UDC 621.86/.87 : 621.854 : 677.72 DEUTSCHE NORM February 1974

Lifting Appliances

Principles Relating to Rope Drives

Calculation and Construction

DIN 15 020 Part 1

Hebezeuge; Grundsätze für Seiltriebe; Berechnung und Ausführung

As it is current practice in standards published by the International Organization for Standardization (ISO), the comma has been used throughout as a decimal marker.

This Standard incorporates technical safety stipulations within the meaning of the Law on Technical Equipment, see Explanations.

This Standard has been drawn up in collaboration with the Hauptverband der gewerblichen Berufsgenossenschaften, Zentralstelle für Unfallverhütung (Federation of Industrial Injuries Insurance Associations, Central Office for Accident Prevention), Bonn, and with the Bundesverband der landwirtschaftlichen Berufsgenossenschaften, Hauptstelle für landwirtschaftliche Unfallverhütung (Federal Association of Agricultural Injuries Insurance Associations, Central Office for Accident Prevention in Agriculture), Kassel.

For connection with publications of the Fédération Européenne de la Manutention (FEM = European Mechanical Handling and Conveying Technology Federation), see Explanations.

Contents

See DIN 15 020 Part 2 (new edition, at present still in draft form) for principles relating to rope drives, supervision during service.

See DIN 15 018 Part 1, draft February 1967 edition, Section 8, for holding ropes and tensioning ropes

See DIN 15 060 for sling ropes

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Explanations on pages 10 to 12

1 Scope

This Standard applies to rope drives of cranes (see DIN 15001) and of serial lifting appliances (see DIN 15100) of all types.

It does not apply to rope drives with friction pulley drive, to rope drives for excavators, elevators, aerial ropeways and winding engines, nor does it apply to rope drives on board ships with the exception of deck cranes.

Wire ropes which do not run on rope drums and/or over rope pulleys (carrying ropes and tensioning ropes) and sling ropes are not dealt with in this Standard.

2 Purpose

The purpose of the procedure for the calculation of rope drives recommended in this Standard is to ensure an adequate degree of safety of operation of the lifting appliance and to achieve an adequate service life for the wire ropes used.

3 Concepts

A "rope drive" within the meaning of this Standard comprises the wire ropes running on rope drums and on or over rope pulleys, as well as the associated rope drums, rope pulleys and compensating pulleys.

Compensating pulleys are rope pulleys over which the wire rope normally runs during operation, over a segment not exceeding three times the diameter of the wire rope.

The term "grab" in this Standard applies only to the load suspension devices defined in DIN 15002.

4 Calculation of rope drive

When calculating the rope drives, the following factors which influence the service life of a wire rope must be taken into consideration:

1. Mode of operation (drive group)
2. Wire rope diameter (coefficient c)
3. Diameters of rope drums, rope pulleys and compensating pulleys [coefficient $(h_1 \cdot h_2)$]
4. Rope grooves

4.1 Mode of operation (drive group)

The mechanical components of cranes and serial lifting appliances, i.e including the rope drives, shall be graded according to their mode of operation into a "drive group" in accordance with Table 1 below, in order to achieve an adequately long service life. The grading is made according to running time categories, which take the average running time of the rope drive into account, and also according to load collectives, which take the relative level of the loading or the frequency of full load occurrence into consideration. As regards the grading into running time categories, the mean running time per day, related to one year, is the determining factor.

If the service life is largely a function, in exceptional cases, of factors which lie mainly outside the rope drive itself, then one of the lower drive groups may be adopted for the purpose of calculation, rather than the drive group corresponding to the anticipated operating conditions, providing that

experience indicates that no accidents are likely to be caused thereby

a safeguard against overload is incorporated, and the rope drive is monitored during operation with particular care.

4.2 Calculation of rope diameter (coefficient c)

The rope diameter d (in mm) is determined in accordance with one of the two formulae below, from the calculated traction force on the rope S (in N) or S' (in kp):

$$d_{min} = c \cdot \sqrt{S} \qquad (1)$$

or

$$d_{min} = c' \cdot \sqrt{S'} \qquad (2)$$

Table 1. **Drive groups according to running time categories and to load collectives**[1])

Running time category	Symbol			V_{006}	V_{012}	V_{025}	V_{05}	V_1	V_2	V_3	V_4	V_5
	Mean running time per day in h, related to one year			up to 0,125	over 0,125 up to 0,25	over 0,25 up to 0,5	over 0,5 up to 1	over 1 up to 2	over 2 up to 4	over 4 up to 8	over 8 op to 16	over 16
Load collective	No	Term	Explanation	Drive group								
	1	light	maximum load occurs only infrequently	$1E_m$	$1E_m$	$1D_m$	$1C_m$	$1B_m$	$1A_m$	2_m	3_m	4_m
	2	medium	low, average and maximum loads occur with roughly equal frequency	$1E_m$	$1D_m$	$1C_m$	$1B_m$	$1A_m$	2_m	3_m	4_m	5_m
	3	heavy	maximum loads occur almost continuously	$1D_m$	$1C_m$	$1B_m$	$1A_m$	2_m	3_m	4_m	5_m	5_m
If the duration of an operating cycle is 12 minutes or longer, the rope drive may be graded one drive group lower than the drive group grading determined from the running time category and from the load collective.												

1) This Table can be dispensed with as soon as a suitable standard applicable to all drives has been elaborated.

2) See page 9