



## NATURE AND LANDSCAPE MANAGEMENT STANDARDS

### ARBORIST STANDARDS

#### SERIES A

### TREE FELLING

### SPPK A02 005:2018

#### Kácení stromů

#### Baumfällung

This standard is designed to define technical and work procedures for felling of trees under specific conditions of non-forest environments.

#### Sources:

ČSN 83 9001 (1999): Orchard and landscape management – Terminology – Basic professional terms and definitions

ČSN 83 9051 (2006): Vegetation technology in landscaping – Care of vegetation during development and maintenance in green areas

ČSN DIN 18917 (2002): Landscape vegetation modification techniques – Lawns and their establishment

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

Act no. 289/1995 Coll. on Forests and on amendment of certain acts (Forest Act), as amended

Act no. 20/1987 Coll. on State Heritage Management, as amended

Act no. 254/2001 Coll. on Waters and on amendment of certain acts (Waters Act), as amended

Act no. 127/2005 Coll. on Electronic Communications and on amendment of certain acts (Electronic Communications Act), as amended

Act no. 89/2012 Coll., the Civil Code, as amended

Act no. 185/2001 Coll. on Waste, as amended

Act no. 201/2012 Coll. on Air Protection, as amended

Act no. 500/2004 Coll., Rules of Administrative Procedure, as amended

Act no. 13/1997 Coll. on Roads, as amended

Act no. 226/2013 Coll. on Marketing of Wood and Timber Products, as amended

Act no. 458/2000 Coll. on Requirements for Business and Public Administration in Energy Industries and on amendment of certain acts (Energy Act), as amended

EU Regulation no. 995/2010 on the placing timber and timber products on the market, as amended

Government Regulation no. 339/2017 Coll., laying down work and work procedure organisation methods that employers have to ensure in forest work and workplaces of similar nature

Government Regulation no. 362/2005 Coll., on detailed requirements on occupational health and safety in workplaces with a risk of fall from a height or into a depth

Government Regulation no. 591/2006 Coll., on detailed minimum requirements on occupational health and safety in workplaces, as amended.

Decree no. 189/2013 Coll. on Tree Protection and Felling Permission, 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

MoE General Nature and Landscape Protection Unit Methodological Recommendation on Application of certain provisions of MoE Decree no. 189/2013 Coll. on Tree protection and felling permitting process, as amended (MoE Bulletin no. 1/2015)

MoE General Nature and Landscape Protection Unit Methodological Instruction on Application of Sections 8 and 9 of Act no. 114/1992 Coll. on Nature and Landscape Protection, as amended (NLPA) defining the permitting process for non-forest trees and substitute planting and levies (MoE Bulletin no. 5/2014)

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## 1. Standard purpose and contents

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### 1.1 Standard purpose

- 1.1.1 The standard “Tree felling” defines work procedures associated with tree felling notably under conditions of non-forest environments. It is applied particularly in making project and executive documentation, inspection and acceptance of works.
- 1.1.2 The standard does not include definitions of general procedures for occupational health and safety and special work procedures used in tree felling.

### 1.2 Legal framework

- 1.2.1 **Act no. 114/1992 Coll.** on Nature and Landscape Protection, as amended, defines rights and obligations in connection with cutting of woody plants growing outside forest, as well as rights and obligations in connection with substitute planting and levies. The Act is based on the principle that cutting of woody plants growing outside forest is essentially subject to a permission regime; cutting of such woody plants requires a permit from a nature protection authority, unless specified otherwise. No permit is required, for example, when felling woody plants of a defined size or for reasons of health and life protection. Moreover, the Act defines felling of memorable or specially protected trees.
- 1.2.2 **Decree no. 189/2013 Coll.** on Protection of woody plants and permission of their cutting, as amended, makes a detailed specification of requirements for protection of woody plants and for permission of cutting of woody plants and defines terms related to felling.
- 1.2.3 **Act no. 500/2004 Coll.**, Rules of Administrative Procedure, as amended, defines the general procedure and requisites during administrative decision-making.
- 1.2.4 **Act no. 289/1995 Coll.** on Forests and on amendment of certain acts (Forest Act), as amended, defines rules related to felling in forests and on land intended for performance of forest functions. Forest management, including felling, is governed by so-called Forest Management Plans, by Forest Management Outlines for smaller areas (up to 50 ha) or by approval of Professional Forest Manager.
- 1.2.5 **Act no. 20/1987 Coll.** on State Heritage Management, as amended, defines, among other things, the capacity of regional authorities to specify, after negotiation with applicable authorities, which properties that are not cultural monuments but are within a heritage reserve or a heritage zone, or what types of works on them, including planting and cutting of woody plants in public areas exclude the owner’s obligation to apply for a prior binding position statement of the authority of the municipality with extended powers that is otherwise necessary for such works. The regional authority does so by means of protection plans,

issued in the form of general measures.

- 1.2.6 **Act no. 254/2001 Coll.** on Waters and on amendment of certain acts (Waters Act), as amended, enables water management authorities to prohibit owners of land adjacent to watercourse beds from felling trees and shrubs providing stability for the watercourse bed. Moreover, the Act defines the watercourse manager's obligation to maintain riparian vegetation on watercourse bed land and adjacent land and the obligation for owners of land on which watercourse beds are situated to suffer riparian vegetation on their land.
- 1.2.7 **Act no. 13/1997 Coll.** on Roads, as amended, defines felling of woody plants on road land, which needs to proceed in accordance with requirements of Act no. 114/1992 Coll.
- 1.2.8 **Act no. 127/2005 Coll.** on Electronic Communications and on amendment of certain acts, as amended, permits an entrepreneur providing a public communication network to fell and prune back, based on a demonstrable notification to the owner and to the necessary extent, any woody plants posing a threat to safe and reliable operation of communication lines and electronic communication equipment in accordance with requirements of Act no. 114/1992 Coll.
- 1.2.9 **Act no. 89/2012 Coll.**, the Civil Code, as amended, defines rules for planting and removing trees near shared boundaries of land plots. The provisions of the Act do not affect any provisions of general laws.
- 1.2.10 **EU Regulation no. 995/2010** on the placing timber and timber products on the market, as amended, obliges everyone who markets wood and timber products in the EU to maintain and periodically update a due diligence system. It shall consist of three components:
- access to information relating to timber supplies to the market;
  - assessment of risk of placement of illicitly logged timber or timber products from it on the market;
  - mitigation of identified risk in the case of non-negligible risk of placement of illicitly logged timber or timber products from it on the market.
- 1.2.11 **Act no. 226/2013 Coll.** on Marketing of Wood and Timber Products, as amended, defines “centralised records”, used for inspection of due diligence systems (see 1.2.10) and defines jurisdiction and powers of public authorities and penalties for administrative violations in relation to EU Regulation no. 995/2010.
- 1.2.12 **Act no. 458/2000 Coll.** on Requirements for Business and Public Administration in Energy Industries and on amendment of certain acts (Energy Act), as amended, defines authorisation for entry on land and the right to fell a woody plant in the case of assurance of safe and reliable operation of a distribution system (electricity and gas), mining gas pipelines, gas production plants and transport systems, unless the land owner or user has done so after a prior notification.

- 1.2.13 **Government Regulation no. 339/2017 Coll.**, laying down work and work procedure organisation methods that employers have to ensure in forest work and workplaces of similar nature, defines employer obligations, including definition of danger areas, labour organisation and basic work procedures **for tree felling from the ground.**
- 1.2.14 **Government Regulation no. 362/2005 Coll.**, on detailed requirements on occupational health and safety in workplaces with a risk of fall from a height or into a depth, defines labour organisation and work procedures that the employer is required to ensure when working in places where employees are at a risk of fall from a height or into an unprotected depth. In terms of the present standard, it therefore concerns primarily work procedures **for gradual tree felling.**
- 1.2.15 **Government Regulation no. 591 /2006 Coll.**, on detailed minimum requirements on occupational health and safety in workplaces, as amended, defines specific procedures for ensuring occupational safety on construction sites.
- 1.2.16 **Act no. 201/2012 Coll.** on Air Protection, as amended, defines the possibility to burn plant materials (not contaminated with chemicals) in open fireplaces and the right of municipalities to regulate such burning.

### 1.3 Qualification

- 1.3.1 Non-forest tree felling frequently proceeds under complicated conditions, which is why it is necessary that all operations associated with the felling be done by qualified persons. Tree felling is a professional activity.
- 1.3.2 The recommended qualification for persons doing **felling from the ground** in the contractor-client relationship is having taken a course in working with the chainsaw.
- 1.3.3 Persons performing felling using height techniques have to meet the requirement of 1.3.2 and additionally:
- be trained for work at heights,
  - be informed about use of protective work equipment for work at heights,
  - be trained in first aid administration and transport of injured persons when working at heights and over unprotected depth as part of tree climbing techniques.
- 1.3.4 The recommended qualification for persons performing danger tree felling using height techniques is a recognised national or international proof of professional knowledge in the area of arboriculture, qualification for safe movement in the tree crown using climbing equipment or lift platform and safe handling of the chainsaw.<sup>1</sup>

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<sup>1</sup> For example, *European Treeworker, ISA Certified Tree Worker Aerial Lift Specialist, ISA Certified Tree Worker Climber Specialist, ABA International level A2, European forestry and environmental skills council (EFESC), Czech Certified Arborist – Platform Worker, Czech Certified Arborist – Tree Climber, Arborist Technician, etc.*

## 2. Preparatory works

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2.0.1 The conversion of trunk thickness at breast height (1.3 m) to stump trunk diameter can be made using the following formula:

$$d_{\text{stump}} = d_{1.3} * 1.37$$

where  $d_{1.3}$  is the trunk thickness at breast height and  $d_{\text{stump}}$  is the trunk thickness at the stump. The result is rounded to entire centimetres.

### 2.1 Tree inspection

2.1.1 **Formal inspection** should focus primarily on meeting of requirements of Section 8 of Act no. 114/1992 Coll. on Nature and Landscape Protection.

2.1.2 Inspection includes identification of the tree being felled by verifying its location, taxon and trunk dimensions.

2.1.3 The nature protection authority decision has to contain requisites defined by Act no. 500/2004 Coll. (see 1.2.3). The decision has to be conclusive.

2.1.4 It is recommended to request a copy of the nature protection authority decision and to archive it.

2.1.5 **Inspection of basic nature and landscape protection context pursuant to Act no. 114/1992 Coll.** is made when developing the project documentation or the felling design. It is in the implementing person's interest to make sure in particular that:

- the tree is not a memorable tree; otherwise, the memorable tree protection has to be lifted before the felling (Section 46),
- the tree is not part of a notable landscape feature (Section 4, Para. 2),
- the felling cannot reduce or alter the landscape character by reducing its aesthetic or natural value (Section 12, Para. 2),
- the tree is not a specially protected species (Sections 48 and 49),
- the tree is not a biotope for a specially protected species and its felling cannot disrupt the basic protection conditions (Section 49, Para. 1, Section 50, Para. 2),
- the felling is not an activity bound to a nature protection authority approval as part of detailed protection conditions for a specially protected area (Section 44, Para. 3),
- the felling cannot result in damage or destruction of nests and eggs of wild birds, unless the nature protection authority has specified a different procedure (Section 5b, Para. 1),
- the tree is not situated within a Special Protection Area, where the felling is an activity bound to a nature protection authority approval (Section 45e, Para. 2),
- the felling cannot lead to serious or irreversible damage or destruction of

the object of protection in European habitats or habitats for species of European importance; otherwise, the felling cannot be approved with a nature protection authority approval (Section 45c, Para 2),

- the felling cannot, by itself or in combination with other plans, significantly affect the favourable condition of the object of protection or integrity of a Site of Community Importance or a Special Protection Area; otherwise, the felling cannot be approved with a nature protection authority approval (Section 45i, Para 1).

2.1.6 Before starting any work, the person doing the felling shall make an **inspection of the tree and its surroundings**, in particular from an occupational safety perspective.

2.1.7 **Tree inspection** includes a check for damage to the tree or its parts and any growth anomalies in terms of straining of the parts due to the chosen tree felling technique (wood material properties) and an assessment of their effects. The check includes:

- identification of the tree taxon in terms of wood mechanical properties,
- identification of the tree centre of gravity (trunk deflection, crown shape and symmetry),
- check for symptoms of presence of wood-decaying fungi at and around the trunk base,
- check of the tree base, trunk and primary boughs for presence of compression forks, cavities, cracks, etc.,
- presence of large hanging or dry branches in the tree crown threatening with a fall,
- check for presence of a security bond in the tree crown,
- other potential risks.

2.1.8 **Inspection of tree surroundings** includes:

- objects near the tree (such as building structures, public technical and transport infrastructure, other trees),
- traffic near the tree,
- accessibility to machinery,
- ground slope and elevation differences, surface carrying capacity.

2.1.9 **Check of important climate conditions** for the felling period (typically a 3-day range).

2.1.10 Based on the check, the contractor chooses the adequate work procedure (felling technique or use of special devices and machinery – trunk fastener, crane, lift platform, etc.).

## 2.2 Work area

2.2.1 Locking out of the work area and the danger area when felling trees has to conform to Government Regulation no. 339/2017 Coll., no. 591/2006 Coll. and

no. 362/2005 Coll., as the case may be (see 1.2.13 – 1.2.15).

- 2.2.2 The danger area when felling a tree refers to a circular area of a radius equal to at least twice the height of the tree being felled (Annex 1, Figure 1).
- 2.2.3 An escape route has to be arranged in accordance with Government Regulation no. 339/2017 Coll. If the site conditions do not permit that, another work procedure has to be chosen, such as gradual felling (see 4.0.2).
- 2.2.4 Obstacles to felling include, but are not limited to, roads, structures, overhead public technical infrastructure networks, tree crowns and trunks in the danger area.
- 2.2.5 Objects that can be damaged shall be removed, if possible, from the area equalling (twice) the height of the tree being felled before the felling starts. Their appropriate securing against damage is also an option.



### 3. Recommended tree felling work procedures

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- 3.0.1 Tree felling work procedures are defined in the present standard only to a basic extent without possible different options. A different option is not a process error.
- 3.0.2 Tree felling work procedures are basic procedures for safe performance of the felling process.

#### 3.1 General felling (felling with an aiming kerf/undercut and a back cut)

##### 3.1.1 Aiming undercut

- 3.1.1.1 An **aiming undercut** is a wedge-shaped part of the trunk base removed by sawing on the side of the intended direction of the tree fall. It is always made in trees more than 150 mm in diameter at the stump.
- 3.1.1.2 The horizontal and inclined cuts of the undercut intersect at the edge.
- 3.1.1.4 The depth of the undercut is 1/5 - 1/3 of the trunk diameter, the height is at least 2/3 of its depth (Annex 1, Fig. 2).
- 3.1.1.5 The aiming undercut is made in two cuts: a horizontal one and an inclined one. The two cuts intersect at the edge around which the tree rotates when falling. The edge has to be horizontal and perpendicular to the fall direction. After the removal of the cut-out section, the **line of intersection** (edge) has to be smooth.
- 3.1.1.6 A **top wedge undercut** is used in trees standing on flat ground or on a gentle slope (Annex 1, Fig. 3).
- 3.1.1.7 A **bottom wedge undercut** is used in trees standing on slopes (Annex 1, Fig. 4) and in gradual felling as necessary.
- 3.1.1.8 When felling trees on a slope, always fell down the slope.

##### 3.1.2 Aiming kerf

- 3.1.2.1 An **aiming kerf** may replace an aiming undercut in trees up to 150 mm in diameter.
- 3.1.2.2 An aiming kerf has to be horizontal to the expected fall direction.
- 3.1.2.2 An aiming kerf extends to 1/5 - 1/3 of the trunk diameter.

##### 3.1.3 Back cut

- 3.1.3.1 The **back cut** is made from the opposite side against the aiming undercut or kerf.

- 3.1.3.2 The back cut has to be made horizontally.
- 3.1.3.2 A **hinge** has to be left between the kerf and the back cut. The width of the hinge is 1/10 of the trunk diameter but no less than 20 mm. The hinge may be wider in justified cases (see 3.1.5.1.3, 3.1.7). The tree becomes uncontrollable if the hinge width is not observed or if the hinge is cut through.
- 3.1.3.4 If a **top wedge undercut** is made (see 3.1.1.6), the back cut level is at 1/2 to 2/3 of the undercut.
- 3.1.3.5 If a bottom wedge undercut is made (see 3.1.1.7), the back cut is made at the level of the horizontal cut.

### 3.1.4 Deflecting the tree in the fall direction

- 3.1.4.1 In thinner trees, it is possible to deflect the tree in the fall direction after the back cut is made by merely pushing the trunk by hand. A feller hook can be used, which is inserted in the back cut and levered to exert the force necessary to deflect the tree.
- 3.1.4.2 In larger trees (typically above 150 mm trunk diameter at the stump), deflection is achieved using various equipment: combined shovel for trees up to 350 mm at the stump (pull the shovel up or press it down), pull wedges particularly for trees above 350 mm at the stump, hydraulic or mechanical wedges, hydraulic jacks (for very thick trees), pusher bar, puller for hanging trees (aiming pulley is necessary), winch or horse team tow line (aiming pulley is necessary).
- 3.1.4.3 As soon as the tree begins to fall, all the involved persons retreat along the arranged escape route obliquely backwards into a safe distance, where they remain until there is no evident risk of injury (e.g., by falling branches caught in crowns of adjacent trees).
- 3.1.4.4 Do not remove the chainsaw from the cut if it might threaten people's life (by falling tree or otherwise).

### 3.1.5 Felling a tree with a deflected centre of gravity

#### 3.1.5.1 Felling a tree deflected in the fall direction

- 3.1.5.1.1 If the tree is deflected in the fall direction, there is no difficulty guiding the tree in the fall direction. However, the risk of the trunk base splintering increases due to tension in the wood. This can be prevented by using a trunk fastener and the following felling methods.
- 3.1.5.1.2 **Back cut via heart cuts.** The trunk is cut in three parts. Cuts from the right and from the left produce an uncut triangular (V-shaped) sector; the base of the triangle is identical to the hinge edge. The wood in the sector is cut in a gradual back cut. (Annex 1, Fig. 5). This procedure accelerates the back cut.

- 3.1.5.1.3 **Double hinge method.** The back cut is made with a piercing, leaving another outer hinge. The tree is made to fall by cutting through the rear hinge, which is situated on the opposite side of the trunk against the undercut. (Annex 1, Fig. 6).
  - 3.1.5.1.4 **Double undercut method.** Two undercuts are made from the perpendicular to the expected tree fall direction, which intersect in the expected tree fall direction. The angle between them has to be more acute than a right angle. The back cut is made gradually.
  - 3.1.5.1.5 The kerf is only made to approx. 1/5 of the trunk diameter.
  - 3.1.5.1.6 If the tree has thick root tapers, they are removed only on the pressure side and on the aiming undercut side.
- 3.1.5.2 Felling a tree deflected away from the fall direction**
- 3.1.5.2.1 If the tree is gently deflected away from the required fall direction, the back cut is made first, then the tree is balanced in a vertical position by wedging, an aiming undercut is made and the tree is then further deflected in the fall direction.
  - 3.1.5.2.2 It is advisable to use a winch tow line or puller to pull the tree into the required fall direction and to secure it, always using an aiming pulley (see 3.1.4.2).

### **3.1.6 Felling merged trees (doubles)**

- 3.1.6.1 If the merging of two trunks is up to 1 m above ground, each tree is felled separately. The fall direction of each trunk is away from the opposite trunk.
- 3.1.6.2 If the merger is higher than 1 m above ground, the double is felled as one tree and the fall direction is perpendicular to the line connecting the crowns of the merged trees (known as flatways). The use of a trunk fastener is advisable.

### **3.1.7 Felling dry and defective trees**

- 3.1.7.1 When felling a tree with an apparent cavity or other extensive defect in the lower portion of the trunk, the depth of the aiming undercut is 1/3 of the trunk diameter.
- 3.1.7.2 Root tapers are typically not removed in apparently infected trees.
- 3.1.7.3 Wedging (including hydraulic wedges) is impossible when felling rotten trees, as there is a risk of wood collapsing.
- 3.1.7.4 When using pull wedges while felling dead trees, there is a risk of branches or tops breaking off as a consequence of impacts on the wedges.
- 3.1.7.5 It is advisable to use winches or rope pullers via an aiming pulley to deflect trees into the fall direction.

### **3.1.8 Broken trees**

- 3.1.8.1 Broken trees where a broken part hangs on a trunk stub or its tip sits on the ground and cannot be released safely are felled as a single unit using usual procedures.
- 3.1.8.2 With utmost caution, the tree is felled in the direction into which the broken part outweighs it; the feller must not work under the fracture.
- 3.1.8.3 When felling broken trees, it is advisable to secure the fall direction using a rope winch or puller for hanging trees (using an aiming pulley).
- 3.1.8.4 Pull wedges must not be used as there is a risk of the broken part breaking off as a consequence of impacts on the wedges.
- 3.1.8.5 Trees (broken) without a crown are felled using standard methods. The depth of the aiming undercut is 1/3 of the trunk diameter, but beware that they fall to the ground much faster than trees with a crown.

## **3.2 Gradual felling**

### **3.2.1 General principles**

- 3.2.1.1 In gradual felling, the parts of the crown and trunk are removed gradually; the size of the parts being removed has to be adequate, primarily depending on the technical devices used for lowering as necessary.
- 3.2.1.2 It can be done using machinery (lift platform, crane, etc.) or tree climbing techniques.
- 3.2.1.3 Work with the chainsaw must not be done off a ladder.
- 3.2.1.4 During ascent to the tree crown, the work and the descent, both the worker and the chainsaw have to be secured against falling using separate security devices attached to the work platform or the tree outside the current work zone.
- 3.2.1.5 Gradual felling requires constant presence of at least two specialists for work at heights on the site (see 1.3.4 to 1.3.5) with adequate equipment and ability to rescue any injured persons from the height.
- 3.2.1.6 Specialised devices (platforms, lowering equipment, cranes, etc.) are always operated by trained personnel. Arrangement of signals between the operator and the person doing the felling is necessary.
- 3.2.1.7 The tree climbing felling technique has to use climbing irons.
- 3.2.1.8 Felling of the trunk and primary boughs proceeds in sections from the tree top. Branches are usually removed during the ascent to the crown; if left on the tree, there is a risk of bouncing sideways when the section falls.
- 3.2.1.9 All parts that are cut off have to be lowered or dropped into a defined area. The dropping or lowering proceeds by means of the arranged signals.
- 3.2.1.10 Gradual felling can be divided into several days of implementation depending on technical and climate conditions.

- 3.2.1.11 The tree that is left (half-felled) has to show sufficient stability. The felling client has to be informed about any felling interruption.

### 3.2.1 Types of cuts

- 3.2.2.1 **Branch tilting.** Used to aim a falling branch. An aiming kerf or undercut is made according to 3.1.1 to 3.1.2. The undercut angles may differ from the rules in 3.1.1 as needed for aiming the branch. The open angle of the aiming undercut defines the distance of impact of the branch from the cut point and its position during the fall.

- 3.2.2.2 **Branch cutting flatways.** Used for cutting off a horizontal branch or one angled up to approx.  $45^\circ$  from the horizontal axis. This is the usual procedure for cutting off side branches.

Instead of an aiming undercut, a bottom kerf or undercut is made to approx.  $1/4$  to  $1/3$  of the branch. Another cut, made at a distance of approximately  $2/3$  of the diameter of the branch being cut from the first cut towards the trunk, makes the branch break off.

- 3.2.2.3 **Log cut.** Used when cutting vertical branches or trunks.

The first cut is made horizontally perpendicular to the fall direction, in the fall direction, up to  $3/4$  to  $4/5$  of the trunk diameter. The second cut is made from the opposite side approx. 20 mm below the first one (depending on the dimensions of the section being cut off and the wood mechanical properties), horizontally or at a gentle incline of approx.  $5^\circ$  in the fall direction up to  $1/3$  to  $2/3$  of the trunk diameter. The two cuts have to overlap. The cut-off section is easy to snap off and drop in the desired direction.

Used typically in gradual felling where tree sections are suspended on a crane.

## **4. Felling techniques**

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- 4.0.1 The technique is an indicator used when developing the bill of quantities and project documentation. The felling performance has to correspond to the actual condition of the tree, the site and site conditions.
- 4.0.2 Free felling (S-KV) and pull felling (S-KSP) is designed in cases where the felling can be performed without ascending up the tree crown and where a free escape route is provided. Gradual felling (S-KPV and S-KPP) is designed primarily in trees growing under conditions that rule out felling the entire trunk length. It is often used in defective or infected trees.

### **4.1 Free felling (S-KV)**

- 4.1.1 Free felling refers to a case where a tree is felled with a free circular space without any obstacles the radius of which is at least twice height of the felled tree in all directions.
- 4.1.2 The free felling technique is also applied in cases where trees to be felled have a trunk diameter up to 150 mm at the stump, regardless of surrounding conditions.

### **4.2 Pull felling (S-KSP)**

- 4.2.1 Pull felling is applied in cases where only a corridor of free space without any obstacles is available for felling the tree (to a distance of at least twice the height of the tree felled and a width of at least twice the crown diameter in the impact area).
- 4.2.2 Pull felling also refers to cases where the only obstacles within the impact distance are trunks of surrounding trees.
- 4.2.3 In pull felling, the fall direction has to be secured using an appropriate device (machinery rope pull, special puller, etc.).
- 4.2.4 Pull felling cannot be performed in the case of a significant deflection of the trunk in a direction away from the felling direction.

### **4.3 Gradual felling with an open impact area (S-KPV)**

- 4.3.1 Gradual felling with an open impact area is applied in cases where an impact area without any obstacles that could be damaged is available for felling the tree, with a continuous area equal to at least 75% of the crown diameter expressed as a circular sector.

### **4.4 Gradual felling with an obstacle in the impact area (S-KPP)**

- 4.4.1 Gradual felling with an obstacle in the impact area is applied in cases where there is not a sufficient impact area for felling the tree and obstacles that could be damaged take up a sector in excess of 25% of the crown diameter.

## 5. Handling the felled tree

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### 5.1 Limbing

- 5.1.1 Limbing is cutting off branches at the trunk surface with a tolerance up to 10% of the diameter of the branch being cut off.
- 5.1.2 The diameter of branches removed is up to 100 mm. Thicker branches are handled according to 5.2.
- 5.1.3 Cut branches are laid on piles mostly in a single direction.
- 5.1.4 Stability of branch piles has to be secured in an appropriate way.
- 5.1.5 Piles are located within 20 m of the trunk of the felled tree preferably outside the drip line of the remaining trees.
- 5.1.6 It is advisable to apply one of the three tried-and-tested methods below for efficient limbing.

#### 5.1.7 **Six-stage method**

- 5.1.7.1 This method is intended for trees with branches growing in whorls (e.g., spruce, larch, fir).
- 5.1.7.2 Whorls are assumed to grow relatively close to each other and that each whorl contains four branches, out of which those pointing to the right, upwards and to the left are removed as the feller advances forward. The fourth branch in each whorl, pointing down, is removed after the trunk is rotated (particularly if less readily accessible, when the trunk lies on the ground), but it can be removed even without rotating the trunk in the course of the limbing cycle.
- 5.1.7.3 The maximum branch thickness is approx. 40 mm, so the course of pressure and tension in the wood does not matter during their removal.

#### 5.1.8 **Axial line method**

- 5.1.8.1 The method is suitable for removing thick branches (over 50 mm) with whorls growing farther apart, so that the worker can deal with a single whorl from each position without advancing.
- 5.1.8.2 In this method, the greater thickness of branches requires a distinction between pressure and tension in the branch wood because the guide bar could be seized in the cut.
- 5.1.8.3 At the start of the work, the worker stands on the left side of the tree and rests the chainsaw on the surface straight line on the top of the trunk. The worker cuts off branches on the left side of the whorl first: the top and side branch top-down using

a pitch cut (they both protrude into the open – tension acts on the upper side of the branch wood), the bottom branch bottom-up using a pitch cut (this branch is assumed to rest on the ground – tension acts on the lower side of the branch wood). Branches on the right side are then removed in an analogous fashion.

### **5.1.9 Swing method**

5.1.9.1 This method is usable for removing thin branches (up to 20 mm).

5.1.9.2 The worker stands astride and uses a fast pull forward of the chainsaw in the base position, with the chain moving away (i.e., with the top of the guide bar), to remove branches on the left side within reach (about 1.5 m), then turns the chainsaw flatways and limbs the top side of the trunk analogously with the chain moving towards him and moving the chainsaw backwards, then again limbs the right side of the tree while moving the chainsaw forward in the base position with the chain moving away.

5.1.9.3 This method is characterised by lower-quality limbing, i.e., greater tolerances of the removed branches at the trunk surface than those specified in 5.1.8 (approx. 100%).

### **5.2 Handling the trunk and thick branches**

5.2.1 The trunk and primary boughs are handled alternatively:

- for removal using machinery,
- for manual clearing.

5.2.2 In the case of handling for removal using machinery, the trunk and primary boughs have to be stacked on stable piles with a maximum pile height of 1.5 m in lengths permitting loading and transport using common machinery for the area (maximum 14 m).

5.2.3 In the case of handling for manual clearing, the trunk and primary boughs are cut to pieces weighing up to 30 kg and stacked on stable piles with a maximum pile height of 1.5 m.

5.2.4 The handling type and the possibility to run heavy machinery in the felling area have to be specified in the project documentation while respecting the client's requirements.

5.2.5 Cross-cutting, or handling, consists in cutting the trunk transversely at a set place using a chainsaw.

5.2.6 During this activity, the material being cut is in most cases variously braced or weighted, and tension occurs in the wood grain due to gravity.

5.2.7 The cross-cutting has to respect the sequence of cuts depending on pressure or tension in the wood.

5.2.8 Tensioned wood is first partly cut on the pressure side (up to 1/3 of the material thickness) and then finished on the tension side.

5.2.9 The cuts have to meet. That means that the difference in the positions of the two cuts is no more than the kerf thickness.



## **6. Clearing the area after felling**

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### **6.0 Stump removal**

- 6.0.1 Stumps comprise a potential biotope for numerous species of organisms and are important for retention of populations and individuals of specially protected organisms, which is why they should be removed only in justified cases.
- 6.0.2 The stump removal type and depth of milling (if different from the provisions of 6.4) have to be specified in the project documentation.
- 6.0.3 It is advisable to leave stumps particularly in areas with increased risk of soil erosion.
- 6.0.4 The result (except 6.1) is stump removal, including root tapers and roots protruding above ground within 1.5 times the trunk diameter at the cutting point.
- 6.0.5 If removing stumps in mown lawn areas, the removal must not result in uneven spots higher than 20 mm.
- 6.0.6 If the depth of the pit after stump removal is over 500 mm, the pit has to be secured.

### **6.1 Stump treatment by cutting (S-US)**

- 6.1.1 Stump destruction by cutting proceeds at the ground level with a maximum tolerance of 5% of the felled tree trunk diameter at the cutting point.

### **6.2 Stump removal by excavation (S-OR)**

- 6.2.1 Stump removal (grubbing) is done by excavating the stump and structural roots.

### **6.3 Stump removal by pulling using heavy machinery (S-OK)**

- 6.3.1 This is done on sites where heavy machinery can be used.
- 6.3.2 Trees left standing have to be protected from damage while pulling stumps and running heavy machinery according to A01 002 Protection of woody plants during development activities.

### **6.4 Stump removal by milling (S-OF)**

- 6.4.1 The default depth for milling stumps is 200 mm below ground.
- 6.4.2 The milled profile area is a square area with the edge length equal to 1.5 times the trunk diameter at the cutting point.
- 6.4.3 Any need for deeper milling has to be specified in an individual requirement.
- 6.4.4 The pit produced by the milling is not backfilled as a rule (except 6.0.5).

### **6.5 Site modification**

- 6.5.1 Felling, limbing, handling and stump treatment must not result in excessive soil compaction and damage to roots in the rootable area of the trees left standing.
- 6.5.2 Removal and handling of branching must not result in any damage to surrounding trees. Disposal of branches by burning is only possible in exceptional cases while meeting requirements of Act no. 201/2012 Coll. (see 1.2.16).
- 6.5.3 If pits and uneven areas resulting from the felling (e.g., in intensive lawns) need to be backfilled, a suitable material has to be used (earth without any significant contents of felling leftovers) and compacted.
- 6.5.4 Any excess material produced by stump milling has to be removed from the site.
- 6.5.5 After felling, paved areas have to be cleaned by removing sawdust, leaves, needles and branch remains.
- 6.5.6 Any branch remains and layers of leaves, needles and sawdust have to be removed from intensive lawn areas.

## 7. Work acceptance

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### 7.1 Site inspection

- 7.1.1 The vegetation surface in the rootable area of trees left standing must not be compacted excessively.
- 7.1.2 The ground surface has to be restored to its original condition (see 6.5).
- 7.1.3 Remains of branches and trunks from felled trees have to be removed from water bodies as well.
- 7.1.4 Any material retained has to be stored according to 5.1 and 5.2.
- 7.1.5 No property damage, including adjacent vegetation and structures, is permissible.
- 7.1.6 Any damage to adjacent trees, particularly branches over 100 mm in diameter and wounds in the trunk over 200 mm long, is considered gross process error.
- 7.1.7 If any damage to adjacent woody plants is caused, wounds have to be trimmed and treated professionally.

**Annex 1            Illustrations**

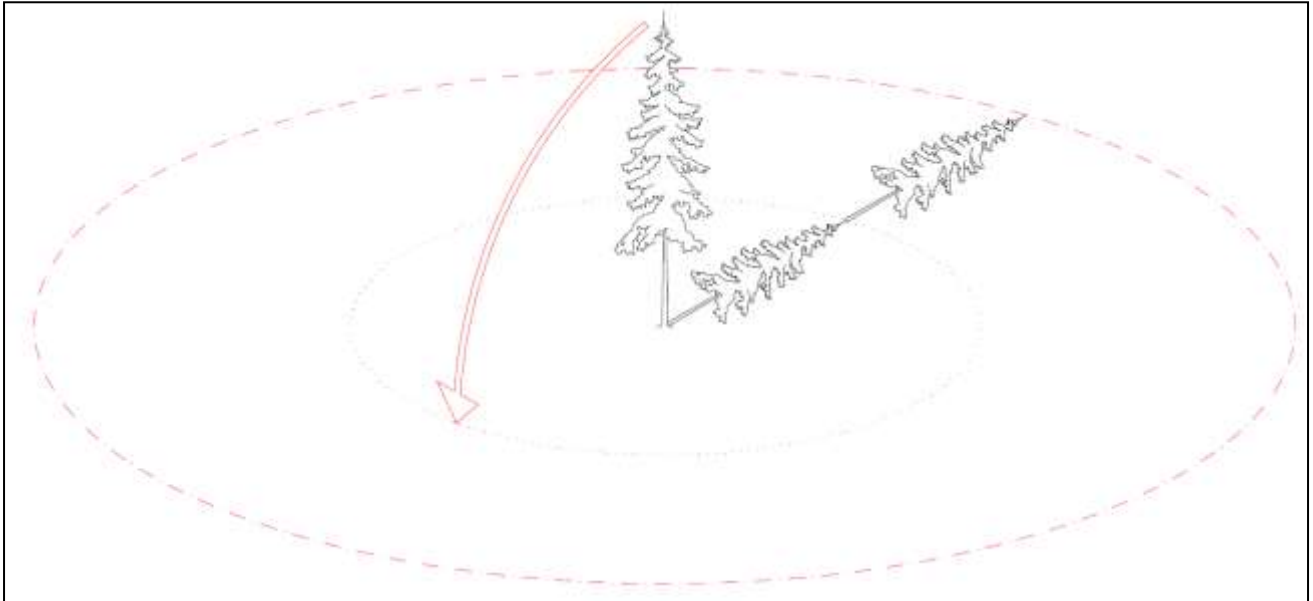


Fig. 1 Minimum danger area (2.2.2).

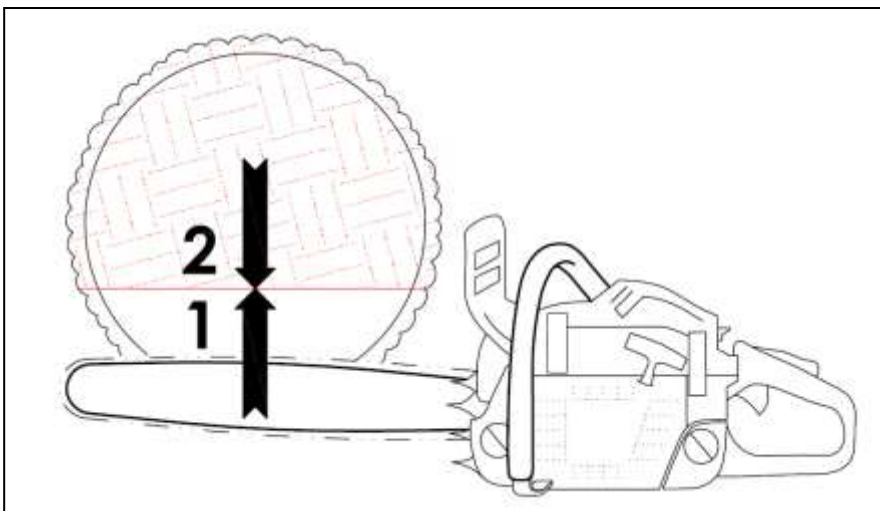


Fig. 2 Aiming kerf – 1 (3.1.1.4).

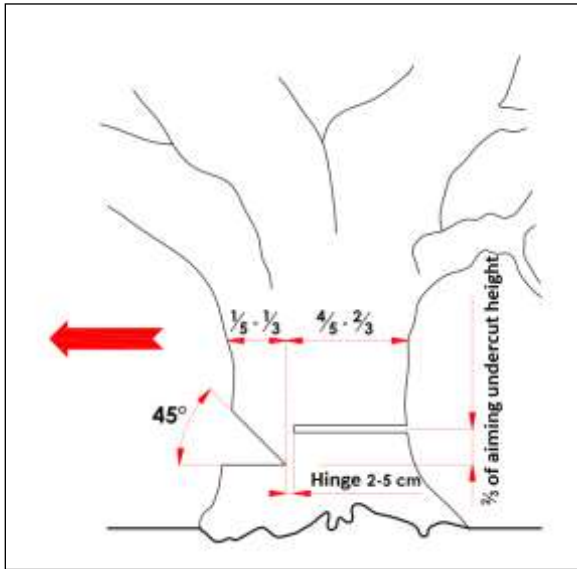


Fig. 3 Top wedge undercut and back cut in a tree on flat ground or a gentle slope (3.1.1.6).

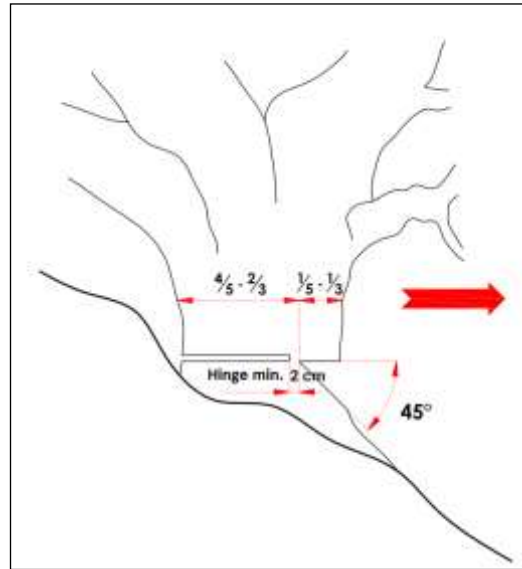


Fig. 4 Bottom wedge undercut and back cut in a tree on a slope (3.1.1.7).

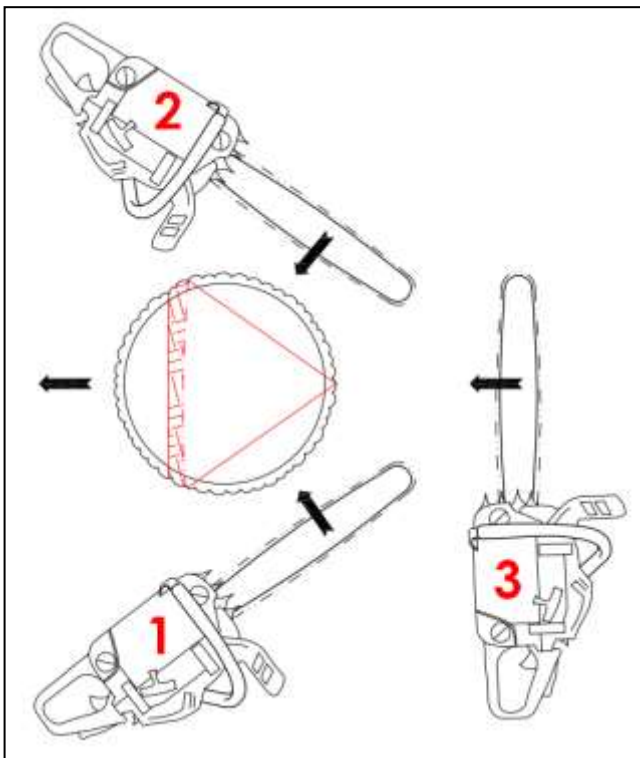


Fig. 5 Back cut via heart cuts (3.1.5.1.2).

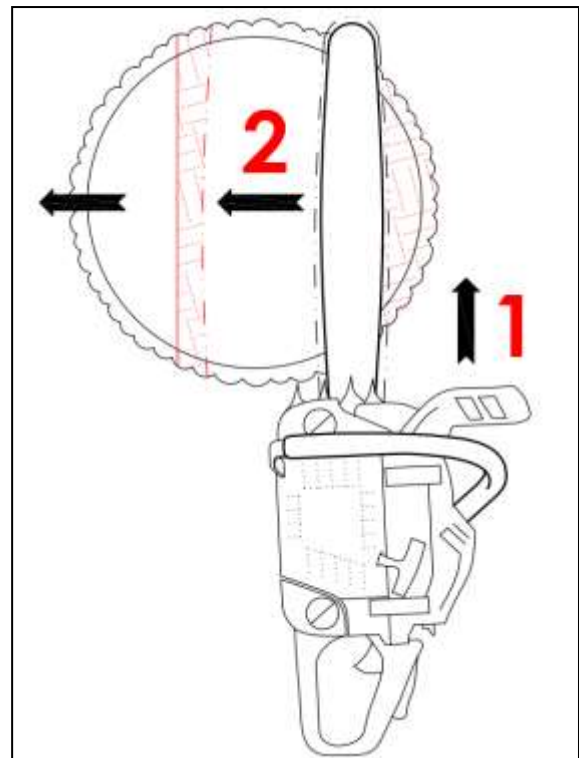


Fig. 6 Two-hinge method (3.1.5.1.3).

**Annex 2**                      **List of Nature and Landscape Management Standards  
(Arborist Standards) developed**

**01**                      **Inspection, assessment, planning**

- 01 001                      Tree assessment
- 01 002                      Protection of woody plants during development activities

**02**                      **Work procedures**

- 02 001                      Planting of trees
- 02 002                      Pruning of trees
- 02 003                      Planting and pruning of shrubs and climbing plants
- 02 004                      Safety bonds and other stabilisation systems
- 02 005                      Cutting of trees
- 02 006                      Protection of trees against lightning strike
- 02 007                      Modification of woody plant site conditions
- 02 008                      Woody plant stand establishment and management
- 02 009                      Special tree treatment
- 02 010                      Management of woody plants along public transport infrastructures
- 02 011                      Care of woody plants along utility lines

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