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Machinery for forestry — Winches —

Part 2: Traction aid winches

Matériels forestiers — Treuils —

Partie 2: Treuils d'aide à la traction

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 15, *Machinery for forestry,* in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 144, *Tractors and machinery for agriculture and forestry,* in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 19472 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a type-C standard as stated in ISO 12100:2010.

This document is of relevance, in particular for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document. When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

Traction aid winches are used with forest machines when operating in sloped terrain and on soils with limited bearing capacity or poor traction. Such winches do provide traction aid to a supported machine. The combined tractive effort provided by the machine's wheels or tracks and the traction aid winch makes it easier to access steep slopes and manage unfavourable soil conditions while maintaining productivity by avoiding excess uphill driving or driving around a gradient, especially with harvesters, fellers, forwarders and skidders. Forest floor damages are greatly reduced which leads to a lower risk of erosion after logging operations. Machine stability is also enhanced, and thus general safety of operation is improved. Traction aid winches offer a possibility for machines to work on slopes which otherwise would be difficult to negotiate. This makes it simpler to mechanize work in steep terrain which otherwise would have to be performed manually.

Forestry winches for typical logging, such as the ones used for skidding or cable yarding of stems/logs, are designed for a different application than traction aid winches. The control systems, safety features, and performance measures of forestry winches have been designed for a purpose that is incompatible with the requirements of traction aid applications. Therefore, forestry winches should not be used in traction aid applications.

The main categories of winches for tractive efforts are shown in Figure 1. Further aspects of the design and operation of traction aid winches can be found in Annex E.

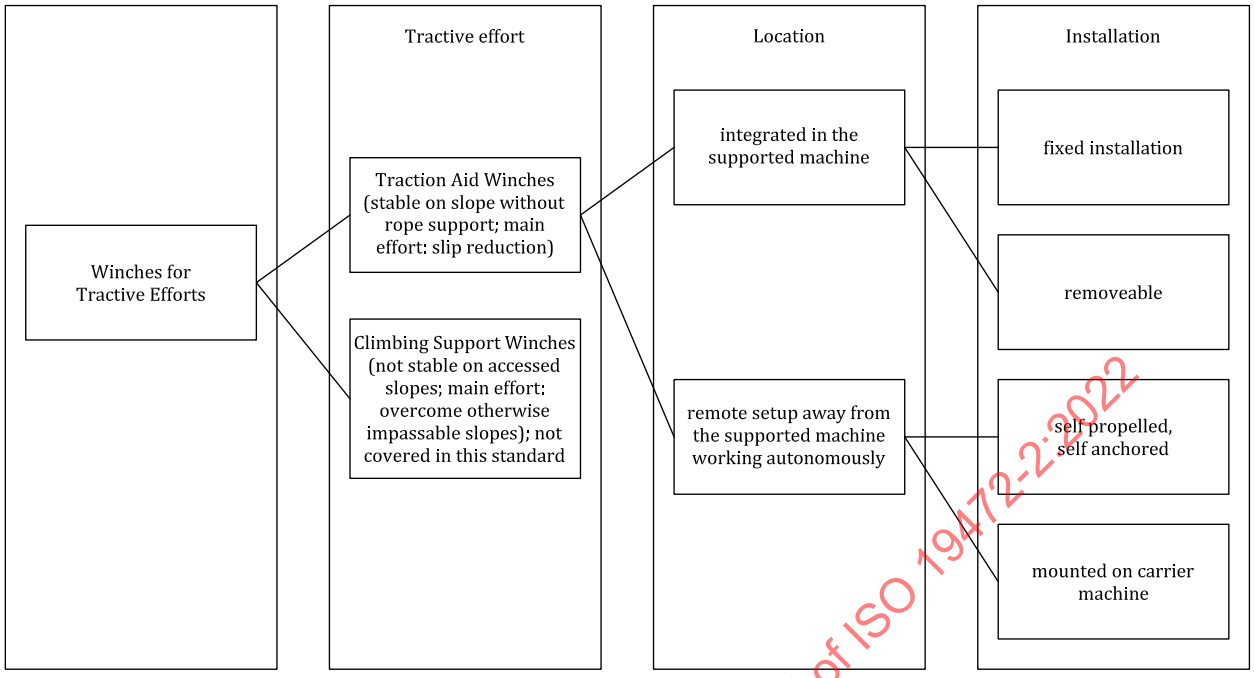


Figure 1 — Categorization of winches for tractive efforts

Machinery for forestry — Winches —

Part 2: Traction aid winches

1 Scope

This document defines the dimensions and specifies the performance and safety requirements for traction aid winches used in forestry for assisting supported machines while going uphill and downhill (pulling and braking).

This document is applicable to fixed and detachable winches and their components, connections and communications, which are used with mobile and self-propelled forestry machinery as defined in ISO 6814:2009 and earth moving machinery as defined in ISO 6165:2012. It is also applicable to remote traction aid winch systems which are installed on a position away from the supported machine. In addition, this document defines requirements for the assembly of supported machine and traction aid winch. It is not applicable to winches which are not using a controlled rope force while going downhill and winches used for skidding, hoisting operations on cranes, draglines, high lead logging, rope logging systems or yarding. The kind of prime mover used to drive a traction aid winch does not limit the applicability of this document. This document is intended to be applied to traction aid systems used on machines where, without use of these systems, the machine remains stationary on slopes under its independent control (see Annex E).

Forestry machines, as defined in ISO 6814:2009, that are used as anchor or supported machines are not in the scope of this document. Requirements for the safety of many types of supported machines are within the scope of ISO 11850:2011.

This document is not applicable to traction aid winches manufactured before the date of its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2867:2011, *Earth-moving machinery — Access systems*

ISO 3600:2015, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and format*

ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 4254-1:2013, *Agricultural machinery — Safety — Part 1: General requirements*

ISO 4309:2017, *Cranes — Wire ropes — Care and maintenance, inspection and discard*

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 6750-1:2019, *Earth-moving machinery — Operator's manual — Part 1: Contents and format*

ISO 8084:2003, *Machinery for forestry — Operator protective structures — Laboratory tests and performance requirements*

ISO 10968:2020, *Earth-moving machinery — Operator's controls*

ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 11684:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*

ISO 11850:2011, *Machinery for forestry — General safety requirements*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 12508:1994, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design*

ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 15077:2020, *Tractors and self-propelled machinery for agriculture — Operator controls — Actuating forces, displacement, location and method of operation*

ISO 15817:2012, *Earth-moving machinery — Safety requirements for remote operator control systems*

ISO 15818:2017, *Earth-moving machinery — Lifting and tying-down attachment points — Performance requirements*

ISO 16625:2013, *Cranes and hoists — Selection of wire ropes, drums and sheaves*

ISO 20474-1:2017, *Earth-moving machinery — Safety — Part 1: General requirements*

EN 12385-1:2002+A1:2008, *Steel wire ropes — Safety — Part 1: General requirements*

EN 12385-2:2002+A1:2008, *Steel wire ropes — Safety — Part 2: Definitions, designation and classification*

EN 12385-3:2004+A1:2008, *Steel wire ropes — Safety — Part 3: Information for use and maintenance*

EN 12385-4:2002+A1:2008, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

EN 13411-3:2004+A1:2008, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule securing*

EN 13411-6:2004+A1:2008, *Terminations for steel wire ropes — Safety — Part 6: Asymmetric wedge socket*

EN 13411-8:2011, *Terminations for steel wire ropes — Safety — Part 8: Swage terminals and swaging*

EN 14492-1:2006+A1:2009, *Cranes — Power driven winches and hoists — Part 1: Power driven winches*

EN 17067:2018, *Forestry machinery — Safety requirements on radio remote controls*

EN 60204-1:2018, *Safety of machinery — Electrical equipment of machines — General requirements*

IEC 60447:2004, *Basic and safety principles for man-machine interface, marking and identification — Actuating principles*

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
traction aid
working method in which a forest machine is using an assisting rope to support the machine's own tractive or braking effort by a regulated pulling and/or braking force which is kept constant or regulated according to the slip or other traction defined parameters of the supported machine while the supported machine when stopped remains stationary on the slope travelled upon without any further rope assistance

3.1.2
winch
mechanism which transmits pull by means of a rope from a power-driven drum, for example a drum hoist, friction hoist or capstan

[SOURCE: ISO 4306-1:2007, 4.6, modified — The mechanism has been specified to be used for applications other than lifting.]

3.1.3
traction aid winch
winch mounted on the self-propelled forest machine itself or placed separately providing *traction aid* (3.1.1)

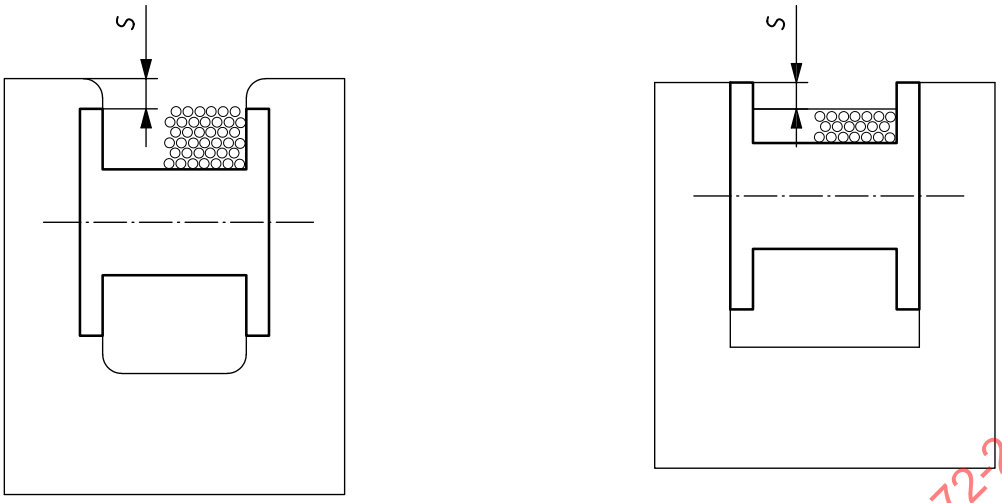
3.1.4
rope
arrangement of individual wires twisted in order to form single strands and out of them an integral unit which is able to transmit tensile forces

3.1.5
rope diameter
d
maximum distance which can be measured between the outer boundaries of a perpendicular cross section of a rope

3.1.6
service mass
mass of the supported machine including the operating mass of the supported machine and its permitted payload, and if the winch is mounted onto it, the mass of the winch system including rope

3.1.7
rope clearance distance
S
distance from the outmost periphery of the winch flange or housing left free from rope to ensure the rope stays within the drum

Note 1 to entry: See Figure 2.



a) Winch with drum housing **b) Winch without drum housing**

NOTE The housing material can be either full (360°) or partial, with alternative means of ensuring that the rope remains within the drum.

Figure 2 — Rope clearance distance of winch drum

[SOURCE: ISO 19472:2006, 3.6, modified — The definition has been editorially revised to remove the requirement. The accompanying figure has been changed.]

3.1.8
rope deflection angle
angle between the actual running direction of the rope and a line perpendicular to the drum axis or the groove direction of the drum grooving while they are projected on a plane through the drum axis and parallel to the incoming direction of the rope

3.1.9
power transmission
two or more connected parts that transmit power

3.1.10
maximum speed
highest possible speed in the intended direction of movement in kilometres per hour

[SOURCE: ISO 17253:2014, 3.5, modified — the definition has been editorially revised to be succinct and clear.]

3.1.11
pulling
working action where the *traction aid winch* (3.1.3) is spooling the rope while transferring a force to the supported machine

3.1.12
dynamic braking
<retarder action> working action where the *traction aid winch* (3.1.3) is unspooling rope while transferring a force between the supported machine and an anchoring point or the body of the winch

3.1.13
static braking
<holding brake> working action where the *traction aid winch* (3.1.3) is set fixed up to a predetermined force which is thus transferred onto the supported machine in order to hold the supported machine at a given position while it will allow the traction aid winch to unwind once a given maximum holding force is exceeded

3.1.14
nominal tensile force
minimum breaking force of a rope divided by the required working coefficient (safe working limit)

3.1.15
overload protection
device which automatically prevents impermissible high loads at the winch during operation

3.1.16
rope drive
system of ropes which run on rope drums and via rope pulleys as well as rope fastening parts

3.1.17
rope end connector
device situated at the free end of a winch rope which has direct contact to the rope that enables connection of the rope to the load, the supported machine, an anchoring point or allows transferring the rope force onto sling gear

Note 1 to entry: The rope end connector is capable of transmitting the rope force between elements (e.g. from the rope through shackles to an attachment point).

3.1.18
sling gear
parts and devices that form the connection between the anchoring point and the rope or between an anchoring point and an additional deflection pulley

Note 1 to entry: Examples of recognized sling gear include shackles, loop fastening straps, round slings or rope slings together with shackles.

3.1.19
deflection pulley
fastened component of the rope drive, generally installed at a location away from the traction aid winch system, which allows the rope to deflect angles ≤ 180° from its initial direction

3.1.20
guide roller
fixed component of the rope drive, generally forming part of the traction aid winch system, which allows the rope to deflect a desired angle from its initial direction

3.1.21
pressure roller
fixed component of the rope drive with the task of ensuring adequate spooling quality

3.1.22
installation mode
operation mode in which the *traction aid winch* (3.1.3) is operated manually for winching and spooling in order to connect winch, anchoring points and supported machine

3.1.23
synchronized mode
operation mode in which the *traction aid winch* (3.1.3) is operated automatically with both pre-set pulling and braking forces or other traction relevant parameters and with a speed of the winch which is regulated according to the forward or reverse speed of the supported machine

Note 1 to entry: Control is normally effectuated by regulation of the rope force.

3.1.24
auxiliary mode
operation mode in which the *traction aid winch* (3.1.3) is operated manually for pulling purposes foreseen by the manufacturer

3.1.25
supported machine
self-propelled machine, as defined in ISO 6814:2009 or ISO 6165:2012, equipped with a fixed or removable *traction aid winch* (3.1.3) or attached to a remote traction aid winch to which the traction aid winch system transfers a pulling or a braking force at a rope speed regulated according to the speed of such a machine in order to facilitate its mounting or descending slopes or help to overcome unfavourable soil conditions

3.1.26
rope speed
speed of the rope with reference to the position of the *traction aid winch* (3.1.3) at which the rope is spooled or unspooled by the traction aid system especially in *synchronized mode* (3.1.23)

3.1.27
working coefficient
ratio of the minimum breaking force of the rope and the maximum applied force to the rope (this means active pulling or dynamic braking) with the maximum applied force resulting from the operation of the force limiter

3.1.28
rated pulling force
maximum nominal pulling force for which a *traction aid winch* (3.1.3) has been designed by the manufacturer

3.1.29
proper spooling
operating a winch in a way that rope windings are situated one next to the other in layers which cover the whole width of the drum and which does not allow rope from an upper layer to slip down into a lower layer

3.1.30
attachment point
connecting point at the supported machine which is designed for attaching the rope of a remote traction aid winch

3.1.31
anchoring point
fixed point in the area of the upper end of the driving path of a supported machine with sufficient bearing capacity (e.g. on a tree, on a heavy mobile machine or in the ground) used to attach the rope of an integrated *traction aid winch* (3.1.3) or the body of a remote traction aid winch to provide sufficient counter bearing for the arising forces of the rope of the respective traction aid winch

3.1.32
sheave
rotary mounted cylindrical device, usually fitted with grooves around which the winching rope is wound partially or several times, which is used to deflect the pulling direction of a rope a given angle

3.1.33
capacity
maximum value of a force the referred element is able to exert or to bear

3.1.34
integrated traction aid winch fixed installation
traction aid winch system, which forms an integral part of the supported machine and which is driven entirely by the power source of the supported machine while the winch system rope is not moving against the ground and is attached to an anchor point on the upper side of the slope negotiated by the supported machine

3.1.35
integrated traction aid winch removable installation
traction aid winch system consisting of a self-contained winch system unit containing the winch system which can be attached to or removed from the supported machine using a coupling system and which is driven entirely by the power source of the supported machine while the rope is not moving against the ground and is attached to an anchor point on the upper side of the slope negotiated by the supported machine

3.1.36
remote traction aid winch
traction aid winch system purpose built (integrated into an anchor machine or attached to an anchor machine) which is operated remotely from the supported machine and which is positioned above the supported machine on the upper side of the slope or to the side of the machine if used in combination with a deflection pulley while the supported machine is attached to the rope of this winch system and the system rope is moving with respect to the surrounding area

3.1.37
anchor machine
machine which a remote traction aid winch is integrated into or attached to

3.1.38
anchor winch
winch mounted on a remote traction aid winch system and used to keep this system in a stable position by guy lines which in turn are connected to stumps, trees, plate and pin, earth anchors or rock anchoring points and which can be tightened as needed

3.1.39
safe state
state automatically or manually applied after a malfunction of the control system, where the controlled equipment, process or system is stopped or switched to a safe mode to prevent unexpected movements or the potentially hazardous build-up of stored energy (e.g. high-voltage electricity, hydraulic pressures or compressed springs)

[SOURCE: ISO 15998:2008, 3.1.10]

3.1.40
self-propelled remote traction aid winch
remote traction aid winch which is equipped with a crawler track or wheeled chassis and which is driven to its site of operation either by a ride-on driver or use of pedestrian-control

3.2 Symbols

Symbol	Definition	Unit
d	maximum distance which can be measured between the outer boundaries of a perpendicular cross section of a rope	mm
S	distance from the outmost periphery of the winch flange or housing left free from rope to ensure the rope stays within the drum	mm

4 Safety requirements for traction aid winches

4.1 General

Traction aid winches shall be in accordance with the following safety requirements. In addition, traction aid winches shall be designed according to ISO 12100:2010 for relevant but not significant hazards. For a list of hazards related to the use of traction aid winches, see Annex C.

4.2 Design

4.2.1 Modes of operation

Traction aid winches designed for operation in different modes shall not generate any hazard by movements in an operation mode which is not selected. Only one mode of operation shall be active at a time. A mandatory reciprocal shut off of the modes fulfils this requirement.

Verification of the requirements shall be done by inspection and test run.

4.2.2 Anchor monitoring

The traction aid winch shall be equipped with a system which is able to detect hazardous movements of the anchor or the anchor machine (in case of failure of anchor, breaking of rope or movement of the anchor machine of a remote traction aid system). In case of such a hazardous movement, the traction aid winch shall be brought to a safe state while the supported machine shall be alarmed automatically by the control system at the same time. If the supported machine and the traction aid winch are equipped with a linking system of the safety control circuits, the linked system shall be used.

Verification of the requirements shall be done by inspection and test run.

4.2.3 Mechanical safety and stability

Guards shall be in accordance ISO 11850:2011, 4.2. If moving guards which can be removed without the use of a tool (e.g. hinged hoods) are used, they shall be equipped with an interlock which stops all dangerous movements while these guards are opened. Hoods covering moving parts of engines shall be lockable or they shall be equipped with a lockable opening mechanism (e.g. an opening mechanism situated in a lockable cab).

Structural edges and corners of metallic or non-metallic materials of hardness sufficient to cause contusions or penetration of the human skin shall meet the requirements of ISO 12508:1994.

Painted or coated areas with a surface temperature of higher than 75 °C shall be protected against direct reach.

Where risk assessment shows that safety distances towards hazard zones shall be observed, ISO 13857:2019 applies.

The manufacturer of the traction aid winch system shall provide information to the system integrator on how sufficient stability for supported machines with integrated or attached traction aid winches and for anchor machines can be observed, and how to choose suitable machines for such purposes. In order to provide sufficient stability for self-propelled remote traction aid winches, ISO 11850:2011, 4.11 shall be observed for this kind of machinery.

Verification of the requirements shall be done by inspection and measurement.

4.3 Rope drive

4.3.1 General

Rope drives shall be in accordance with EN 14492-1:2006+A1:2009 unless stated otherwise in this document. Information on a reasonable range of rope forces, parameters to be considered and general rope layouts with respect to terrain is given in Annex E.

The winching system shall have an automatically operating force control system that regulates the rope tension in a way to provide the desired traction aid. The rope force shall be adjustable separately for driving uphill and driving downhill. The control system shall at the same time limit the force to the maximum allowed force of the winch. Traction aid winches shall be able to regulate the maximum

applied force to the rope in highly dynamic load cases and keep it within a limit of 1,25 times the rated pulling force. This regulation enables the synchronized mode.

Between the drum and the first roller or pulley, the winching system shall maintain the rope at a minimum tension so that proper spooling is ensured and slack-rope situations are avoided while operating the winch system. A rope deflection angle of 4° shall not be exceeded. If for the purpose of pulling out the rope, the drive is disconnected from the drum, uncontrolled unspooling shall be prevented by equipment design consideration.

Rope drives shall at least correspond to the following conditions.

The D/d ratio (D defined by the distance of the centreline of the rope on both sides of the drum on the innermost winding or this distance on sheaves) shall be at least 16 for the drum and sheaves.

Sheaves used with a small deflection angle and /or short term may be designed smaller.

Multilayer spooling is allowed for traction aid winches. If multilayer spooling is used, the requirements for proper spooling of the rope according to Annex B shall be met. Grooved drums may be used as well as pressure rollers to improve spooling performance.

It shall not be possible for ropes to run off the side of the rope drums.

NOTE Design measures on drums are for example, flanged drum end plates, frame/housing, or rope guides.

There shall be a safety overhang of at least 1,5 times the nominal rope diameter while overfilling of the drum shall be prevented.

Rope grooves on pulleys shall have a groove radius of 0,52 to 0,56 times the nominal rope diameter. If the rope is deflected laterally, the opening angle of the pulley shall be symmetrical. The depth of the grooves shall not be less than 1,4 times the nominal rope diameter.

Limiters for the end positions are not required if the operator has the possibility to check the winding behaviour of the rope on the drum and the path of the rope running to the drum shows no obstacle. The use of a camera to control the rope and the loading of the drum is sufficient to fulfil this requirement. A warning system shall be installed which gives an audible and visible warning signal to the operator if a situation is reached where less than 10 m of rope in addition to 4 complete windings are remaining on the drum of the winch.

Alternatively, a motion limiter may ensure that in synchronized mode at least 4 complete windings of rope remain on the drum at all times. Such a motion limiter shall, when activated, initiate a loud acoustical and an optical signal (see 4.3).

Where, for the purpose of unspooling the rope by hand, engaging and disengaging clutches are used, these shall be secured against unintended operation. This requirement is considered fulfilled if it is not possible to engage or disengage the clutch once a pulling force of more than 3 % of the rated pulling force is applied to the rope.

Deflection pulleys shall support a load of 4 times the maximum rated pulling force before any form of failure, breaking or disengagement occurs. The bearings shall be rated for continuously working at the maximum rope speed of the traction aid winch. If deflection pulleys are used which can be opened in order to insert sling gear, an interlocking device shall be used which allows the user to check the locked state of the deflection pulley.

Verification of the requirements shall be done by inspection, test run, inspection of documents, and measurements.

4.3.2 Steel wire ropes

Steel wire ropes shall be in accordance with EN 12385-1:2002+A1:2008, EN 12385-2:2002+A1:2008, EN 12385-3:2004+A1:2008 and EN 12385-4:2002+A1:2008.

The dimensioning of steel wire ropes shall be done according to ISO 16625:2013.

Discard criteria for steel wire ropes shall be observed according to ISO 4309:2017.

In order to determine the nominal tensile force, the working coefficient for the rope shall be at least 2 related to the rated pulling force of the winch. For determination of the maximum tensile force of the rope see 4.3.1.

Verification of the requirements shall be done by inspection, inspection of documents, and measurements.

4.3.3 Rope end connectors

For traction aid winches the following rope end connectors shall be used unless otherwise stated in this document:

a) turn-back eye ferrule-secured termination (with or without thimble) according to EN 13411-3:2004+A1:2008;

b) flemish-eye ferrule-secured termination according to EN 13411-3:2004+A1:2008;

c) terminations of steel wire rope with wedge socket according to EN 13411-6:2004+A1:2008;

d) spelter and swaged socket according to EN 13411-8:2011.

Verification of the requirements shall be done by inspection.

4.4 Attachment points at the supported machine for use with remote traction aid winches

Attachment points shall be able to support two times the rated pulling force of the winch before any form of failure, breaking or disengagement occurs. The attachment point shall not disengage unless opened intentionally by the operator. The design and layout of the attachment points shall be of such a nature so that under foreseeable use breaking or disengaging of the attachment points will not occur before breaking of the rope. Attachment points shall be marked with their bearing capacity. Attachment points shall be locked and secured.

Verification of the requirements shall be done by inspection, inspection of documents, test run and measurements.

4.5 Combination of the supported machine with the traction aid winch system

The manufacturer of the traction aid winch system shall provide and, if necessary, install all sufficient gear for attaching or coupling the traction winch system with the supported machine for both integrated and remote winches. At the same time, gear for anchoring integrated traction aid winch systems and, if necessary, for remote traction aid systems shall be provided.

The manufacturer shall provide information on minimum requirements for material (e.g. sling gear) for attaching the rope of the supported machine or remote traction aid winch to its anchor points.

A machine equipped with a traction aid winch, either fixed or removable from this machine or supported by a remote traction aid system, shall be in accordance with ISO 11850:2011, 4.5 with the exception of 4.5.5. Inclusion of a traction aid winch and its controls shall not adversely affect the control system performance levels.

For remote traction aid winch systems, a means shall be provided to deter unauthorized machine operation or tampering with the operating winch system. Locking devices such as key-type ignition switches, a lockable battery disconnector, or provisions for padlocks and lockable covers over the controls of the winch systems satisfy this requirement. Lockable cabs may be used as a protection for controls or systems located within a cab. Where a removable remote traction aid winch is being used the controls of the machine which the winch is coupled to shall be isolated whilst a supported machine is attached to the winch rope.

Verification of the requirements shall be done by inspection.

4.6 Brake systems

Traction aid winches shall be equipped with a system for dynamic braking; the system for continuous braking shall be able to maintain the maximum permitted load on the rope constant at maximum speed without considering any further supporting force.

The traction aid winch system shall be equipped with a static (holding) brake which is able to maintain permanently a braking force of 1,2 to 1,4 times the maximum rated pulling force of the winch.

Verification of the requirements shall be done by inspection and measurement.

4.7 Electrical safety

The electric system shall be in accordance with EN 60204-1:2018. Battery installations shall be in accordance with ISO 4254-1:2013, 5.3 and ISO 11850:2011, 4.3.2.5 c).

Traction aid winch systems shall be equipped with a means to disconnect electrical power.

Verification of the requirements shall be done by inspection.

4.8 Energy supply

Hydraulic energy supply of traction aid winches shall be in accordance with ISO 4413:2010.

PTO driven traction aid winches shall be in accordance with ISO 4254-1:2013, 6.4.

Verification of the requirements shall be done by inspection.

4.9 Operator controls, starting and stopping

Controls shall be in accordance with ISO 15077:2020, ISO 10968:2020 or IEC 60447:2004. Controls of self-propelled machines shall be in accordance with ISO 11850:2011, 4.5. For all winch functions that are operated manually only, hold-to-run controls shall be used. Free spool (e.g. for installation) and the synchronized automatic working mode shall be activated using latched controls.

NOTE With regard to the respective application, it may be appropriate to refer to all 3 standards (ISO 15077:2020, ISO 10968:2020 and IEC 60447:2004).

Starting the traction aid system shall require the voluntary operation of a control device in order to initiate automatic traction aid mode; after activation, automatic operation of the system is permitted. After an emergency stop or power failure, return from the safe state to automatic traction aid mode shall require the voluntary operation of a control device.

For stopping integrated, removable, and self-propelled remote traction aid winches shall be equipped with a control which stops the prime mover and which is in accordance with ISO 11850:2011, 4.5.2. Such a control shall be within the reach of the operator while it shall be easily recognizable and accessible during operation. For remote traction aid systems mounted on a carrier, machine stopping shall be effectuated by stopping the prime mover of the carrier machine. The user information shall state that for safe operation the stopping device of the carrier machine shall be in accordance with ISO 11850:2011, 4.5.2. When the prime mover is stopped or a failure of the power supply occurs, all traction aid winches shall reach a safe state.

For remote traction aid winches means shall be provided to render the starting control and if applicable the parking release system inoperative in order to deter unauthorized machine operation. Locking devices such as key-type ignition switches, a lockable battery disconnector or provisions for padlocks satisfy this requirement. Lockable cabs may be used as a protection for controls or systems located within the cab. Where a removable remote traction aid winch is being used, means shall be provided to isolate the controls of the machine which the traction aid winch is coupled to whilst a supported

machine is coupled to the winch rope in order to prohibit unauthorized activation of these controls during traction aid.

Verification of the requirements shall be done by inspection and test run.

4.10 Emergency stop

For a machine equipped with a traction aid winch, either fixed or removable from this machine an emergency stop acting on the traction aid winch system shall be available. The emergency stop shall work as defined by ISO 13850:2015 and observe stop category 1.

Verification of the requirements shall be done by inspection and test run.

4.11 Control system

4.11.1 General

Traction aid winches need to be equipped with a control system. The control system shall provide operation mode control with the functionalities stated in 4.11.2.

4.11.2 Operation mode control

Operation mode control shall provide the following functions:

— enable operator switching between installation mode, synchronized mode, and auxiliary mode;

— in installation mode, allow installation action (spooling, unspooling, and free spool);

— in synchronized mode:

  — enable operator regulation of the rope force of the traction aid winch while either pulling or braking at a desired pre-set value including minimization of slack rope formation;

  — alternatively, the wheel slip or the speed of the supported machine can be regulated to a desired pre-set value;

  — it shall be possible to set separate different values for driving uphill and for driving downhill; the set value shall be indicated to the operator.

NOTE 1 Rope force regulation includes the avoidance of slack rope formation between the machine exit and the anchor point.

A traction aid winch system shall communicate the following information:

— display of the actual rope force with a reference to the maximum permitted force;

NOTE 2 A colour marking in the display like a red area can fulfil the second part of this requirement.

— indication of the actual working mode to the operator;

— if the operation mode is switched from synchronized mode to any other working mode, a warning may be issued to the operator to separate the rope from the anchoring point or from the supported machine;

— indication of all operational warnings to the operator;

— the manufacturer of the traction aid winch shall ensure that the actual inclination of the mainframe of the supported machine in the longitudinal and also in the lateral direction is displayed to the operator of the supported machine. Control systems of integrated traction aid winches shall display this information in the supported machine itself.

For integrated traction aid winches, fixed and removable installation, an emergency stop signal in the supported machine shall act on the traction aid winch as well. The emergency stop shall fulfil the requirements of ISO 13850:2015. Stop category 1 according to ISO 13850:2015 shall be implemented.

A fault diagnosis system for the winch control system shall be provided either as part of the control system or in the form of a connecting device. The fault diagnosis system shall permit a check of the correct operation of the alarms.

Verification of the requirements shall be done by inspection, test run and inspection of documents.

4.11.3 Remote control system

The remote control system shall be in accordance with EN 17067:2018 or ISO 15817:2012.

A rechargeable remote control box shall be used while offering a sufficient battery operating time of at least 10 h. The manufacturer shall state the minimum battery operating time in the operator's manual. A compatible charging device in order to guarantee continuous operation of the remote control box for installation in the supported machine should be provided with the remote control box.

Verification of the requirements shall be done by inspection and inspection of documents.

4.11.4 Safety relevant functions

For identifying requirements, risk assessment shall be performed according to ISO 12100:2010. Emergency stop/safety related stop and the protection against unexpected movement are always safety relevant functions. Additional safety relevant functions may be identified by risk assessment. The determination of the performance level (PL_r) required should consider the purpose of such safety relevant functions.

Safety relevant parts of control systems identified by risk assessment according to ISO 12100:2010 and safety relevant functions as well as the determination of the performance level (PL_r) shall be in accordance with ISO 13849-1:2015.

Verification of the requirements shall be done by inspection and inspection of documents.

4.12 Additional requirements for removable traction aid winches of both integrated traction aid winches removable installation and the remote traction aid winches removable from their anchor machines

The attachment points of a traction aid winch shall be designed to support at least two times the rated pulling force of the winch force before any form of failure, breaking or disengagement occurs. Localized yielding (e.g. local peening) is allowed. All mechanical, hydraulic, electrical and other detachable connections shall be protected against exposure to the harsh operating conditions encountered during intended use. Hydraulic connections shall be in accordance with ISO 4413:2010 and ISO 4254-1:2013, 4.13. Electric wiring shall be in accordance with EN 60204-1:2018, 12 and 13 as well as ISO 4254-1:2013, 4.12.

Access to the operator station of the supported machine shall not be obstructed by the installation of a removable traction aid winch system.

The course of the rope shall not interfere in a hazardous way with other elements of the supported machine (e.g. wheels, boom, and grapple, harvesting head).

The traction aid winch shall be equipped with attachment points which allow the use of a lifting device for removal of the winch.

Verification of the requirements shall be done by inspection and measurement.

4.13 Additional requirements for remote traction aid winches

For remote traction aid winches synchronized operation together with the respective supported machine shall be ensured. It is allowed to use two ropes on two independent drums as long as equal force on both ropes is guaranteed.

The communication system between supported machine, control box and the control system of the traction aid winch shall be an established and monitored, continuous, safe, two-way radio communication system. The radio remote control shall be equipped with a separate emergency stop acting on the traction aid winch. With the activation of the emergency stop the command shall be implemented immediately but the implementation shall not lead to an abrupt deceleration in order to avoid peak loads. With the activation of the emergency stop, the traction aid winch shall reach a safe state so that the supported machine is not able to move the traction aid winch. At the same time the supported machine shall be alarmed automatically by the control system.

NOTE A safe state can be a state where unspooling of the winch is possible with transfer of a defined braking force or without transfer of a braking force.

The remote control system of the traction aid winch shall at least provide a warning to the driver of the supported machine if the following incidents occur:

— loss of signal;

— coolant temperature in the remote traction aid winch is dangerously high;

— hydraulic fluid temperature in the remote traction aid winch is dangerously high;

— fuel level in the remote traction aid winch is dangerously low;

— hydraulic level in the remote traction aid winch is dangerously low;

— engine speed in the remote traction aid winch system is dangerously low or engine has stopped;

— end of usable rope according to 4.3 is reached;

— detection of rope looping or rope breakage;

— excess of speed of the supported machine while going down;

— low battery of the remote control box.

In case of failure or interruption of the remote control signal for more than 4 s or in case of loss of energy at the traction aid winch, the winch drive shall be brought into a safe state while the supported machine shall be alarmed automatically by the control system at the same time.

The manufacturer shall foresee attachment points and provide the equipment for safely anchoring this type of traction aid winches during traction aid operation. Anchoring may be done by separate anchoring with guy lines. If anchor winches are used, either proper spooling of the anchor winch shall be ensured during operation or a tensioning drum shall be foreseen.

The maximum speed of non-riding, pedestrian controlled traction aid winch machines shall be limited to 6 km/h, except that the reverse speed shall be limited to 4 km/h.

Remote traction aid winch systems shall provide a movement detection system on the anchor machine that warns the operator of the supported machine of unintended movement of the anchor machine (see 4.2.2). If unintended motion occurs, the operator shall be informed instantly by a clearly visible and audible warning signal.

Self-propelled machines with a ride-on driver shall be in accordance with ISO 11850:2011, 4.4, 4.5.1 and 4.5.4.

An interlock system shall be installed which prevents all travel of a self-propelled remote traction aid winch with a ride-on operator and a designated operator station unless the operator is at the operator station.

Visibility from the operator station of a self-propelled remote traction aid winch shall be in accordance with ISO 11850:2011, 4.6.

The brakes of a self-propelled remote traction aid winch shall be in accordance with ISO 11850:2011, 4.8.

Verification of the requirements shall be done by inspection.

4.14 Noise emissions

A traction aid winch system shall be in accordance with ISO 11850:2011, 4.15.1.

Typical sources of noise for all sorts of traction aid winches are the hydraulic power transmission and noise generated by the action of winch brakes. The main source of noise with remote traction aid winches is the diesel engine of the anchor machine.

Noise emissions shall be determined for the following types of traction aid winches:

— integrated traction aid winches;

— traction aid winches which can be attached to a supported machine;

— remote traction aid winches either self-propelled or attached to a carrier machine.

The determination of noise emissions for remote PTO-driven traction aid winches is not required.

For those winches for which noise shall be declared, noise emissions shall be determined according to the noise test code given in Annex D.

Verification of the requirements shall be done by inspection and measurement.

4.15 Vibration

A machine equipped with a traction aid winch, either fixed or removable from this machine shall be in accordance with ISO 11850:2011, 4.16.

The vibration during traction aid operation (synchronized mode) shall be measured at the operator station of a supported machines equipped with a traction aid winch, either fixed or removable installation according to ISO 11850:2011, 4.16.2.

NOTE Support by a remote traction aid winch does not significantly change the vibration load of the operator of the supported machine while no other person is affected; therefore, additional requirements for measuring vibrations in machines supported by remote traction aid winches are not necessary.

Verification of the requirements shall be done by inspection and measurement.

4.16 Fire risks

Traction aid winch systems shall be designed to reduce possible fire risks. This can be accomplished, for example, by minimizing debris accumulation, providing cleanouts, guarding fuel lines, arranging fuel filters to avoid fuel spillage, and by proper routing, clamping or overload protecting of electric wires and hydraulic lines.

Self-propelled remote traction aid winch systems shall have provision for holding a portable fire extinguisher of a mass of at least 2 kg, suitable for fuel, oil and wood product fires. The position of such an installation shall be chosen that it can be reached from the ground from outside the machine.

Protection of an operator inside the driver's cab of a remote traction aid winch system shall be considered.

The installation of an automatic fire suppression system and of fire alarm system alerting the operator of the supported machine should be considered.

NOTE Local regulations governing fire extinguishers can apply.

For self-propelled remote traction aid winch systems, it shall be possible to electrically isolate the battery by means of either a circuit breaker or disconnect switch accessible from outside the machine or by a battery relay activated by the stop control of the prime mover. Such disconnection shall not affect low current, constantly powered circuits provided for electronic requirements like memory related systems. Low current, constantly powered circuits shall be protected against fire risks by fuses which do not permit electric currents to surpass the rated capacity of the electric wiring.

Verification of the requirements shall be done by inspection and inspection of documents.

4.17 Maintenance

A traction aid winch, either fixed or removable, or part of a remote traction aid system, shall be in accordance with ISO 11850:2011, 4.18.

Additionally, a maintenance mode for inspecting and maintaining the wire rope (slow spooling not faster than 1 m/s on any point on the wire rope) shall be considered.

The attachment point of the rope shall be easily accessible for maintenance and replacement of the rope. Provisions shall be made to allow safe un-reeling and reeling for inspection of the rope and correcting spooling conditions in order to ensure proper spooling during winch operation.

Access to routine maintenance positions of remote traction aid winch systems shall be in accordance with ISO 2867:2011.

Verification of the requirements shall be done by inspection.

4.18 Access system

A machine equipped with a traction aid winch either fixed or removable, or part of a remote traction aid system, shall be in accordance with ISO 11850:2011, 4.4 or ISO 20474-1:2017, 4.2.

Verification of the requirements shall be done by inspection.

4.19 Tie down and machine lifting devices

Self-propelled remote traction aid winch systems shall be provided with tying-down attachment points to anchor the machine (e.g. on a trailer) which be in accordance with ISO 15818:2017.

Lifting points shall be provided for self-propelled remote traction aid winch systems and be designed for the operating mass in the heaviest configuration. Lifting points shall be in accordance with ISO 15818:2017.

Tying-down attachment points and lifting points shall be clearly identified on machines.

Verification of the requirements shall be done by inspection.

5 User information

5.1 General

The manufacturer shall provide an operator's manual containing information and instructions for commissioning, use, regular tests as well as inspections and maintenance of the winch mechanism.

Information for use of the machine shall be provided in accordance with ISO 12100:2010 and ISO 3600:2015 or ISO 6750-1:2019.

Sales literature describing the winch shall not contradict the operator's manual, as far as health and safety aspects are concerned. Sales literature describing the performance characteristics of the winch shall contain the same information on emissions as is contained in the operator's manual.

Verification of the requirements shall be done by inspection of documents.

5.2 Special requirements

The operator's manual shall describe clearly the type of the traction aid winch to which it refers. Its intended use shall be clearly described (traction aid and if applicable further applications, e.g. salvaging other machines). Warnings shall be provided with regard to misuse of the traction aid winch.

The operator's manual shall always include the following instructions, restrictions information and guidelines:

a) the maximum and if applicable minimum service mass of the supported machine;

b) information on the basic training for the operating personnel;

c) the requirement that the operator shall always work in compliance with the operator's manual;

d) no persons shall be allowed in the work area or hazard zone according to 5.3;

e) a print of Figures A.1, A.2 and A.3, if applicable, shall be enclosed in the user information;

f) the value W (see Figure A.1) for the width of the risk zone downhill for supported machines, which are meant to work with the traction aid winch or the statement that a risk zone of 20 m on both sides of the centreline of the driving path in the sloped area shall be observed;

g) information on safe working procedures which shall be maintained while working with the traction aid winch system;

h) if the winch system is working under traction aid conditions, information on operational checks and what limiting factors (e.g. loads, slopes, relevant ground conditions) shall be considered;

i) a description of the operating modes that the machine may be used in, what tasks may be carried out in each of these modes and any specific systems of work to allow these to be carried out safely;

j) advice that traction aid winches may only be used if, under all circumstances the supported machine has sufficient traction on the ground;

k) indication that if the machine will not remain stable without the support of the traction aid winch, it is not allowed to work under such conditions;

l) indication that contacts of the rope with the grapple or the harvester head of the supported machine are prohibited;

m) indication that contact of the rope with the ground shall be minimized;

n) interdiction of the lifting and lowering of loads using traction aid winches;

o) description of all maintenance and repair work required to ensure the safe function of the winch mechanism, especially:

   — lubrication of bearings, ropes, chains, gearboxes, hooks etc.;

   — inspection of wear parts such as ropes, chains, hooks, belts and brake linings; specification of test and inspection intervals and discard criteria;

p) information not to overload the traction aid system;

q) information on the correct use of safety devices and requirements in the event of triggering these devices, for example, resetting the emergency stop device, restarting winch operation;

r) information on how to verify the proper function of the limiters;

s) for remote traction aid winches, information on the minimum required loading capacity of the load attachment points at the supported machine;

t) for remote traction aid winches information about the protective structures and devices especially at the supported machine which are required for a safe operation of the traction aid winch and an interdiction to operate machines which do not possess such protective structures;

u) the requirement to use and apply only parts and procedures cleared by the manufacturer for maintenance and repair;

v) information about coupling, uncoupling, installation, de-installation and safe storage of detachable traction aid winches;

w) all information (e.g. weight, dimensions, lifting eyes, hydraulic and electric connections) which enables the user to connect and disconnect or to disassemble and reassemble detachable winches;

x) information on how to choose or install proper anchoring points and how to determine their load bearing capacity. This includes a simple test loading procedure of the anchoring trees;

y) information that if a deflection pulley is used, it shall be considered that an anchor for such a pulley shall resist two times the maximum possible rope force;

z) for anchoring slings a provision that they have to be flat and large in order to avoid twisting and an interdiction to twist such a sling and to use swivel hooks together with anchoring slings;

aa) prescription of a minimum breaking load for anchoring slings of 3,5 times the rated pulling force of the winch;

bb) information on the recognition of wear limits and damages of the fixing and attachment points;

cc) specifications of approved deflection pulleys and approved sling gear;

dd) description of the correct rope replacement procedure;

ee) information on how to inspect the rope after each use and on further periodical tests and other procedures that shall be adopted to detect interior or other failure of the rope or the rope end connector;

ff) instructions on care, maintenance, inspection and definition of criteria that make a replacement of the wire rope mandatory according to ISO 4309:2017;

gg) information on personal protective equipment;

hh) for pneumatic and hydraulic winches the user information shall provide information regarding the specifications of the pressure medium and data of pressure and flow rate;

ii) regarding airborne noise emission, the following information shall be given:

   1) the A-weighted emission sound pressure level determined according to the noise test code which is contained in this standard (see Annex D);

   2) the A-weighted emission sound power level determined according to the noise test code which is contained in this standard, where the A-weighted emission sound pressure level according to ii) 1) exceeds 80 dB (A);

3) the uncertainty of measurement;

jj) regarding vibration transmitted by the machine, the following information for integrated traction aid winches fixed and removable installation shall be given by the responsible system integrator:

1) the vibration total value to which the hand-arm system is subjected at the operator station of the supported machine measured according to ISO 11850:2011, 4.16 when working with traction support, if it exceeds 2,5 m/s^2. Where this value does not exceed 2,5 m/s^2, this shall be mentioned;

2) the highest root mean square value of weighted acceleration to which the whole body is subjected at the operator station of the supported machine, measured according to ISO 11850:2011, 4.16 when working with traction support, if it exceeds 0,5 m/s^2. Where this value does not exceed 0,5 m/s^2, this shall be mentioned;

3) the working conditions during the measurements and the uncertainty of measurement;

NOTE For remote traction aid winches no additional information on vibration is required.

kk) for the installation and use of the traction aid winch in supporting structures, the manufacturer shall provide the information which enables the designer of the supporting structure to take into account the static and dynamic maximum forces which can occur during operation of the force limiter of the winch.

Verification of the requirements shall be done by inspection of documents.

5.3 Hazard zones

Hazard zones are defined according to Annex A and shall be listed in the user information.

To both sides of the rope a hazard zone with a width of 20 m (measured from the vertical projection of the rope to the ground) shall be taken into account unless otherwise specified by the manufacturer. In addition, when the rope is tensioned, a possible falling zone for anchoring trees shall be respected as part of the hazard zone. This falling zone is defined by a circle around the centre of the anchoring tree and with a radius of 2 times the height of this tree. In any case a minimum hazard zone of 20 m from the centreline of the tree (e.g. for the case that an anchor tree is cut and the stump is used as an anchor) is to be observed.

The area on the slope travelled upon below the machine shall be considered as part of the hazard zone at least until the end of the slope area where the supported machine is operating (risk zone downhill). The width (Key 3 in Figure A.1) of this part of the hazard zone depends on the type of machine used. If no value is supplied the width shall be understood to be 40 m.

When using a deflection roller, also the interior of the triangle formed by the anchor tree, the exit of the rope from the supported machine and the deflection pulley and the zone marked with crosses in Figure A.3 (Risk zone deflection area) shall be treated as part of the hazard zone.

Verification of the requirements shall be done by inspection of documents.

6 Marking

Every traction aid winch shall be marked permanently in the form of a name plate with the following information:

— name and full address of the manufacturer and his authorised representative if applicable;

— designation of the machine;

— designation of type and model if applicable;

— serial number if any;

— year of manufacturing;

— service mass;

— for remote traction aid winches maximum and minimum service mass of the supported machine;

— rated pulling force;

— nominal travelling speed upwards and downwards;

— minimum breaking load of the rope used;

— allowed rope diameters;

— a warning against crushing hazards at the entrance of the rope into the machine;

— for integrated traction aid winches, removable installation and removable remote traction aid winches attached to an anchor machine the mass of the traction aid winch system including the rope in kilograms (kg).

Every self-propelled remote traction aid winch shall be marked permanently with the following additional information on the name plate:

— nominal power;

— mass of the complete traction aid system including the rope in kilograms (kg).

The following information shall be placed on the outside of a remote traction aid winch at least on the left and on the right side:

— a warning that the traction aid winch can move against expectation and that bystanders shall keep their distance; (see Annex F for an example) which shall be recognizable from a distance of at least 10 m.

Local legislation can require further markings (e.g. the European Machinery directive 2006/42/EC).

Every supported machine shall be marked permanently with the following information:

— attachment points;

— maximum permitted tractive rope force;

— operator protection (OPS according to ISO 8084:2003).

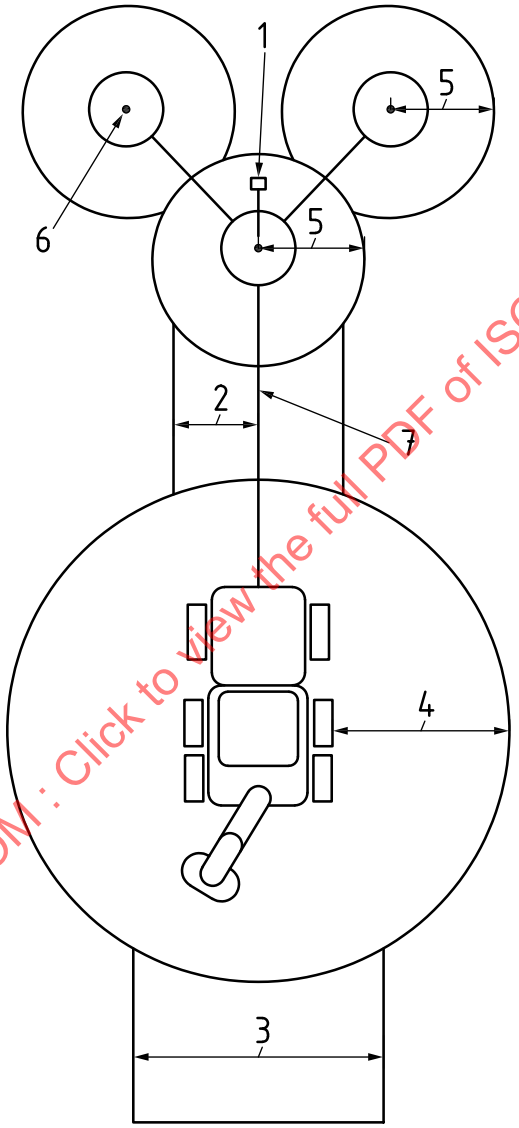
Hazard pictorials shall be in accordance with ISO 11684:1995.

All markings shall be clearly legible, durable and firmly attached.

Verification of the requirements shall be done by inspection.

Annex A
(normative)

Hazard zones



Key

1 movement detector

2 hazard zone on one side of the supporting rope; width 20 m

3 hazard zone below the supported machine of width W; width to be determined by the system integrator; minimum width is 40 m

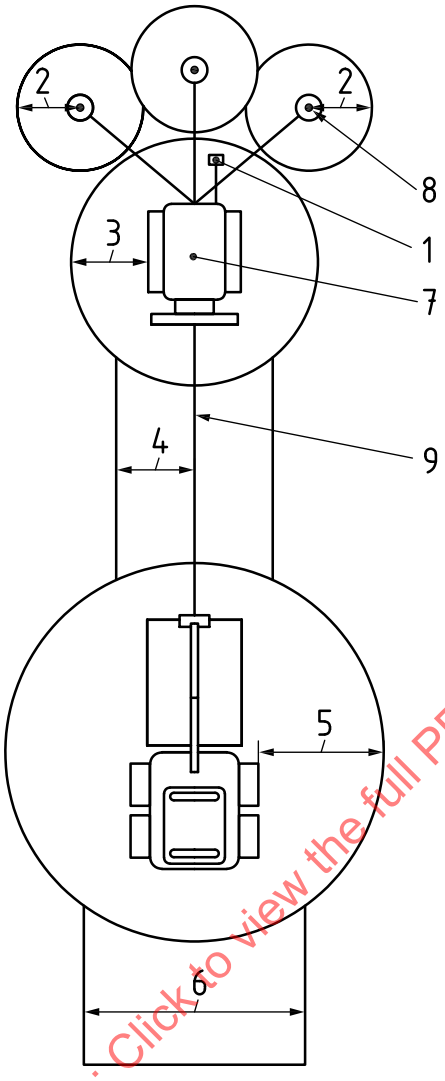
4 hazard zone around the supported machine; to be determined by the system integrator

5 hazard zone around an anchor tree; a radius of two times the tree height with a minimum radius of 20 m around the centreline of the tree or stump shall be observed

6 anchor tree

7 supporting rope

Figure A.1 — General hazard zones



Key

1 movement detector

2 hazard zone around an anchor tree; a radius of two times the tree height with a minimum radius of 20 m around the centreline of the tree or stump shall be observed

3 hazard zone around the anchor machine; to be determined by the system integrator

4 hazard zone on one side of the supporting rope; width 20 m

5 hazard zone around the supported machine; to be determined by the system integrator

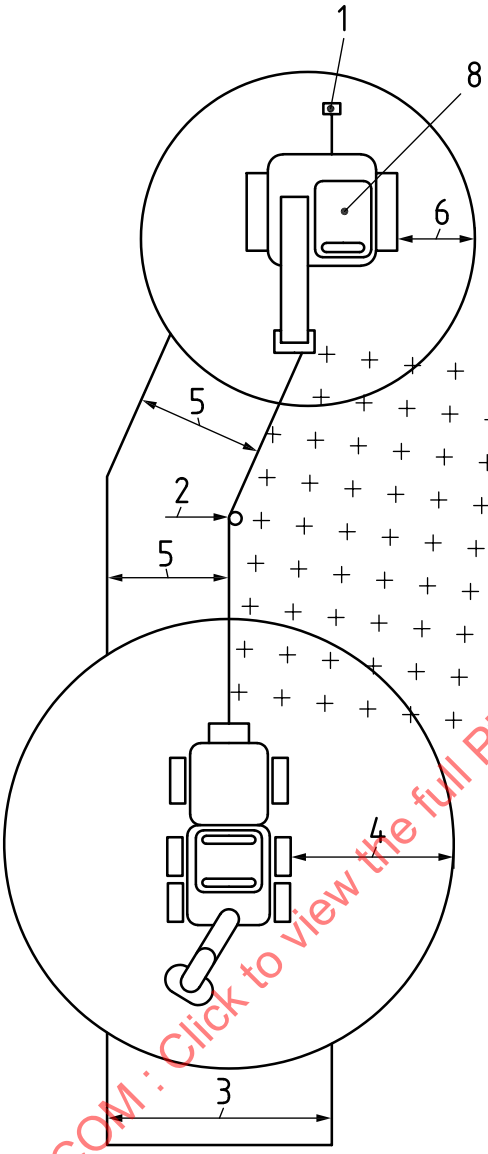
6 hazard zone below the supported machine of width W; width to be determined by the system integrator; minimum width is 40 m

7 remote traction aid winch (anchor machine)

8 anchor tree

9 supporting rope

Figure A.2 — Hazard zones of a remote traction aid winch system



Key

1 movement detector

2 deflection pulley

3 hazard zone below the supported machine of width W; width to be determined by the system integrator; minimum width is 40 m

4 hazard zone around the supported machine; to be determined by the system integrator

5 hazard zone on one side of the supporting rope; width 20 m

6 hazard zone around the anchor machine; to be determined by the system integrator

7 hazard zone due to the risk of breaking of the deflection pulley where the supporting rope and the deflection pulley may be thrown into this hazard zone

8 anchor (remote traction aid winch attached to an anchor machine shown as an example)

Figure A.3 — Additional hazard zones with deflection pulley

Annex B
(normative)

Rope arrangement for proper spooling

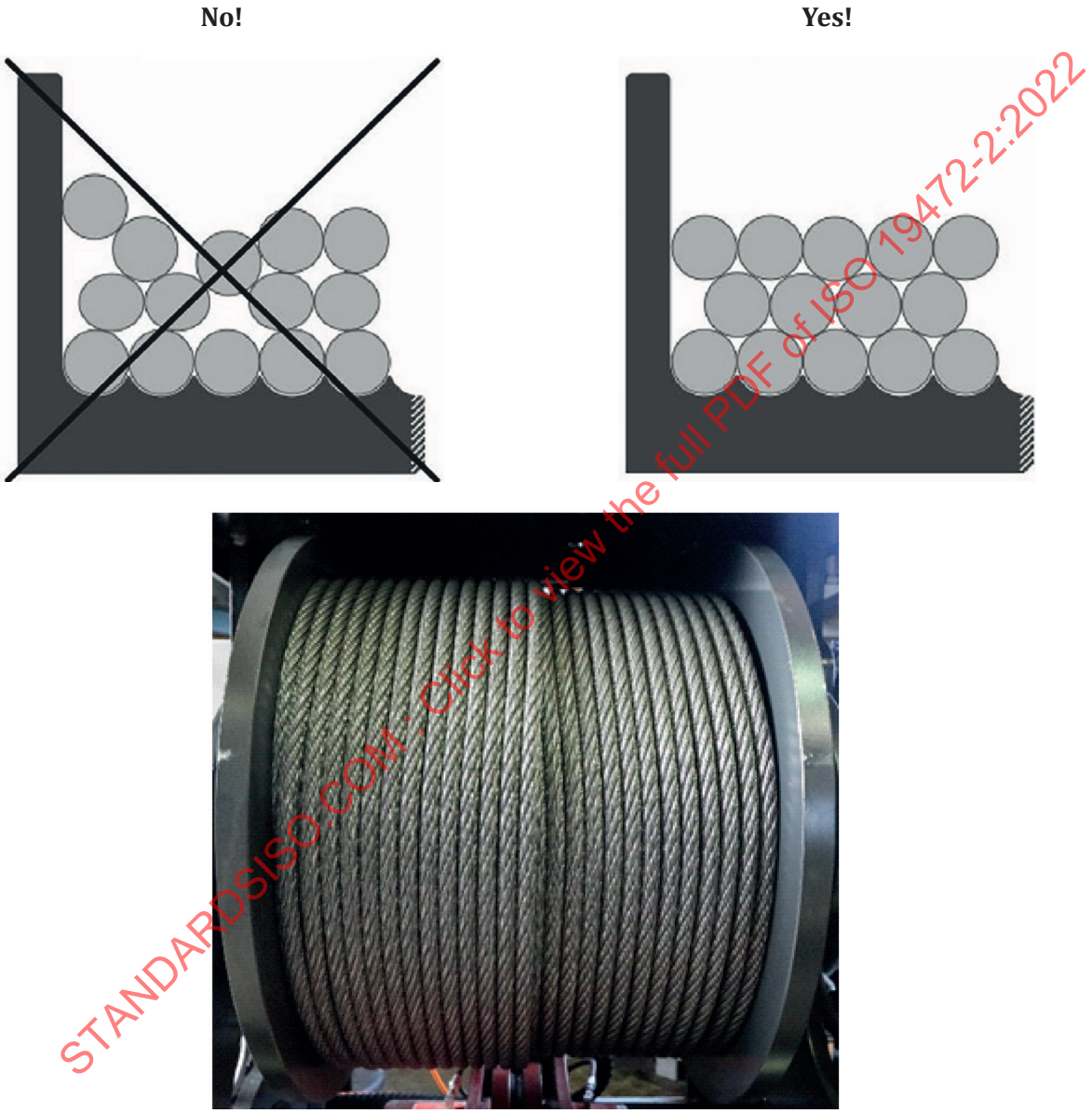


Figure B.1 — Proper spooling

Annex C
(informative)

List of significant hazards

Table C.1 lists the relevant hazardous situations and dangerous occurrences, which can put persons into hazard during the intended use or reasonably foreseeable misuse of the machine. It includes references to parts of this document to minimize or exclude these risks.

Table C.1 — Significant Hazards identified with traction aid winches according to ISO 12100:2010, Annex B

No.	Hazard identified			
	Type or group	**Origin**	**Potential consequences**	**Appropriate clause of this document**
1	Mechanical Hazards	Basic mechanical hazards; Hazards generated by machine parts and components: e.g. form, spatial assembly; Mass and Speed (kinetic energy of parts in case of controlled or uncontrolled machinery movements or parts of it; Inadequate mechanical strength; Energy accumulation inside the machine - caused by elastic elements (spring) - caused by liquids and gases under pressure; Loss of control; Loss of stability	Being run over; Crushing; Crash; Shearing; Cutting; Entanglement; Drawing-in or trapping; Impact; Stabbing or puncture; Friction and abrasion; High pressure fluid injection or ejection	4.2; 4.3; 4.4; 4.5, 4.7; 4.8; 4.12; 4.13, 4.18; Clause 5
2	Electrical hazards	Battery stored electrical energy Control system	Short circuits; Fire Malfunction	4.7; 4.10
4	Noise hazards	Hydraulic components of the winch drive; Rope drive	Loss of hearing (deafness) and other physiological; Impairments (e.g. sense of balance, power of concentration); Disturbance of verbal communication, disturbance of acoustic signals	4.14
5	Vibration hazards	Vibrating equipment	Vibration health impairments (e.g. damage to the spine)	4.15

Table C.1 *(continued)*

No.	Hazard identified			
	Type or group	**Origin**	**Potential consequences**	**Appropriate clause of this document**
8	Ergonomic hazards	Access Design or location of indicators and visual displays units; Hazards arising from operator mistakes	Slipping, falling Discomfort; Fatigue; musculoskeletal disorder; Stress; Malfunction Any other (for example, mechanical, electrical) as a consequence of a human error	4.9; 4.11; 4.12; 4.13; 4.18; Clause 5
9	Hazards associated with the environment in which the machine is used	Dust and fog; Electromagnetic disturbance; Pollution; Snow; Temperature	Slight disease; Slipping, falling; Any other as a consequence of the effect caused by the sources of the hazards on the machine or parts of the machine	4.11; Clause 5

Annex D
(normative)

Noise test code

D.1 General

For the measurement of the A-weighted emission sound pressure levels and determination of installation conditions, ISO 11201:2010 shall be used while A-weighted sound power level shall be determined according to ISO 3744:2010, unless otherwise stated in this document.

The winch system shall be operated for all measurements without rope and over a reflecting surface. The drum or the driving sheaves shall be run in both directions at the maximum speed according to the manufacturer's specifications. For both directions a measuring time of at least 20 s shall be observed. Measurements shall start once the maximum winch speed for the respective operating directions is reached.

Relevant A-weighted emission sound pressure levels at the respective microphone positions shall be calculated from the measurements taken during operating the winch in forward and reverse direction according to ISO 11201:2010, 10.1.5 using equal time shares for both directions of rotation.

D.2 Mounting of integrated traction aid winches fixed installation, integrated traction aid winches removable installation and remote traction aid winches attached to an anchor machine

The emission of noise of integrated traction aid winches fixed and removable installation and remote traction aid winches attached to an anchor machine shall be determined for the winch system removed from the carrying machine. The winch shall be mounted on a supporting structure where the centre axles of the drum, storage drum and/or of the capstan system are situated at a vertical distance of 0,75 m from the reflecting surface. This structure shall not cover the winch system more than necessary for holding it in place for the measurements. The horizontal distance of components shall correspond to the layout used in working conditions. A testing bench according to ISO 11201:2010, Annex E may be used. Energy supply shall be provided by a power unit distanced from the winch system which shall not affect the level of the noise emissions of the winch system.

In case the housing of an integrated traction aid winch fixed installation forms an integral non removable part of the supported machine, the setup and measuring instructions for remote traction aid winches integrated into an anchor machine as described below shall be used.

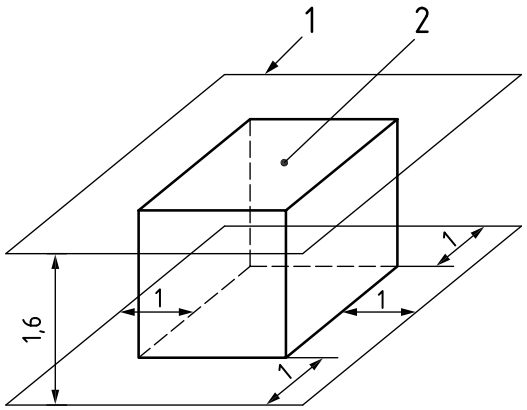
D.3 Setup for remote traction aid winches integrated into an anchor machine

The emission of noise of remote traction aid winches which are self-propelled and where the prime-mover forms an integral part of the winch system, shall be determined with the complete remote traction aid winch system positioned stationary on a flat reflecting surface. The running speed of the prime mover shall be set at the operating speed according to the manufacturer's specifications; if no such operating speed is given, the rated speed of the prime-mover shall be used.

D.4 A-weighted emission sound pressure level measurements

Measurements of A-weighted emission sound pressure level shall be performed according to ISO 11201:2010, 9.5. The measurement shall be taken at the point exhibiting the highest A-weighted

emission sound pressure level along the path around the reference surface (ISO 11201:2010, 3.20 and 3.21) for each driving direction of the winch as described in Figure D.1.



Key

1 microphone path (height 1,6 m; distance from the reference cuboid 1 m)

2 reference cuboid as defined by ISO 11201:2010, 3.20

Figure D.1 — Reference surface and microphone path for A-weighted emission sound pressure level measurements for remote traction aid winches integrated into an anchor machine

D.5 A-weighted sound power level measurements

A-weighted sound power level shall be determined according to ISO 3744:2010, using the hemispherical envelope according to ISO 3744:2010, 7.2 and Annex B, Table B.1.

D.6 Measurement uncertainties

The total measurement uncertainty of the A-weighted emission sound pressure level respectively sound power level determined according to this standard is depending on the standard deviation σ_{R0} given by the applied basic noise emission measurement method and the uncertainty associated with the instability of the operating and mounting conditions σ_{omc}.

The resulting total uncertainty σ_{tot} is then calculated from Formula (D.1):

$$\sigma_{tot} = \sqrt{\sigma_{R0}^2 + \sigma_{omc}^2} \tag{D.1}$$

The value of σ_{R0} may be taken from ISO 11201:2010, 11.4, Table 1 for grade 2 measurements unless it is determined according to ISO 11201:2010, 11.3.

Unless very unstable noise emission values are recorded, a value of 0,5 dB shall be assumed for σ_{omc}. In case of an unstable operation 2 dB shall be assumed for σ_{omc}.

The expanded measurement uncertainty U, in decibels, is calculated from Formula (D.2):

$$U = k\,\sigma_{tot} \tag{D.2}$$

where k is the coverage factor. A coverage factor k of 1,6 shall be observed, corresponding to a 95 % confidence level. Further information is given in ISO 4871:1996.

D.7 Reporting

D.7.1 General

As a minimum, the following information shall be reported:

— a reference to this document, i.e. ISO 19472-2:2022;

— reference to the basic noise emission standard(s) used;

— description of the mounting and operating conditions used;

— type and positioning of the traction aid winch;

— the relevant speed of drum and capstan;

— locations of work station(s) and other specified positions; and

— the noise emission values obtained and the associated expanded measurement uncertainty.

Noise emission values shall be recorded according to ISO 11201:2010, 13 and ISO 3744:2010, 10 as applicable.

Deviations from these requirements shall be stated and technical justification for the deviations shall be given.

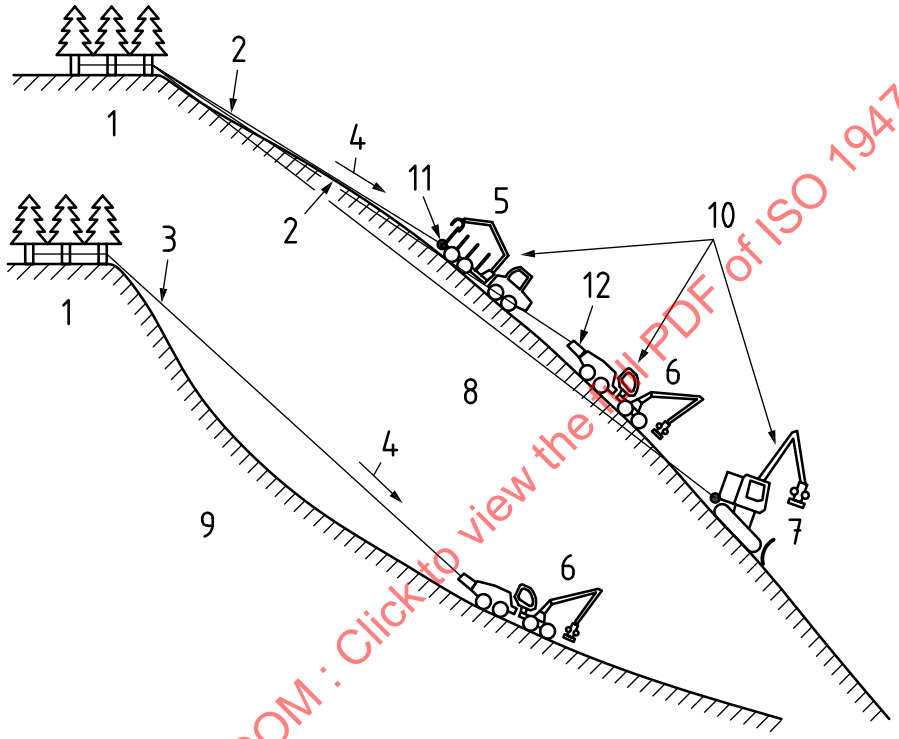
D.7.2 Declaration and verification

Declaration of the noise emission values shall be in accordance with the requirements of ISO 4871:1996. It also describes the requirements for verification of declared noise emission values.

Annex E
(informative)

Aspects of operating traction aid winches

Annex E gives information on some of the aspects to be considered when designing or operating traction aid winches. Figure E.1 shows the operation of integrated traction aid winches fixed and removable installation.

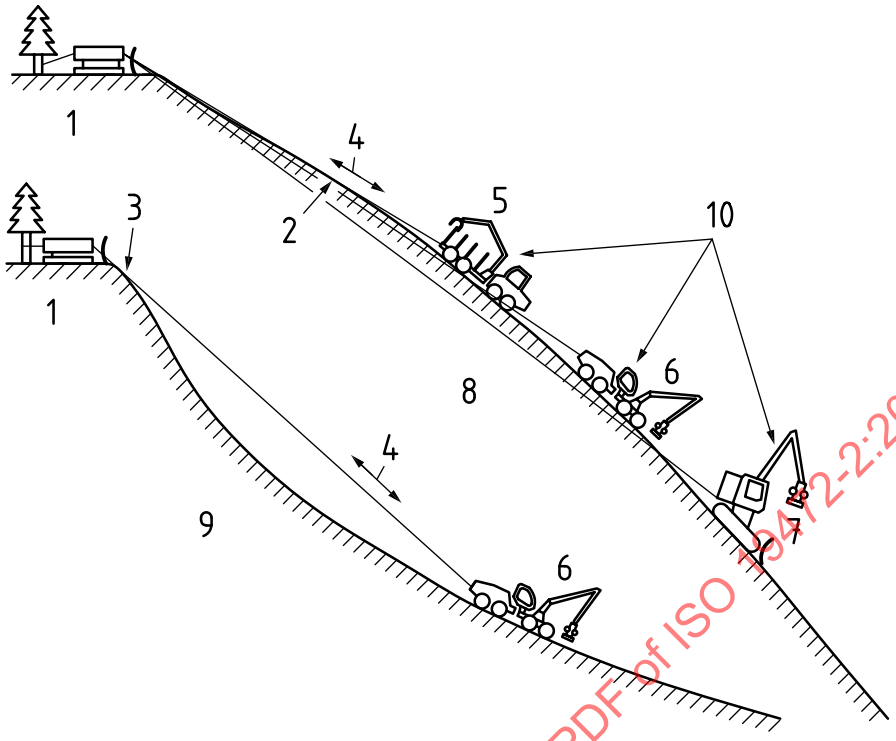


Key

1 anchors (anchor trees)
2 rope having ground contact all the way
3 no contact of the rope
4 path of the immovable rope
5 forwarder
6 harvester
7 feller
8 convex slope shape
9 concave slope shape
10 machines generating dynamic forces in the rope
11 integrated traction aid winch fixed installation
12 integrated traction aid winch removable installation

Figure E.1 — Aspects to be considered when using traction aid winches as an integrated system

Figure E.2 shows the operation of remote traction aid winch systems which are set up at a position detached from the supported machine.



Key

1 anchor winch (remote traction aid winch)
2 rope having ground contact all the way
3 ground contact of the rope at the shoulder of the slope
4 path of the moving rope
5 forwarder
6 harvester
7 feller
8 convex slope shape
9 concave slope shape
10 machines generating dynamic forces in the rope

Figure E.2 — Aspects to be considered when using traction aid winches as a remote system

Table E.1 — System parameters for the use of traction aid winches

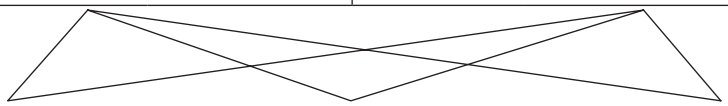
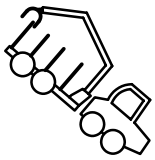
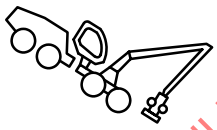
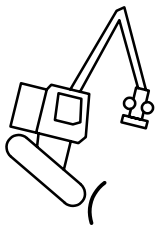
Anchoring	Fixed anchor point (e.g. tree)		Mobile anchor point (e.g. anchor winch using blade support)
	|		|
Winch installation	Integrated traction aid winch fixed or removable installation		Remote traction aid winch
Motion of rope	Immovable rope		Moving rope
			
Samples of supported machines	Forwarder	Harvester	Feller
Possible cause of additional dynamic forces in the winch rope	Increase and decrease of driving speed; loading	Acceleration forces while de-branching	Acceleration forces during felling operations or while cutting
			
Undercarriage	Wheels (single axles or bogies), traction belts or tracklayers		
Natural parameters			
Slope shape	Concave — Convex		
Inclination/ Gradient	Percentage range encountered while negotiating slopes using traction aid		
Soil type	Clay; silt; loam; sand; gravel; many or few stones		
Climatic conditions	Dry — moist — wet rain — snow — ice		

Table E.1 shows relevant system parameters which should be considered for the design and layout as well as the operation of traction aid winch systems.

The task of traction aid winches is to use the rope force of to such an extent that there is only slight slip and nearly no damage to the ground.

The range of reasonable rope forces as a function of the slope that has to be overcome can in general terms be described by Figure E.3. The supported machine shall generate an adequate tractive/braking force for safe slope operation taking into consideration the rope force. The minimum rope force is the force which is necessary to keep the supported machine stable on the gradient. For traction aid conditions, where the supported machine is always able to maintain a stable position in the gradient without rope support the minimum necessary rope force is therefore zero. For increased gradients, where the traction (holding force) of the drivetrain of the supported machine is no longer sufficient to keep the supported machine in a stable position on the slope, the minimum rope force is the difference between the maximum possible traction (holding force) and the grade resistance of the supported machine. The necessary minimum rope force is drawn in Figure E.3 and it is called slide boundary. As long as the rope force is at least as high as given by the slide boundary, the supported machine may be able to overcome the slope albeit with considerable wheelslip and high resulting soil damage and loss of energy.