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Machinery for forestry — Winches — Dimensions, performance and safety

Matériel forestier — Treuils — Dimensions, performance et sécurité

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 19472 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 15, *Machinery for forestry*.

This first edition of ISO 19472 cancels and replaces ISO 4254-4:1990, ISO 6816:1984 and ISO 6687:1994, of which it constitutes a technical revision.

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Machinery for forestry — Winches — Dimensions, performance and safety

1 Scope

This International Standard defines dimensions and specifies performance and safety requirements for winches used in forestry. It is applicable to fixed and detachable winches and their components mounted on mobile and self-propelled forestry machinery such as skidders and forwarders as defined in ISO 6814 and on agricultural tractors used for skidding in forestry operations. It is not applicable to winches used for hoisting operations on cranes, draglines, high lead logging, cable logging systems or yarding.

2 Normative references

The following referenced documents are indispensable for the application 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 3457:2003, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3600:1996, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Operator's manuals — Content and presentation*

ISO 3767-4:1993, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Symbols for operator controls and other displays — Part 4: Symbols for forestry machinery*

ISO 6814:2000, *Machinery for forestry — Mobile and self-propelled machinery — Terms, definitions and classification*

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

ISO 9244:1995, *Earth-moving machinery — Safety signs and hazard pictorials — General principles*

ISO 10968:2004, *Earth-moving machinery — Operator's controls*

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

ISO 13852:1996 *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

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3 Terms and definitions

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

3.1
barrel diameter
A
diameter of the rope drum barrel measured in millimetres

See Figure 1.

3.2
flange diameter
B
diameter of the rope drum flanges measured in millimetres

See Figure 1.

3.3
distance between flanges
C
distance between the flanges of the rope drum measured in millimetres at half the depth of the flange minus the rope clearance distance

See Figure 1.

3.4
depth of flange
D
radial distance from the outside diameter of the rope drum flange to the surface on the rope drum barrel measured in millimetres

See Figure 1.

3.5
throat clearance
E
minimum distance from the barrel of the rope drum to the winch housing at any point located between the flanges of the rope drum

See Figure 1.

3.6
rope clearance distance
S
distance from the outmost periphery of the winch flange or housing that shall be left free from rope to ensure the rope stays within the drum

See Figure 2.

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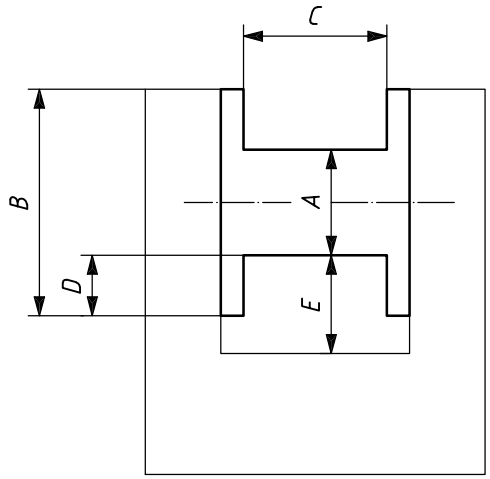

Figure 1 — Basic dimensions of winch drum

4 Symbols

A Barrel diameter, in millimetres (mm)

B Flange diameter, in millimetres (mm)

C Distance between flanges, in millimetres (mm)

D Depth of flange, in millimetres (mm)

E Throat clearance, in millimetres (mm)

L Rope length, in metres (m)

S Rope clearance distance, in millimetres (mm)

d Rope diameter, in millimetres (mm)

F Line pull, in newtons (N)

n Rotational frequency of input shaft, in revolutions per second (r/s)

T Torque on winch input shaft, in newton metres (N · m)

R Total gear reduction between the winch input shaft and the rope drum

u Efficiency of total gear reduction between input shaft and rope drum at the speed corresponding to the torques used for T

v Line speed, in metres per second (m/s)

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5 Performance requirements

5.1 Drum storage capacity

5.1.1 Rope clearance distance, S

The rope clearance distance to be used in the calculations according to 5.1.2 shall be equal to two rope diametres ($S = 2d$).

5.1.2 Calculations

For winches with S built into the portion of the housing extending beyond the rope drum flange, as shown in the example of Figure 2 a), the length of rope in metres that can be stored on the rope drum shall be calculated using Equation (1):

$$L = (A + D) \times D \times C \times K \times 10^{-3} \quad (1)$$

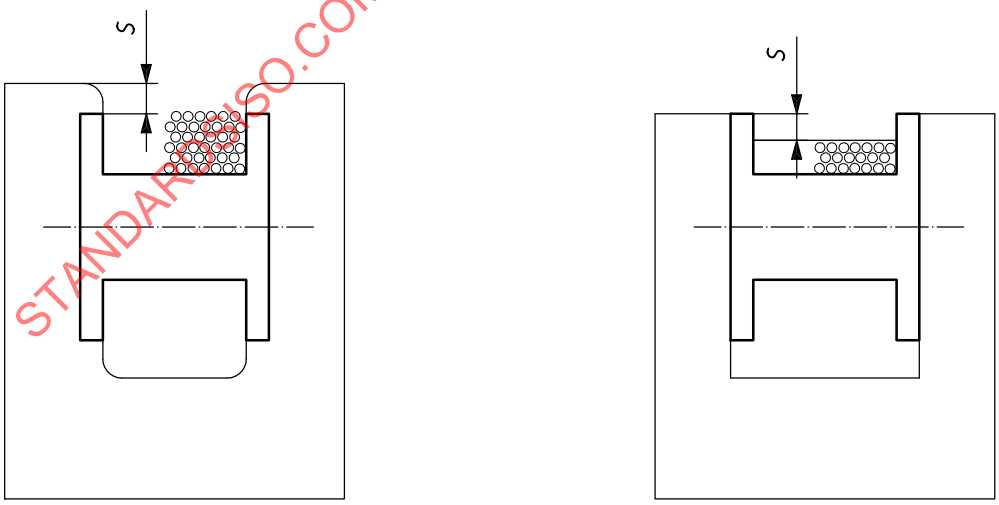
For all other winches, as shown in the example of Figure 2 b), the length of rope in metres that can be stored on the rope drum, taking S into account, shall be calculated using Equation (2):

$$L = (A + D - S) \times (D - S) \times C \times K \times 10^{-3} \quad (2)$$

where, in Equations (1) and (2), K is a factor, function of the diameter, d, of the rope used (see Table 1) and where

$$K = \frac{\pi}{(1{,}04)^2} \quad (3)$$

NOTE The values of K given in Table 1 allow for a normal oversize on cables of 4 %. The formula for calculating K is based on uniform rope winding and will not give correct figures if rope is wound non-uniformly on the rope drum.



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

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Table 1 — Factor K as a function of rope diameter d

d	K	d	K
8	0,045 4	19	0,008 05
9	0,035 9	20	0,007 26
10	0,029 0	22	0,006 00
11	0,024 0	24	0,005 04
12	0,020 2	26	0,004 30
13	0,017 2	28	0,003 70
14	0,014 8	32	0,002 84
16	0,011 3	35	0,002 37
18	0,008 96	36	0,002 24
		38	0,002 01

5.2 Line pull, F

Calculate the line pull in newtons using Equations (4) to (6).

a) Bare drum line pull

$$F = \frac{2\,000 \times T \times R \times u}{A + d} \tag{4}$$

b) Full drum line pull

For winches with S built into the portion of the housing extending beyond the rope drum flange, as shown in the example of Figure 2 a):

$$F = \frac{2\,000 \times T \times R \times u}{B - d} \tag{5}$$

For all other winches, as shown in example of Figure 2 b), taking S into account:

$$F = \frac{2\,000 \times T \times R \times u}{B - (2S + d)} \tag{6}$$

The breaking strength of the rope used could be exceeded in the specification for the line pull. In this case, the maximum rated bare drum pull, see c), in relation to the static breaking load of the rope, shall be in accordance with 6.3.

c) Maximum rated bare drum pull

Calculate the maximum rated bare drum pull of the winch as specified by the winch manufacturer using Equation (4) under one or a combination of the following conditions:

1) when the torque on the input shaft is influenced by a torque converter, calculate for a stall condition while the engine is at the full governor control position;

2) when the torque on the input shaft is influenced by the transmission gear ratios, calculate for maximum engine torque with the transmission in the gear, giving the highest line pull;

3) when the torque on the input shaft is influenced by a fixed gear ratio only, calculate for maximum engine torque.

NOTE The total winch pull may be limited by the machine on which the winch is mounted.

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5.3 Line speed, v

Calculate the line speed in metres per second using Equations (7) to (9).

NOTE The maximum line speed will be calculated using the maximum available rotational speed at the winch input shaft under no-load conditions and stabilized engine speed.

a) Bare drum line speed

$$v = \frac{n\pi(A+d)}{1000R} \tag{7}$$

b) Full drum line speed

For winches with S built into the portion of the housing extending beyond the rope drum flange, as shown in the example of Figure 2 a):

$$v = \frac{n\pi(B-d)}{1000R} \tag{8}$$

For all other winches, as shown in the example of Figure 2 b), taking S into account:

$$v = \frac{n\pi[B-(2S+d)]}{1000R} \tag{9}$$

6 Safety requirements

6.1 Mechanical safety

6.1.1 Unless otherwise specified in this International Standard, safety distances shall be in accordance with of ISO 13852:1996, Tables 1, 3, 4 or 6.

6.1.2 Where a winch rope passes over an idler pulley, provisions shall be made to retain the rope in the groove of the pulley during slack rope conditions.

6.1.3 If the winch operation controls are located such that the operator can reach rope or drum during powered operations of the winch, the rope and winch shall be guarded up to the idler pulley.

6.1.4 Detachable winches shall be designed for easy and safe attachment and removal, including rigid mounted supports, and with a storage position provided, giving stability from tip-over when the winch is detached. A support for a power take-off (PTO) drive shaft disconnected from the tractor power take-off (PTO) shaft shall be provided to prevent contact with the ground.

6.1.5 Machines equipped with fixed and detachable winches, including those with remote controls or fixed controls, shall have OPS guarding meeting the performance requirements of ISO 8084, protecting the operator while sitting in the driver's seat.

6.1.6 Guards and shields to protect the operator and others from winch components that create hazards during normal operation and servicing shall be in accordance with ISO 3457.

6.2 Drum

6.2.1 The ratio between barrel diameter and rope diameter shall not be less than 8.

NOTE It is recognized that for some regional applications higher values are used.

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6.2.2 The winch shall be designed to prevent the rope from running off over the flanges if the top layer for any reason reaches above the flanges. Winches with housings that extend $2d$ beyond the outmost periphery of the flange or the use of kickers and/or crossbars meet this requirement.

6.3 Rope breaking load

The static breaking load of the rope installed on a winch used with a protected operator in the cab shall not be less than 1,4 times the rated line pull of the machine/winch system. For all other applications, use a minimum of twice the rated line pull of the machine/winch system.

NOTE The static breaking load of new wire rope is given in ISO 3108 according to size and construction.

6.4 Rope fastening

6.4.1 The drum shall be provided with a device for attaching the rope that is designed to avoid rope damage, especially at the attachment point. This device shall meet the requirements of 6.4.2 to 6.4.4.

6.4.2 The device for attaching the rope to the drum should be of the breakaway anchor type so that in the event of the load sliding out of control with the winch in free-spool mode, the rope will disengage from the drum.

6.4.3 The device shall be designed to disengage, without any rope on the drum, at less than 0,3 times the maximum rated bare drum line pull. With three turns of rope around the drum, a traction equal to 1,25 times the maximum rated bare drum pull shall be applied to the rope without any disengaging of the device.

6.4.4 The device shall not disengage automatically when the rope is being manually spooled off the drum.

6.5 Brake

6.5.1 The brake system or equivalent shall automatically be applied within 1 s when the power to the drum is disconnected. A release mechanism may be included to allow free spooling.

6.5.2 The brake system or equivalent shall hold a load equal to at least 1,25 times the maximum pull of the winch without slippage.

6.5.3 The brake system or equivalent shall give smooth stopping and release of the drum for all pull conditions up to and including 1,25 times the maximum rated bare drum line pull.

6.6 Controls

6.6.1 The maximum forces necessary to operate manual controls shall not exceed those given in ISO 10968. Out-of-detent positions such as off-free-spool and returning-from-brake shall have a maximum force of 230 N.

6.6.2 The controls shall be so designed and located as to minimize the possibility of unintentional winch actuation. Controls for two-drum winches shall be distinguishable by means such as labels, colour, etc.

6.6.3 Power controls shall, when released, automatically return to the brake applied neutral position, except in the disconnect or free spool position.

6.6.4 Brake controls shall, when released, automatically apply the brakes.

6.6.5 Brake controls and/or disconnect clutch controls may have a freewheeling position lock.

6.6.6 The winch control function and method of operation shall be indicated on or near the control by symbols according to ISO 3767-4.

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6.6.7 The winch control, if in the form of a lever, should be arranged so that the “winch-in” function will occur when the control is moved generally towards the operator.

6.6.8 The brake release and free spool function, if a lever, should occur when the control is moved generally away from the operator.

6.7 Overload device

6.7.1 The overload device, if any, shall ensure that the maximum permissible pull of the machine/winch system cannot be exceeded.

6.7.2 It shall not be possible to alter the setting of the overload device (i.e. slip clutches, relief valves, etc.) without a minimum set of tools.

6.8 Stability

6.8.1 If the required machine stability, when in operation or when stationary, can only be achieved by employing special measures or by using the machine in a particular way, this shall be pointed out on the machine itself and/or in the instruction handbook.

6.8.2 Where a detachable winch mounted on an agricultural machine can in normal operation produce a risk of overturning, supports or other devices providing mechanical stability shall be provided. It shall be possible for the driver/operator to verify visually that the supporting devices are in the transport position.

6.9 Moving parts for power transmission of winches

6.9.1 Hazards of moving transmission parts shall be guarded by location, by safety distance, see 6.1.1, or by means of fixed guards, see 6.1.6.

6.9.2 If normal access is foreseen, e.g. for daily adjustment or maintenance, guards shall be used, where practical, remaining attached to the machine, e.g. by means of hinges or tethers. This requirement shall apply when carrying out daily adjustment or maintenance operations described in the operator’s manual.

NOTE *Normal access* is given, for example, when the operator must adjust certain components for given functions during normal operation according to the intended use of the machine.

6.9.3 Machines with access doors or guards which can be opened or removed to expose machine elements which continue to rotate or move after the power is disengaged shall have, in the immediate area, a readily visible evidence of rotation, or an audible indication of rotation, or a suitable safety sign.

6.9.4 PTO-driven winches designed to operate in a stationary position shall be provided with a means to prevent separation of the PTO drive shaft.

7 Information for use

7.1 Instruction handbook

Winches shall be equipped with an instruction handbook in accordance with ISO 3600. When the winch is incorporated in a machine such as a skidder, the information listed in this subclause may be included in the appropriate sections of the complete machine manuals. The instruction handbook shall give complete instructions for the safe use and maintenance of the winch and, where applicable, at least the following information:

a) information plate data according to 7.2;

b) load data — maximum input torque and r/min (for detachable winches only), maximum rated pull at bare drum and full drum respectively;

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