Rules for the Design of Series Lifting Equipment

Dimensions and Design of Rope Reeving Components

FEM 9.661

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2nd Edition

1 Scope

These design rules apply to rope reeving components of series hoists used either as separate units or in conjunction with other equipment, e.g. overhead travelling cranes fitted with electric hoists. These rules do not apply to combined pulling and lifting appliances, vehicle-mounted winches, and shunting capstans.

The rope reeving components comprise: running ropes, rope drums, rope sheaves and compensating sheaves.

2 Ropes

2.1 Ropes used

For use with electric hoists, preference is given to the standardized wire ropes usually employed in industry, such as ropes of normal construction, parallel construction (Seale-Warrington), and non-spinning ropes.

For ropes subject to damage or heavy wear thick-wire constructions are used to advantage.

The construction of ropes having a tensile strength > 2160 N/mm^2 and/or filling factors > 0.56 must be such that the number of broken wires in accordance with the rope discarding criteria under item 4 can be detected without fail.

Non-spinning ropes shall be used where the lifting height is large or where the load is suspended from a single rope and is not guided (1-fall reeving), even if the hook is supported on a rolling bearing.

Galvanized ropes are recommended where greater corrosion hazards exist (contact with seawater, operation in chemical plants, lifting appliance left unused in the open for some time, etc.).

2.2 Selection of ropes

Ropes are selected according to the following principles and on the above conditions:

1. The total of individual wires is $\geqq 100$
2. The tensile strength of the inidividual wires is $\geqq 1570$ N/mm^2

2.3 Rope diameter

The rope diameter is determined by applying the general formula

$$d_{min} = C \cdot \sqrt{S}$$

where

S = Maximum force in N sustained by one fall of rope

C = Coefficient covering the individual variables required for the calculation of the rope diameter

d_{min} = Minimum outer rope diameter in mm

Coefficient C is calculated as a function of the cable construction and the group of mechanisms:

$$C = \sqrt{\frac{Z_p}{\gamma \cdot f \cdot R_o \cdot \frac{\pi}{4}}}$$

Z_p = Practical safety coefficient given in table 1 according to the group of mechanisms

R_o = Tensile strength of the individual wire in N/mm^2

f = Filling factor

$$= \frac{\text{metallic cross section}}{\text{area of circle circumscribed around rope cross section}}$$

γ = Loss factor

$$= \frac{\text{minimum breaking strength of the rope}}{\text{calculated breaking strength of the rope}}$$

The safety factor of rope reeving components shall be higher for handling dangerous materials such as molten metals or reactor fuel elements. This is achieved by an increased safety coefficient Z_p according to table 1.

At least group of mechanisms 2 m must be obtained for transporting dangerous materials.

2.3.1 Practical safety coefficient Z_p

Table 1.

Group		Z_p	
FEM	ISO	transporting normal materials	transporting dangerous materials
1 D_m	M 1	3,15	–
1 C_m	M 2	3,35	–
1 B_m	M 3	3,55	–
1 A_m	M 4	4	–
2 m	M 5	4,5	5,6
3 m	M 6	5,6	7,1
4 m	M 7	7,1	9
5 m	M 8	9	9

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