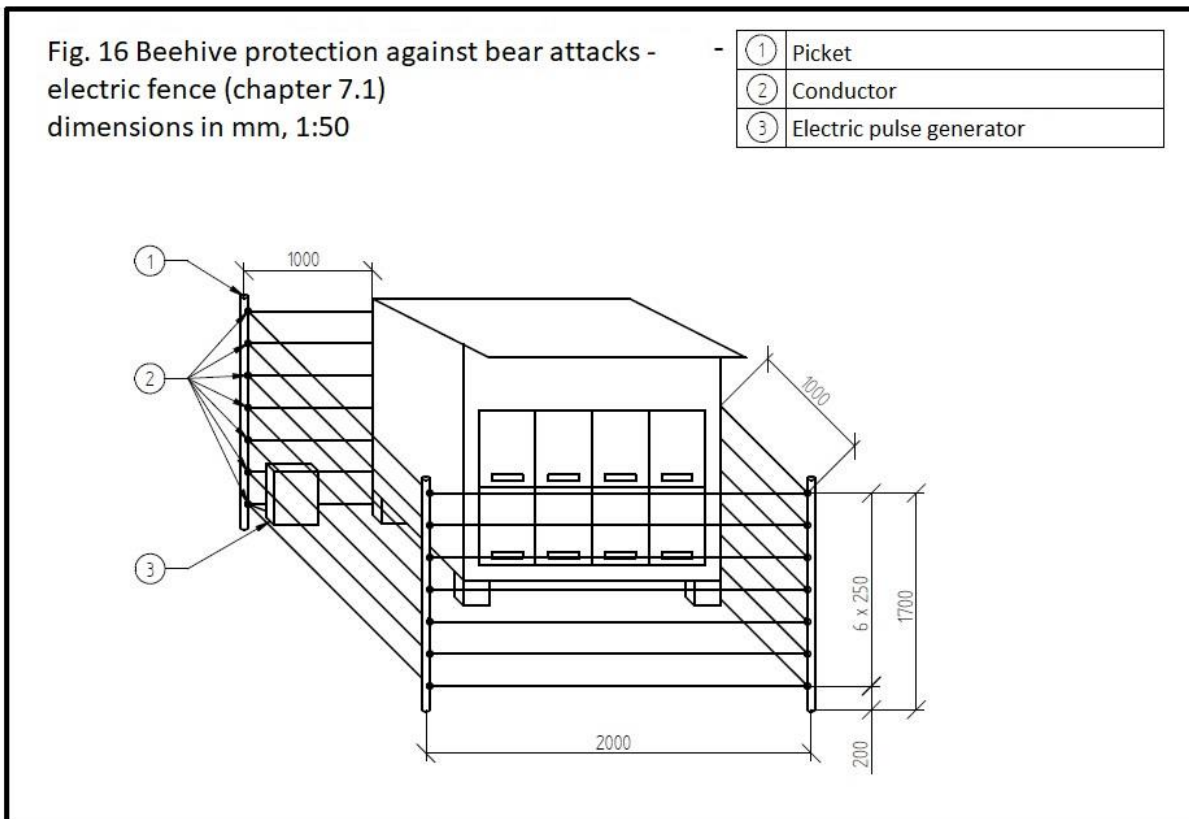


Fig. 15 Mobile sheeiyard (chapter 4.2)

Fig. 16 Beehive protection against bear attacks – Electric fence (chapter 7.1)



© 2021 Nature Conservation Agency of the Czech Republic  
Kaplanova 1931/1  
148 00 Praha 11

SPPK E 02 006 Livestock herd protection against large carnivore attacks

[www.standardy.nature.cz](http://www.standardy.nature.cz)

2021