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Crane safety - General design - Part 2: Load effects

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Normcommissie 345 002 "Hijswerktuigen"

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DRAFT
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English version

Crane safety - General design - Part 2: Load effects

Kransicherheit - Konstruktion allgemein - Teil 2: Lasteinwirkungen

This draft European Standard is submitted to the CEN members for CEN enquiry. It has been drawn up by Technical Committee CEN/TC 147 .

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Ref. No. prEN 13001-2:1997 E

Contents

Foreword

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directives.

For relationship with EU Directives, see informative annex Z, which is an integral part of this Standard.

This European Standard was prepared by CEN/TC 147/WG2 'Cranes - Safety - Design - General' (Secretariat DIN) under the direction of CEN/TC 147 'Cranes - Safety', the Secretariat of which is held by the British Standards Institution (BSI).

This European Standard is one Part of EN ..... The other parts are as follows:

Part 1: General principles and requirements
Part 3: Limit states and proof of competence

The text of the draft standard was submitted to the formal vote and was approved by CEN as EN .....-2 on .....

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by ....., and conflicting national standards shall be withdrawn at the latest by .....

In accordance with CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

0 Introduction

This European Standard has been prepared to be a harmonized standard to provide one means for the mechanical design and theoretical verification of cranes to conform with the essential health and safety requirements of the Machinery Directive, as amended. This standard also establishes interfaces between the user (purchaser) and the designer, as well as between the designer and the component manufacturer, in order to form a basis for selecting cranes and components.

This European Standard is a type C standard as stated in the ENV 1070: 1993.

The machinery concerned and the extent to which hazards are covered are indicated in the scope of this standard.

1 Scope

This European Standard specifies general conditions, requirements and methods to prevent mechanical hazards of cranes by design and theoretical verification.

NOTE: Specific requirements for particular types of crane are given in the appropriate European Standard for the particular crane type.

The following is a list of significant hazardous situations and hazardous events that could result in risks to persons during normal use and foreseeable misuse. Clause 4 of this standard is necessary to reduce or eliminate the risks associated with those hazards:

a) Rigid body instability of the crane or its parts;

b) Exceeding the limits of strength (yield, ultimate, fatigue);

c) Exceeding temperature limits of material or components;

d) Elastic instability of the crane or its parts.

This European Standard is applicable to cranes which are manufactured after the date of approval by CEN of this standard and serves as reference base for the European Standards for particular crane types.

2 Normative references

This European Standard incorporates, by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to, or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest editions of the publication referred to applies.

EN 292-1: 1991	Safety of machinery - Basic concepts, general principles for design Part 1: Basic terminology, methodology
EN 292-2: 1991	Safety of machinery - Basic concepts, general principles for design Part 2: Technical principles and specification
EN 292-2: 1991/ prA1: 1993	Safety of machinery - Basic concepts, general principles for design Part 2: Technical principles and specifications
prEN 292-3	Safety of machinery - Basic concepts, general principles for design - Part 3: Additional technical principles and specifications for mobility and lifting
ENV 1070: 1993	Safety of machinery - Terminology

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of this standard, the definitions given in ENV 1070: 1993 apply.

3.2 Symbols and abbreviations

The symbols and abbreviations used in this part of the standard are given in table 1.

Table 1: Symbols and abbreviations

Symbols, abbreviations	Description
a	Term used in calculating ϕ_1
A, A1 to A4	Load combinations including regular loads
A	Characteristic area of a crane member
A	Projection of the gross load on a plane normal to the direction of the wind velocity
A_c	Area enclosed by the boundary of a lattice work member in the plane of its characteristic height d
A_j	Area of an individual crane member projected to the plane of the characteristic height d
b	Width of the rail head
b	Characteristic width of a crane member
B, B1 to B5	Load combinations including regular and occasional loads
c	Spring constant
c, c_{oy}, c_{oz}	Aerodynamic coefficients
c_o	Aerodynamic coefficient of a member of infinite length
C, C1 to C9	Load combinations including regular, occasional and exceptional loads
CFF, CFM	Coupled wheel pairs of system F/F or F/M
d	Characteristic dimension of a crane member
d_i, d_n	Distance between wheel pair i or n and the guide means
e_G	Width of the gap of a rail
f	Friction coefficient
f_i	Loads

(continued)

Table 1 (continued)

Symbols, abbreviations	Description
f_{rec}	Term used in calculating v(z)
F	Force
F, F_y, F_z	Wind loads
F	Buffer force
$\hat{F}$	Maximum buffer force
$F_{(i)}$, $F_{(f)}$	Initial and final drive force
ΔF	Change of drive force
F_{x1i}, F_{x2i} F_{y1i}, F_{y2i}	Tangential wheel forces
F_y	Guide force
F_{z1i}, F_{z2i}	Vertical wheel forces
F/F, F/M	Abbreviations for Fixed/Fixed and Fixed/Moveable, characterizing the possibility of lateral movements of the crane wheels
g	Gravity constant
h	Distance between instantaneous slide pole and guide means of a skewing crane
h(t)	Time-dependent unevenness function
h_s	Height of the step of a rail
H1, H2	Lateral wheel forces induced by drive forces acting on a crane or trolley with asymmetrical mass distribution
HC1 to HC4	Hoisting classes
HD1 to HD5	Classes of the type of hoist drive and its operation method

(continued)

Table 1 (continued)

Symbols, abbreviations	Description
i	Serial number
IFF, IFM	Independent wheel pairs of system F/F or F/M
j	Serial number
k	Serial number
K	Factor used in calculating v_g
K1, K2	Roughness factors
l	Span of a crane
l	Aerodynamic length of a crane member
l_o	Geometric length of a crane member
m	Mass of the gross or hoist load
m	Mass of the crane and the hoist load
Δm	Released or dropped part of the hoist load
MDC1, MDC2	Mass distribution classes
n	Number of wheels at each side of the crane runway
n	Exponent used in calculating γ_n
n	Exponent used in calculating the shielding factor η
p	Number of pairs of coupled wheels
q	Equivalent static wind pressure
$\bar{q}$	Mean wind pressure
q(z)	Equivalent static out-of-service wind pressure

(continued)

Table 1 (continued)

Symbols, abbreviations	Description
q(3), q(10)	Wind pressure at v(3) or v(10)
r	Wheel radius
R	Out-of-service wind recurrance interval
Re	Reynold number
s_g	Slack of the guide
s_y	Lateral slip at the guide means
s_{yi}	Lateral slip at wheel pair i
S	Load effect
$\hat{S}$	Maximum load effect
S1, S2	Stability classes
$S_{(i)}$, $S_{(f)}$	Initial and final load effects
ΔS	Change of load effect
t	Time
u	Buffer stroke
$\hat{u}$	Maximum buffer stroke
v	Travelling speed of the crane
v	Wind velocity
$\bar{v}$	Constant mean wind velocity
$\bar{v}$ *	Constant mean wind velocity if the wind direction is not normal to the longitudinal axis of the crane member under consideration

(continued)

Table 1 (continued)

Symbols, abbreviations	Description
$v(z)$	Equivalent static out-of-service wind velocity
$v(z)^*$	Equivalent static out-of-service wind velocity if the wind direction is not normal to the longitudinal axis of the crane member under consideration
$v(3)$, $v(10)$	Gust wind velocity averaged of a period of 3 or 10 seconds
v_g	Three seconds gust amplitude
v_h	Hoisting speed
$v_{h,max}$	Maximum steady hoisting speed
$v_{h,CS}$	Steady hoisting creep speed
$v_m(z)$	Ten minutes mean out-of-service wind velocity in the height z
v_{ref}	Reference out-of-service wind velocity
w_b	Wheel base
z	Height above ground level
z(t)	Time-dependent coordinate of the mass centre
α	Relative aerodynamic length
α	Angle between the direction of the wind velocity $\bar{v}$ or v(z) and the longitudinal axis of the crane member under consideration
α	Skewing angle
α_g	Part of the skewing angle α due to the slack of the guide
α_G	Term used in calculating ϕ_4
α_s	Term used in calculating ϕ_4
α_t	Part of the skewing angle α due to tolerances

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