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Machinery for forestry — Winches — Performance requirements

Matériel forestier — Treuils — Exigences de performance

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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.

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.

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Machinery for forestry — Winches — Performance requirements

1 Scope

This International Standard specifies a uniform method of defining specification measurements, drum storage capacity, line pull and line speed for winches used in tree harvesting machines.

2 Definitions

For the purposes of this International Standard, the following definitions apply (see figure 1 and table 1).

2.1 barrel diameter, D_1: Diameter of the cable drum barrel.

2.2 flange diameter, D_2: Diameter of the cable drum flanges.

2.3 distance between flanges, h: Distance measured between the flanges of the cable drum, measured at half the difference between depth of flange and safety distance:

$$\frac{h_1 - h_3}{2}$$

2.4 depth of flange, h_1: Radial distance from the outside diameter of the cable drum flange to the surface on the cable drum barrel.

2.5 safety distance, h_3: Outmost periphery of the flange or housing that is left free from cable.

2.6 throat clearance, h_2: Minimum distance from the barrel of the cable drum to the winch housing at any point located between the flanges of the cable drum.

NOTE 1 The throat clearance, h_2, is greater than the depth of flange, h_1.

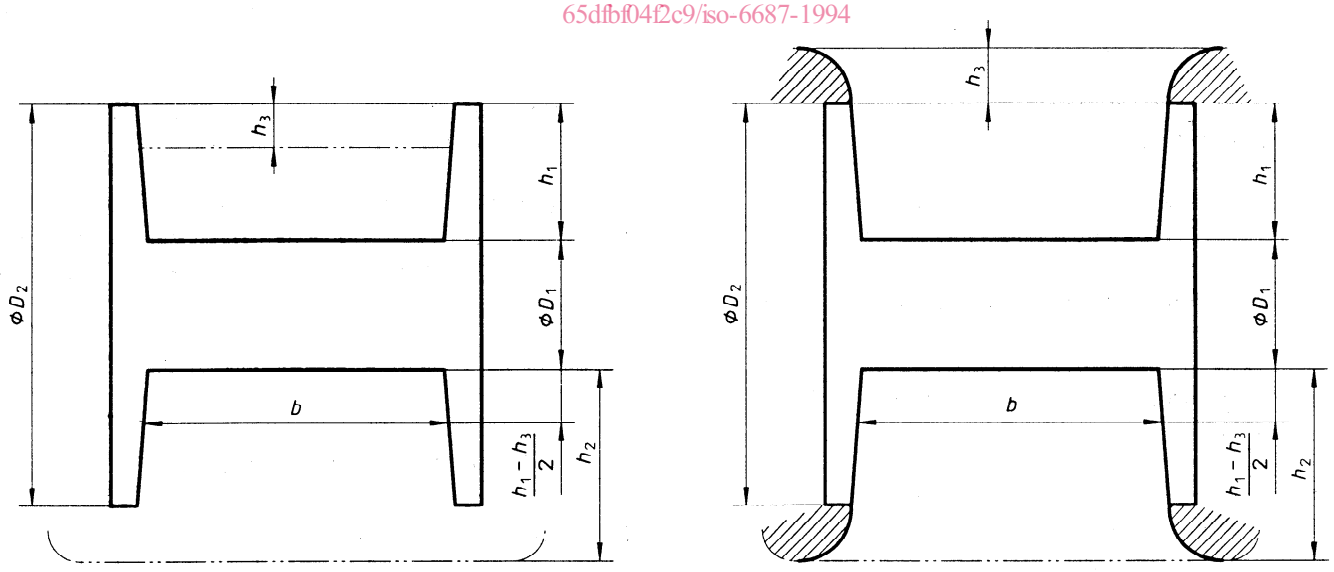
3 Performance requirements

3.1 Symbols and units

See table 1 and figure 1.

Table 1 — Symbols and units

Symbol	Definition	Unit
D_1	Barrel diameter	mm
D_2	Flange diameter	mm
b	Distance between flanges	mm
h_1	Depth of flange	mm
h_2	Throat clearance	mm
L	Cable length	m
h_3	Safety distance	mm
d	Cable diameter	mm
F	Line pull	N
n	Rotational frequency of input shaft	s^{-1}
T	Torque on winch input shaft	N·m
R	Total gear reduction between the winch input shaft and the cable drum	
η	Efficiency of total gear reduction between input shaft and cable drum at the speed corresponding to the torque used for T	
v	Line speed	m/s



NOTE — These sketches of the winch are only indicative and do not relate to a specific winch.

Figure 1 — Basic dimensions of winches

3.2 Drum storage capacity

3.2.1 Safety distance

The safety distance, h_3, to be used in the calculations below shall be equal to two cable diameters:

$$h_3 = 2d$$

3.2.2 Calculations

The length of cable, L, in metres, that can be stored on the cable drum taking into account the safety distance, h_3, shall be calculated using the following formula:

$$L = (D_1 + h_1 - h_3) \times (h_1 - h_3) \times b \times K \times 10^{-3}$$

where K is a factor, function of the diameter of cable used (see table 2), calculated as follows:

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

Table 2 — Factor, K, as function of cable diameter, d

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

The values of K allow for a normal oversize on cables of 4 %. The formula for calculation of K is based on uniform cable winding and will not give correct figures if cable is wound non-uniformly on the cable drum.

3.3 Line pull

3.3.1 Bare drum and full drum

Line pull, F, in newtons, shall be calculated using the following formulae:

a) Bare drum line pull:

$$F = \frac{2\,000 \times T \times R \times \eta}{D_1 + d}$$

b) Full drum line pull:

$$F = \frac{2\,000 \times T \times R \times \eta}{D_2 - (2h_3 + d)}$$

NOTE 2 The breaking strength of the cable used may be exceeded in the specification for the line pull.

3.3.2 Rated line pull of winch

The rated line pull of the winch is the maximum approved bare drum line pull as specified by the manufacturer and calculated in accordance with 3.3.1.

3.3.3 Maximum calculated line pull of installed winch

The maximum bare drum line pull shall be calculated in accordance with 3.3.1 and one or a combination of the following conditions.

a) When the torque on the input shaft is influenced by a torque converter, it is calculated for a stall condition while the engine is at full governor control position.

b) When the torque on the input shaft is influenced by the transmission gear ratios, it is calculated for maximum engine torque with the transmission in the gear giving the highest line pull.

c) When the torque on the input shaft is influenced by a fixed gear ratio only, it is calculated for maximum engine torque.

NOTE 3 The total winch pull may be limited by the machine on which the winch is mounted.

3.4 Line speed

3.4.1 Bare drum and full drum

Line speed, v, in metres per second, shall be calculated using the following formulae:

a) Bare drum line speed

$$v = \frac{n(D_1 + d)}{318{,}4R}$$

b) Full drum line speed

$$v = \frac{n[D_2 - (2h_3 + d)]}{318{,}4R}$$

3.4.2 Maximum line speed

The maximum bare drum and full drum line speed shall be calculated in accordance with 3.4.1 using the maximum speed available at the winch input shaft under no-load conditions and stabilized engine speed.

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