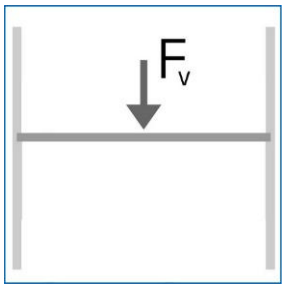
INFORMATION

Characteristics of load and solidity

Certified in cooperation with the Fraunhofer Institute IML, Germany

1. Systems for creating loading levels

Characteristics of load of the respective crossbar types for application in all variations of CORFEX®-supports



Crossbar	Force F_v per level in daN
38/75	200
70/70	350
80/80	500
80/100	700[1] / 500[2]

Force data are quasi-static maximum permissible load values and contain a security factor of 15%.

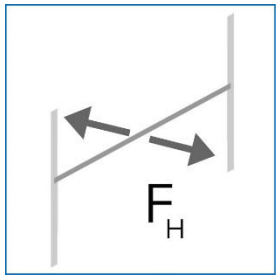
Dynamic factors of influence are still to be considered depending on the respective carrier of traffic.

1 daN = 1,02 kg = 2,248 lb

[1] Force on 1st level / [2]Force on 2nd and 3rd level

2. Systems for restraint and bump (securing of cargo)

Hold forces of the respective crossbar types for application in CORFEX®-supports of systems to restraint and bump the cargo



Crossbar	Force F_H per level in daN
~~38/75~~	only for creating loading levels!
70/70	400
80/80	500
80/100	500

Force data are quasi-static maximum permissible load values and contain a security factor of 15%.

Acceleration and friction factors of influence are still to be considered depending on the respective carrier of traffic.

1 daN = 1,02 kg = 2,248 lb

PLEASE, note!

Preceding forces data serve as a basis for further calculations of load safeguarding measures according to the CTU code of 2014 (http://www.imo.org).
The calculation of load safeguarding measures occurs on the basis of a force balance:

$$c_x \cdot m \cdot g < \mu \cdot m \cdot (1-c_z) \cdot g + F\ [kN]$$

c_x = acceleration coefficient in longitudinal direction (X-axis)
c_z = acceleration coefficient down (Z-axis)
m = mass of cargo
g = gravitational acceleration 9.81 m/s²
μ = friction factor between cargo and contact surface (container/crossbar)

applicable acceleration coefficient and friction factors see in attachments 1 and 2

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Attachment 1:
Applicable acceleration coefficients to respective carriers of traffic:

(Source: IMO/ILO/UNECE code of practice for packing of cargo transport units – CTU-Code)

Road transport				
Securing in	**Acceleration coefficients**			
	Longitudinally (c_x)		Transversely (c_y)	Minium vertically down (c_z)
	forward	rearward		
Longitudinal direction	0,8	0,5	-	1,0
Transverse direction	-	-	0,5	1,0

Rail transport (combined transport)				
Securing in	**Acceleration coefficients**			
	Longitudinally (c_x)		Transversely (c_y)	Minium vertically down (c_z)
	forward	rearward		
Longitudinal direction	0,5 (1,0)[1]	0,5 (1,0)[1]	-	1,0 (0,7)[1]
Transverse direction	-	-	0,5	1,0 (0,7)[1]
[1]The values in brackets apply to shock loads only with short impacts of 150 milliseconds or shorter, and may be used, for example, for the design of packaging.				

Sea transport					
Significant wave height in sea area		**Securing in**	**Acceleration coefficients**		
			Longitudinally (c_x)	Transversely (c_y)	Minimum vertically down (c_z)
A	$H_s \leq 8$ m	Longitudinal direction	0,3	-	0,5
		Transverse direction	-	0,5	1,0
B	8 m < $H_s \leq 12$ m	Longitudinal direction	0,3	-	0,3
		Transverse direction	-	0,7	1,0
C	$H_s > 12$ m	Longitudinal direction	0,4	-	0,2
		Transverse direction	-	0,8	1,0

A : Baltic Sea (incl. Kattegat), Mediterranean Sea, Black Sea, Red Sea, Persian Gulf, Central Atlantic Ocean, Central Indian Ocean, Central Pacific Ocean
B : North Sea, Skagerak, English Channel, Sea of Japan, Sea of Okhotsk, South-Central Atlantic Ocean, South-Central Indian Ocean, South-Central Pacific Ocean
C : unrestricted

All information without guarantee. Mistakes and changes reserved. Further and detailed information are revealed at the CTU code.

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Attachment 2:
Applicable Friction factors to the respective material combinations

(Source: IMO/ILO/UNECE code of practice for packing of cargo transport units – CTU-Code)

Material combination in contact surface	Dry	Wet
Sawn timber/wooden pallet		
Sawn timer/wooden pallet against fabric based laminate/plywood	0.45	0.45
Sawn timer/wooden pallet against grooved aluminium	0.4	0.4
Sawn timer/wooden pallet against stainless steel sheet	0.3	0.3
Sawn timer/wooden pallet against shrink film	0.3	0.3
Planed wood		
Planed wood against fabric based laminate/plywood	0.3	0.3
Planed wood against grooved aluminium	0.25	0.25
Planed wood against stainless steel sheet	0.2	0.2
Plastic pallets		
Plastic pallet against fabric based laminate/plywood	0.2	0.2
Plastic pallet against grooved aluminium	0.15	0.15
Plastic pallet against stainless steel sheet	0.15	0.15
Cardboard (untreated)		
Cardboard against cardboard	0.2	0.2
Cardboard against wooden pallet	0.15	0.15
Big Bag		
Big bag against wooden pallet	0.4	0.4
Steel and sheet metal		
Unpainted metal with rough surface against unpainted rough metal	0.4	-
Painted metal with rough surface against painted rough metal	0.3	-
Painted metal with smooth surface against painted smooth metal	0.2	-
Metal with smooth surface against metal with smooth surface	0.2	-
Steel crates		
Steel crate against fabric based laminate/plywood	0.45	0.45
Steel crate against grooved aluminium	0.3	0.3
Steel crate against stainless steel sheet	0.2	0.2
Concrete		
Concrete with rough surface against sawn wood	0.7	0.7
Concrete with smooth surface against sawn wood	0.55	0.55
Anti-slip material		
Rubber against other materials when contact surfaces are clean	0.6	0.6
Materials other than rubber against other material	As certified or tested to appendix 3	

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Friction factors (μ) should be applicable to the actual conditions of transport. When a combination of contact surfaces is missing in the table above or if its friction factor cannot be verified in another way, the maximum allowable friction factor of 0.3 should be used. If the surface contacts are not swept clean, the maximum allowable friction factor of 0.3 or, when lower, the value in the table should be used. If the surface contacts are not free from frost, ice and snow a static friction factor of 0.2 should be used, unless the table shows a lower value. For oily and greasy surfaces or when slip sheets have been used a friction factor of 0.1 applies.

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