SLOVENSKI STANDARD
SIST EN 12195-1:2004

01-junij-2004

Naprave za varovanje tovora na cestnih vozilih ï Varnost ï 1. del: Izraļ un priveznih sil

Load restraint assemblies on road vehicles - Safety - Part 1: Calculation of lashing forces

Ladungssicherungseinrichtungen auf Straßenfahrzeugen - Sicherheit - Teil 1: Berechnung von Zurrkräften

Dispositifs d'arrimage des charges a bord des véhicules routiers - Sécurité - Partie 1: Calcul des tensions d'arrimage

Ta slovenski standard je istoveten z: EN 12195-1:2003

ICS:

53.080	Skladiġ na oprema	Storage equipment
55.180.99	Drugi standardi v zvezi z distribucijo blaga s prevozom	Other standards related to freight distribution of goods

SIST EN 12195-1:2004 en

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12195-1

December 2003

ICS 55.180.99

English version

Load restraint assemblies on road vehicles - Safety - Part 1: Calculation of lashing forces

Dispositifs d'arrimage des charges à bord des véhicules routiers - Sécurité - Partie 1: Calcul des tensions d'arrimage

Ladungssicherungseinrichtungen auf Straßenfahrzeugen - Sicherheit - Teil 1: Berechnung von Zurrkräften

This European Standard was approved by CEN on 1 September 2003.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 12195-1:2003 E

Contents

Foreword

This document (EN 12195-1:2003) has been prepared by Technical Committee CEN/TC 168 "Chains, ropes, webbing, slings and accessories - Safety", the secretariat of which is held by BSI.

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 June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This European Standard was prepared by WG 6 "Load restraint assemblies" of CEN/TC 168 "Chains, ropes, webbing, slings and accessories", the secretariat of which is held by BSI.

This European Standard has been prepared under a Mandate given to CEN by the European Commission and the European Free Trade Association.

The parts of EN 12195 "Load restraint assemblies on road vehicles – Safety" are:

Part 1: Calculation of lashing forces

Part 2: Web lashing made from man-made fibres

Part 3: Lashing chains

Part 4: Lashing steel wire ropes

Annex A to Annex D are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This Part of EN 12195 has been prepared to provide one means of conforming with the essential safety requirements to calculate lashing forces for load restraint assemblies to be used in the Common European Market and thus enabling the free movement of goods.

The extent to which hazards are covered is indicated in the scope of this standard. In addition, load restraint assemblies for securing of loads on vehicles should conform as appropriate to the other parts of this standard and EN 292 for hazards which are not covered by this standard.

1 Scope

This Part of EN 12195 specifies acceleration coefficients for surface transport. It also gives methods of calculation of lashing forces acting on goods on load carriers, lorries, trailers and swap bodies, either on road, on vessels or by rail and/or combinations thereof for different types of load and different types of lashing. It excludes the hump shunting during railway transport (web lashings see EN 12195-2, lashing chains see EN 12195-3, wire lashing ropes see prEN 12195-4).

The lashing forces to be chosen for calculation in this EN 12195-1 are static forces produced by tensioning of lashings and dynamic forces, which act on the lashing as a reaction of the load movements.

Instructions for the application of calculations are also specified.

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 edition of the publication referred to applies (including amendments).

EN 12195-2:2000, *Load restraint assemblies on road vehicles — Safety — Part 2: Web lashing made from man-made fibres.*

EN 12195-3, *Load restraint assemblies on road vehicles — Safety — Part 3: Lashing chains.*

prEN 12195-4, *Load restraint assemblies on road vehicles — Safety — Part 4: Lashing steel wire ropes.*

3 Terms, definitions, symbols, units and abbreviations

For the purposes of this European Standard, the following terms, definitions, symbols, units and abbreviations apply.

3.1 General terms and definitions

3.1.1
load restraint assembly
systems and devices for the securing of loads

[EN 12195-2:2000]

3.1.2
lashing
flexible device used in the securing of the load on a load carrier

3.1.3
tensioning device
mechanical device inducing and maintaining a tensile force in a load restraint assembly (e. g. ratchets, winches, overcentre buckles)

[EN 12195-2:2000]

3.1.4
tension force indicator
device which indicates the force applied to the lashing system by means of the tension devices and movement of the load or elastic deformation of the vehicle body, acting on the lashing equipment

[EN 12195-2:2000]

3.1.5
attachment point
rigid part of the load, e. g. eyebolt, to place the load restraint assembly

3.1.6
lashing point
securing device on a load carrier to which a lashing may be directly attached; a lashing point can be e. g. an oval link, a hook, a ring or a lashing shoulder

[EN 12195-2:2000]

3.1.7
standard tension force S_{TF}
residual force after physical release of the handle of the tensioning device

3.1.8
frictional lashing method
lashing procedure where the friction force is enhanced by adding a vertical force component to the weight of the load

3.1.9
direct lashing method
lashing procedure where the lashings are fixed directly to the solid parts of the load or to attachment points, that are intended for this purpose

3.2 Definition of calculation parameters

3.2.1
mass of the load m
mass which is to be secured

3.2.2
acceleration of the load a
maximum acceleration of the load during a specific type of transportation

3.2.3
acceleration coefficient c
coefficient which when multiplied by the acceleration due to gravity g gives the acceleration $a = c\ g$ of the load during a specific type of transportation

3.2.4
longitudinal force of the load F_x
inertia force, which acts on the load as a result of the vehicle movements in the longitudinal axis (x-axis) of a load carrier ($F_x = m\ c_x\ g$)

3.2.5
transverse force of the load F_y
inertia force, which acts on the load as a result of the vehicle movements in the transverse axis (y-axis) of a load carrier ($F_y = m\ c_y\ g$)

3.2.6
vertical force of the load F_z
sum of forces that arise from the weight of the load and the inertia force which acts on the load ($F_z = m\ c_z\ g$) due to the load carrier movements during the transport in the vertical axis (z-axis) of a load carrier

3.2.7
static friction factor μ_S
coefficient of static friction between the load and the adjoining surface

3.2.8
dynamic friction factor μ_D
coefficient of friction between the load and the supporting surface during the movement of load

3.2.9
friction force F_F
force acting due to the friction between load and the loading area of a vehicle against the movement of the load

3.2.10
blocking force F_B
force acting on a blocking device in a specified direction

3.2.11
blocking capacity BC
maximum force that a blocking device is designed to carry in a specified direction

3.2.12
number n
number of lashings

3.2.13
tension force of a lashing F_T
force in the lashing created by tensioning of a tensioning device

3.2.14
coefficient k
coefficient which allows for the loss of tension force due to friction between lashing and load

3.2.15
restraining force of a lashing F_R
force carried by a lashing due to the movements of a load carrier during transport

3.2.16
lashing capacity LC
maximum allowable direct force that a lashing may sustain in use

3.2.17
vertical angle α
angle between lashing and loading area of a load carrier

3.2.18
longitudinal angle β_x
angle between lashing and longitudinal axis (x-axis) of a load carrier in the plane of the loading area

3.2.19
transverse angle β_y
angle between lashing and transverse axis (y-axis) of a load carrier in the plane of the loading area

3.3 Symbols, units and terms

Table 1 — Symbols, units and terms

Symbol	Unit	Terms
BC	kN	Blocking capacity
F_B	kN	Blocking force
F_R	kN	Restraining force of a lashing
F_T	kN	Tension force of a lashing
F_x	kN	Longitudinal force actuated by the load
F_y	kN	Transverse force actuated by the load
F_z	kN	Vertical force actuated by the load
F_F	kN	Friction force
F_{FM}	kN	Friction force as result of the vertical force F_z
F_{FR}	kN	Friction force as result of the restraining force F_R
F_{FT}	kN	Friction force as result of the tension force F_T
LC	kN	Lashing capacity
S_{TF}	kN	Standard tension force
a	m/s²	Acceleration
b	m	Lever arm of the standing moment
c	—	Acceleration coefficient
d	m	Lever arm of the tilting moment
h	m	Lever arm of the lashing moment
g	m/s²	Gravitational acceleration
g_n	m/s²	Standard acceleration due to gravity g_n = 9,80665 m/s²
k	—	Coefficient of transmission
m	t (100kg)	Mass of the load
n	—	Number of lashings
w	m	Width of the load
α	Degree	Vertical angle
β_x	Degree	Longitudinal angle
β_y	Degree	Transverse angle
μ_S	—	Friction factor static
μ_D	—	Friction factor dynamic

4 Acceleration coefficients

4.1 General

The acceleration coefficients given in the tables 2, 3 and 4 are specified according to 3.2.2 and 3.2.3 as maximum values for a load on a vehicle for the specific type of transportation.

NOTE These values correspond with the IMO/ILO/UN/ECE Guidelines for packing of Cargo Transport Units (CTUs), but provide safer conditions by using μ_D.

Combinations of longitudinal and transverse accelerations occurring during transport, e. g. values below the maximum values, are covered by the values of the tables.

Superposition of the weight of the load with high frequency stresses and occasional occurring shock loadings of short duration are absorbed by the flexibility of the lashings and the shock absorber system of the lorries and trailers. This occurs without any significant increase of stress, so that this can be ignored for the purpose of this standard which gives a practical and not a scientific view.

4.2 Load on lorries and trailers during road transport

The value for the longitudinal acceleration in the IMO regulation as well as in the national regulations has been set to 1 in connection with the friction factor μ_S. During road transport, the vibrations cause a kind of levitation. For the calculation purposes of this standard this is implemented using μ_D and the table value for the longitudinal acceleration 0,8 instead of 1 in connection with μ_S.

The acceleration coefficients for lorries and trailers during road transport shall be as given in Table 2.

Table 2 — Acceleration coefficients c_x, c_y and c_z during road transport

Securing in	Acceleration coefficients				
	c_x, longitudinally		c_y, transversely		c_z, vertically down
	forward	rearward	sliding only	tilting	
longitudinal direction	0,8 [a]	0,5	—	—	1,0
transverse direction	—	—	0,5	0,5 + 0,2 [b]	1,0

[a] instead of IMO = 1 in combination with μ_S.

[b] + 0,2 only for unstable loads.

4.3 Load on lorries and trailers during rail transport

The acceleration coefficients for lorries and trailers during rail transport shall be as given in Table 3.

Table 3 — Acceleration coefficients c_x, c_y and c_z during rail transport

Securing in	Acceleration coefficients				
	c_x, longitudinally		c_y, transversely	c_z, minimum vertically down	
	tilting	sliding		tilting	sliding
longitudinal direction	0,6	1,0	—	1,0	1,0
transverse direction	—	—	0,5	1,0	0,7

4.4 Load on lorries and trailers during sea transport

The acceleration coefficients for lorries and trailers during sea transport shall be as given in Table 4.

Table 4 — Acceleration coefficients c_x, c_y and c_z during sea transport

Sea area	Securing in	Acceleration coefficients		
		c_x, longitudinally	c_y, transversely	c_z, minimum vertically down
A	longitudinal direction	0,3	—	0,5
	transverse direction	—	0,5	1,0
B	longitudinal direction	0,3	—	0,3
	transverse direction	—	0,7	1,0
C	longitudinal direction	0,4	—	0,2
	transverse direction	—	0,8	1,0

NOTE See IMO regulations.

A Baltic sea

B Southern part of North sea/Mediterranean sea

C Unrestricted

5 Methods of calculation

5.1 General

The general requirements for a safe transport are:

- the sum of forces in any direction equals zero;

- the sum of moments in any plane equals zero.

Web lashings according to EN 12195-2, lashing chains according to EN 12195-3 and wire lashing ropes according to prEN 12195-4 have to sustain the forces and moments, longitudinally, transversely and vertically, the lashing and the cargo unit are supposed to sustain.

Generally, load securing consists of balancing the forces of a load by locking, blocking and/or lashing. Locking, a completely positive connection, is mainly used in the transport of containers and is not usually combined with lashings. Blocking results in a positive connection in the blocked direction only and therefore is often combined with lashings. This is taken into consideration in 5.3, 5.4 and 5.5.

The two basic lashing methods are:

— frictional lashing (see 3.1.8) is characterized by a restraint that is produced by force on the loading area and a positive connection in the direction vertically down;

— direct lashing (see 3.1.9) is a completely positive connection which permits the load to make small movements, the magnitudes of which depend on the flexibility of the lashing and forces acting on the load.

The frictional lashing method is described in 5.4, the direct lashing method in 5.5.

5.2 Stability of an unlashed load

The stability of a load should be determined both in longitudinal direction (x-axis) and in transverse direction (y-axis).

Using the designations of Figure 1, the stability condition for a load is specified as follows:

$$F_z \cdot b_{x,y} > F_{x,y} \cdot d$$

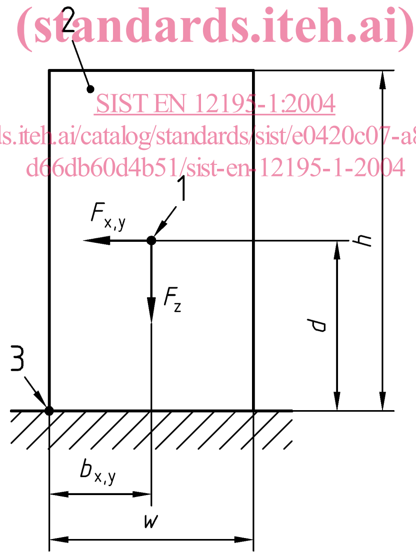
$$b_{x,y} > \frac{F_{x,y}}{F_z} d$$

$$b_{x,y} > \frac{c_{x,y}}{c_z} d \quad (1)$$

The quantities c_x, c_y and c_z are the acceleration coefficients in accordance with clause 4.

If the condition of equation (1) is met, a load is stable. An unstable load will have a high centre of gravity in relation to the dimensions of the bottom surface. In the case of an unstable load the risk of tilting over should be taken into account.

To stabilize against tilting, for over top lashing 5.4.2 is applicable, for slope lashing 5.5.2 and for diagonal lashing 5.5.3 is applicable. In both cases the factor c_y of 0,5 of Table 2 shall be used; for unstable loads c_y = 0,7.



Key

1 Center of gravity
2 Load
3 Tilting edge

Figure 1 — Stability of an unlashed load