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SURFACE VEHICLE STANDARD

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Submitted for recognition as an American National Standard

SPECIFICATION DEFINITIONS—WINCHES FOR CRAWLER TRACTORS AND SKIDDERS

***Foreword*—**This reaffirmed document has been changed only to reflect the new SAE Technical Standards Board format.

***1. Scope*—**The purpose of this SAE Standard is to provide a uniform method of defining and rating winches for crawler tractors and skidders. It in no way implies definition of proper match between rating of a winch and rating of the cable.

***2. References*—**There are no referenced publications specified herein.

3. Definitions

3.1 Barrel Diameter (A)—The diameter of the cable drum barrel measured in millimeters (inches).

3.2 Flange Diameter (B)—The diameter of the cable drum flanges measured in millimeters (inches).

3.3 Distance Between Flanges (C)—The distance measured between the flanges of the cable drum in millimeters (inches) measured at 1/2 x depth of flange.

3.4 Depth of Flange (D)—The radial distance from the outside diameter of the cable drum flange to the surface of the cable drum barrel measured in millimeters (inches).

3.5 Throat Clearance (E)—The minimum distance from the barrel of the cable drum to the winch housing at any point located between the flanges of the cable drum.

***4. Specifications—General*—**This document includes the definition of specifications most commonly used to describe this type of equipment. See Table 1. Paragraphs 3.1 to 3.5 are further defined by Figure 1. The illustration is not intended to be descriptive of any existing winch and is used here only to clarify the meaning of the standard.

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TABLE 1—WINCH NONCLATURE

Symbol	Definition	Units SI	Units English
A	Barrel dia	mm	in
B	Flange dia	mm	in
C	Distance between flanges (measured at 1/2 D from barrel dia)	mm	in
D	Depth of flange	mm	in
d	Cable dia	mm	in
F	Line pull	N	lb
N	Speed of input shaft	rpm	rpm
T	Torque on winch input shaft	N·m	lb-ft
R	Total gear reduction between the winch input shaft and the cable drum		
u	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	fpm

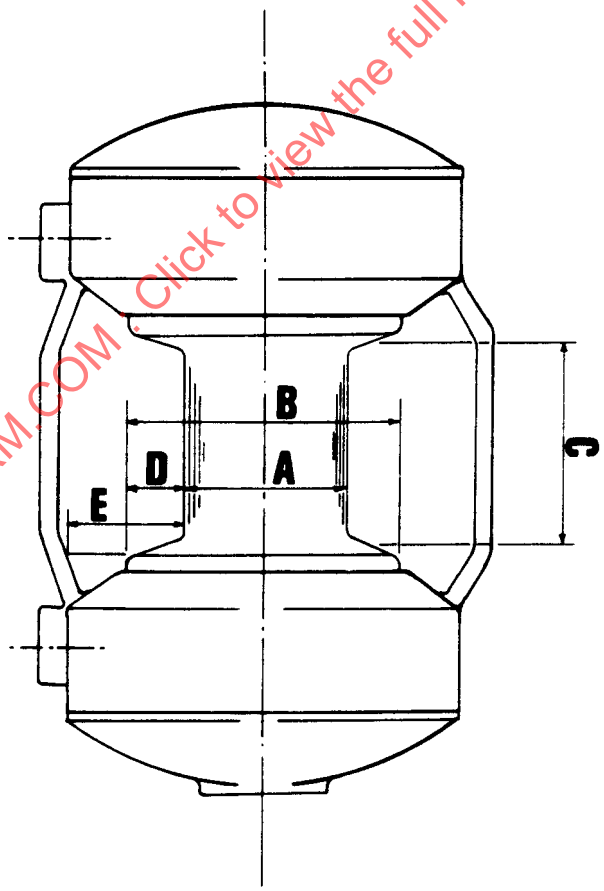

FIGURE 1—ILLUSTRATION OF WINCH DEFINITIONS

5. Specifications—Performance

5.1 Definition of Symbols

5.2 Calculated Drum Storage Capacity—The length of cable that can be stored on the cable drum shall be calculated using Equation 1:

$$\text{Length of cable in feet} = (A + D) \cdot D \cdot C \cdot K \qquad \text{(Eq. 1)}$$

where:

K = Factor for size of cable used. (See Table 2.)

TABLE 2—CABLE DIAMETER FACTOR

Cable Dia, in	Factor K	Cable Dia, in	Factor K
3/8	1.58	13/16	0.354
7/16	1.19	7/8	0.308
1/2	0.925	1	0.239
9/16	0.741	1-1/8	0.191
5/8	0.607	1-1/4	0.152
11/16	0.506	1-3/8	0.127
3/4	0.428	1-1/2	0.107

The values of K allow for normal oversize on cable. The formula is based on uniform cable winding and will not give correct figures if cable is wound nonuniformly on the cable drum.

5.3 Line Pull—Line pull shall be calculated using Equations 2 and 3:

a. Bare drum line pull

$$F\ (\text{SI units}) = \frac{2000 \cdot T \cdot R \cdot u}{A + d} = N \qquad \text{(Eq. 2)}$$

$$F\ (\text{English units}) = \frac{24 \cdot T \cdot R \cdot u}{A + d} = \text{lb}$$

a. Full drum line pull

$$F\ (\text{SI units}) = \frac{2000 \cdot T \cdot R \cdot u}{B - d} = N \qquad \text{(Eq. 3)}$$

$$F\ (\text{English units}) = \frac{24 \cdot T \cdot R \cdot u}{B - d} = \text{lb}$$

NOTE—Breaking strength of the cable used may be exceeded in the previous specifications for line pull.

5.3.1 RATED LINE PULL OF WINCH—The maximum approved bare drum line pull as specified by the winch manufacturer and calculated in accordance with 5.3.

5.3.2 MAXIMUM CALCULATED LINE PULL OF INSTALLED WINCH—The maximum bare drum and full drum line pulls shall be calculated in accordance with 5.3 and one or a combination of the following conditions:

5.3.2.1 When the torque on the input shaft is influenced by a torque converter, the maximum line pull shall be calculated for a stall condition while the engine is at full governor control position.

5.3.2.2 When the torque on the input shaft is influenced by the transmission gear ratios, the maximum line pull shall be calculated using the steady-state maximum engine torque with the transmission in the gear giving the highest line pull. Net torque with allowance for all parasitic losses shall be used.

5.3.2.3 When the torque on the input shaft is influenced by a fixed gear ratio only, the line pull shall be calculated for the steady-state maximum engine torque with allowance for all parasitic losses which affect the input torque.

5.3.3 MAXIMUM LINE PULL WITH MACHINE STABILITY LIMITS AT NORMAL OPERATING WEIGHT—In the case of a rubber-tired skidder, the line pull that will just lift a front wheel off the ground under the conditions listed as follows. In the case of a crawler skidder or crawler tractor, the line pull that will just lift the rear roller off the track under the following conditions:

5.3.3.1 Standard machine weight and weight distribution.

5.3.3.2 Adjustable arch in lowest operating position.

5.3.3.3 Cable leaving the fairlead at an angle of 30 degrees below horizontal and in line with the longitudinal centerline of the machine.

5.3.3.4 Machine on firm level ground that will prevent the wheels or tracks from sliding.

5.3.3.5 Fuel and hydraulic tanks full.

5.3.3.6 Standard tires.

5.3.3.7 Machine in straight travel position (not articulated).

5.3.4 MAXIMUM LINE PULL WITH MACHINE STABILITY LIMITS AT MAXIMUM OPERATING WEIGHT—Same as 5.3.3, except machine is ballasted to the maximum weight approved by the skidder manufacturer.

5.4 Line Speed—Line speed shall be calculated using Equations 4 and 5:

a. Bare drum line speed

$$V\ (\text{SI units}) = \frac{N(A + d)}{19\,099 \cdot R} = m/s \qquad \text{(Eq. 4)}$$

$$V\ (\text{English units}) = \frac{N(A + d)}{3.82 + R} = ft/min$$

a. Full drum line speed

$$V\ (\text{SI units}) = \frac{N(B - d)}{19\,099 \cdot R} = m/s \qquad \text{(Eq. 5)}$$

$$V\ (\text{English units}) = \frac{N(B - d)}{3.82 + R} = ft/min$$

5.4.1 MAXIMUM LINE SPEED—The maximum bare drum and full drum line speed shall be calculated in accordance with 5.4 using the maximum speed available at the winch input shaft under no load conditions and governed engine speed.

PREPARED BY THE SAE MACHINE TECHNICAL COMMITTEE SC4—
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