Planning

The technical information is provided to
- inform you about protective measures against corrosion
- help you finding the suitable products for your application
- inform you about available, castum-made products.

In order to make the use of this catalogue easier for you we use tokens and symbols. You find the explanations on the inner pocket of the back side page. If you should have any technical questions or requests about available non-standard products we are glad to help you from our headquarters in Berlin or our branch offices at any time.

Subject to technical modifications.

Corrosion prevention

Prior to choosing materials for the passing of cables it is recommended to take a look at the corrosive environmental conditions at the construction site and to determine the corrosion prevention accordingly.

For installations in regular environment, zinc coatings have proven to be protective for steel against corrosion. However, the protective zinc coat is being reduced by various climatic influences throughout the years. The following table shows the loss of coating per year:

Environmental influence and corrosion risk

Corrosion-category	Loss of thickness µm/year	Typical environment outdoors	indoors
C1 inconsider-able	≥0,1	-	Heated buildings like offices, stores, schools, hotels
C2 slight	>0,1 until 0,7	Little pollution, like rural areas	Not heated buildings with formation of condensate like store houses
C3 moderate	>0,7 until 2,1	City and industrial environments with moderate pollution	Production plants with high humidity, like laundry, brewery and dairy
C4 strong	>2,1 until 4,2	Industrial areas and coastlines with moderate salt impact	Chemical plants, swimming pools
C5-I very strong (industrial)	>4,2 until 8,2	Industrial environment with high humidity and aggressive atmosphere	Buildings or areas with almost permanent condensation and pollution
C5-M very strong (ocean)	>4,2 until 8,2	Coastlines and offshore areas with high salt impact	Buildings or areas with almost permanent condensation and pollution

(Source: EN ISO 12944-2)

The loss of thickness per year multiplied with the expected life span of the construction determins the necessary thickness of zinc coating. There are mainly three zinc coatings that differ in thickness of coating, adhesive strength and appearance.

Galvanic zinc (EN ISO 4042)

The small parts are zinced by means of electrolysis bath in which the zinc ions apply very evenly to the metal. The zinc coat is app. 5 µm thick, light glossy, and has an additional protection by succeeding bi chromium conditioning against abrasion.

Nuts and bolts (without further marking) in the catalogue are galvanic zinc coated GV. They are used for connecting Sendzimir zinc coated construction elements.

Hot galvanized according to the Sendzimir procedure (EN 10346)

The steel strapping (thickness up to 2 mm) is coated in the steel-mill with zinc (flow path procedure). The result is an evenly spread and highly adhesive zinc coat with an average thickness of 19 µm.
Damage to the zinc coat caused by cutting, punching or drilling does not result in progressing corrosion because the neighbouring zinc is dissolving under the impact of (air-)humidity and builds a protective, brown coating layer of zinc hydroxide over the blanc metal. The „migration“ of zinc ions protects free areas up until app. 2 mm width.These articles are marked with the symbol S.

Hot dip galvanized (EN ISO 1461)

The parts are hot dip galvanized after processing in liquid zinc (app. 450 C). Chemical reactions lead to various zinc-iron alloys, which are especially firmly connected to the steel core. These alloys are usually coated with a „pure zinc layer". Depending on the speed of the reaction, steel composition, time of dipping, cooling process etc., a „growing through" to the surface of the zinc-iron alloy is possible as well.

Therefore the appearance of the surface varies from dull dark grey to light glossy. This is no indication of thickness of zinc coating or quality of corrosion prevention. Humid environment can also cause a forming of zinc-hydroxide-carbonate (so called white rust). This does not influence the efficiency of the corrosion prevention. Cutting edges need to be protected with cold zinc paint (see catalogue chapter A).

According to EN ISO 1461 the average local thickness of the coating is at least
- 45 µm for material thicknesses up to 1.5 mm
- 55 µm for material thicknesses from 1.5 up to 3 mm
- 70 µm for material thicknesses from 3 up to 6 mm

The EN ISO 1461 complies basically with

BS EN ISO 1461	in Great Britain
EN ISO 1461	in France
NEN EN 1461	in USA

All types of cable trays and medium- heavy / heavy support systems are deliverable conditional of manifactoring in hot dip galvanized. This program is marked with the symbol F.

Stainless steel

Considering the aspects of high corrosion resistance, easily cleanable surface, ability of recycling, and fire resistance, stainless steel becomes increasingly the material of first choice. Especially for the chemical, paper, textile and food industry, in sewages, refineries, car tunnels and in off-shore areas it is being commonly used.

Regarding the long lasting life cycle of such constructions, stainless steel is often times the economically most suitable solution in spite of the higher initial investment. In case of insufficient corrosion resistance the investments are accelerated by business interruption, rearrangement of cable loads, exchange of structural components.
Compared to various plastic materials stainless steel features through high firmness, resistance against fire and heat, as well as the emission free mannor in case of fire and mechanical processing.

The commonly used material No.: 1.4301 is marked with the short description X5CrNi 18-10 according to EN 10088-2 and has been approved by the German Institute for Construction Engineering in Berlin under the general admittance Z-30.3-6 for construction processes.

Assignment to recent and outdated norms:

EN 10088-2	1.4301 X5CrNi 18-10
AISI	304
UNS	S 30400
BS	304 S31
AFNOR	Z7CN 18-09
DIN	17441

PUK offers a complete high-grade steel program made of: bracket supports, brackets, cable trays, ladders, vertical ladders, channels and cable clamps.
Nuts and bolts comply to steel-group A2 (according to ISO 3506). This is indicated with the symbol E.

The stainless steel program is available on request in material No. 1.4571 with the short appellation X6CrNiMoTi17-12-2 (according to EN 10088-2) and has been also certified by the German Institute for Construction Engineering in Berlin.
Nuts and bolts comply to steel-group A4 (according to ISO 3506).

Assignment to recent and outdated norms:

EN 10088-3	1.4404 X2CrNiMo 17-12-2
AISI	316 L
UN	S 31603
BS	316 S 11
AFNOR	Z3CND17-11-02/ Z3CND 17-12-02/
DIN 17440	1.4404

Alternatively available in 1.4571. This steel type is marked with E4.

Other materials of the same corrosion category available on request.

For special applications (light- and cable support constructions in car tunnels according to ZTV-ING) the high alloyed material No. 1.4529 is available.

Plastic Coating

For the use in zinc aggressive environments (pH index < 6 or > 12.5) or for indication through colours, zinc-coated construction parts can be coated with plastic on request (for example with epoxy or polyester).

Cable trays

The choice is made based on:

1. the number or volume of cables to be passed in a cable tray (load carrying capacity of the tray)
2. the distance between the support points of the tray (type of the tray)
3. the distance between the support points of the tray (load carrying capacity of the tray)

Re 1. Cable capacity / usable diameter

If the cable volume (type of cables, size, number) is not known, table 1 can help with the estimation: For cables of any size the volume needed is multiplied with the number of cables in order to determine the total sum. The result is the minimum cross section area of the cable tray needed, which may have to be extended by a standby factor). The regulations of the VDE 0100 regarding the load of cable trays must be observed in all cases.

Table 1: Space requirements for cables type NYY

Cable NYY	Diameter (mm)	Space per cable (app.)	Number of cables			
4 x 1,5	12.5	1.5 cm^2	x		=	
4 x 2,5	14.0	1.8 cm^2	x		=	
4 x 6	16.5	3.0 cm^2	x		=	
4 x 16	22.0	5.0 cm^2	x		=	
4 x 35	31.0	12.0 cm^2	x		=	
4 x 70	41.0	16.0 cm^2	x		=	
				A	≥ ∑	cm^2

(Source: EN ISO 12944-2)

The usable diameter area (A) of each cable tray is specified in the catalogue. If needed, several cable trays must be installed in parallel.

Re 2. Type of cable tray / weight of cable

If the total weight of the cables is unknown, table 2 can help with the estimation: For any cable size, the cable weight is multiplied by the number of cables to determine the total sum. The result is the estimated cable load (Q).

All specifications for carrying capacity listed in this catalogue relate to the respective product. The carrying capacity of the installed system depends on the actual configuration and specifically on the operational discharge of load into the structure.

Table 2: Weight of cables type NYY

Cabel NYY	Weight of cable (app.)	Number of cables			
4 x 1.5	2.3 N/m	x		=	
4 x 2.5	3.0 N/m	x		=	
4 x 6.0	5.2 N/m	x		=	
4 x 16	11.0 N/m	x		=	
4 x 35	22.0 N/m	x		=	
4 x 70	41.0 N/m	x		=	
			Q	= ∑	N/m

With regard to security, the highest possible cable load is pivotal. It is calculated by multiplying the usable diameter by the specific cable weight*. The result (Q_{LK}) for each cable tray is listed in this catalogue.

*	type of cable tray cable ladder cable tray wire-mesh cable tray	Cable performance cable (Q_{LK}) control cable (Q_{SK}	specific cable weight 2,8N/m pro cm^2 1,5 N/m pro cm^2

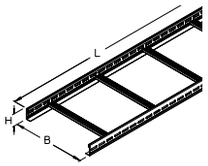
Re 3. Distance between supports (StA)

The recommended distance between supports is 1.5 meters. Nevertheless, the actual possible distance between supports can be considerably higher (up to 10 m), depending on available points of fastening (pillars, supporting structures).

The capacity diagrams of the cable trays list the maximal load capacity (Q_{max}) a cable tray can carry securely with the given support distance.

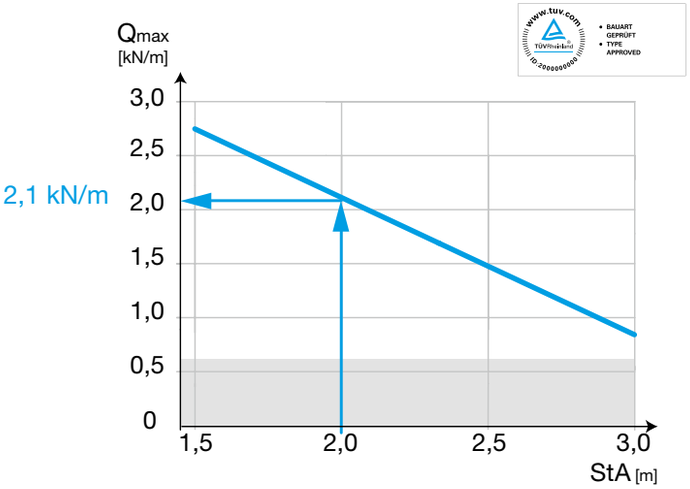
Please observe the following calculation examples!

How to determine the additional load based on the example LGG 60-40 with a support distance StA of 2,0 m



LGG 60 Cable ladder, height = 60 mm

Article number	H mm	B mm	L mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F | E						
LGG 60-20	60	200	6000	81	0,23	2,64
LGG 60-30	60	300	6000	122	0,34	2,87
LGG 60-40	60	400	6000	162	0,45	3,1
LGG 60-50	60	500	6000	203	0,57	3,33
LGG 60-60	60	600	6000	243	0,68	3,56



The difference between the maximum load capacity and the possible cable load equals the highest permissible additional load:

Q_{max} = 2,10 kN/m
Q_{LK} = -0,45 kN/m
add. load = 1,65 kN/m

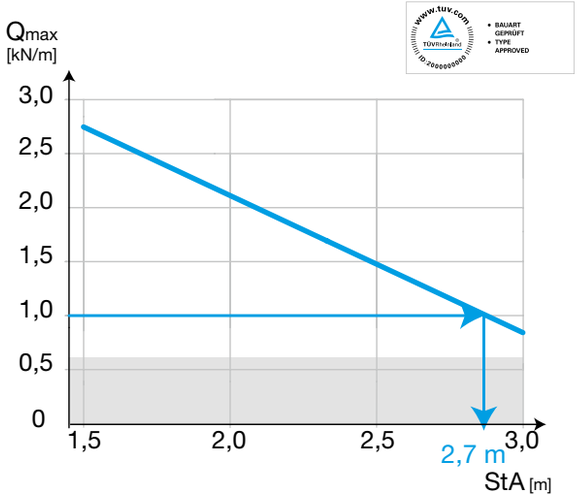
The cable tray load diagrams furthermore provide the maximum permissible support distance figures when the load is known.

How to determine the maximum support distance StA based on the example LGG 60-60:

LGG 60 Cable ladder, height = 60 mm

Article number	H mm	B mm	L mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F | E						
LGG 60-20	60	200	6000	81	0,23	2,64
LGG 60-30	60	300	6000	122	0,34	2,87
LGG 60-40	60	400	6000	162	0,45	3,10
LGG 60-50	60	500	6000	203	0,57	3,33
LGG 60-60	60	600	6000	243	0,68	3,56

Cable load = 0,68 kN/m
add. load = 0,40 kN/m
Q_{max} = 1,08 kN/m



Maximum distance between supports is 2.7 meters.

The load capacity diagrams allow for a security reserve of at least 70% until possible failure (according to DIN EN 61537). Nevertheless cable trays may not be used for walking!
If the maximum load capacity (Q_{max}) or the maximum distance between supports of the selected cable tray is insufficient, types with a higher load capacity must be considered.
If these do not meet the requirements either, a cable tray type with a higher load capacity must be chosen:

light ⇨ heavy:
Wire-mesh cable tray ⇨ cable tray ⇨ cable ladder ⇨ wide-span cable tray

Wide-span cable trays

are suitable for wide distances between supports. The load carrying capacity of such “cable bridges” primarily depends on the firmness and thus on the height of the side profiles. However, an increased side height also means an increased volume capacity and thus a higher maximum cable load.

This generally leads to the risk of unplanned overloads / overstress; therefore the wide-span cable trays offer the following solutions to said risk:

– an elevated cable tray bottom
– electrically welded connection of side rail and rung
– almost symmetric torsion-free side rail profiles
– at least 70% of security reserve in the load carrying capacity specifications* (see explanations EN 61537)

This information applies to all wide-span cable trays if side rail supports (WPHS) are mounted at the support point (bracket).

Cable trays may not be used for walking or as ladders. Wide-span cable trays may have a higher volume capacity than load carrying capacity depending on the distance between supports. Specifications on load carrying capacity based on the distance between supports need to be complied with.

Supporting structures

As a rule, supporting structures for the trace route contain on ceilings of steel bracket and ceiling bracket support (stem) and on walls of wall bracket or bracket support and stem bracket.
In order to select construction pieces of sufficient weight load ability, firstly the load of each cable tray at the support point must be determined:

Bracket load P = (cable load Q + weight of cable tray w + additional load) x distance between supports StA
P = (Q + w) x StA

1. Bracket (extension)

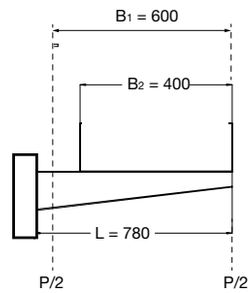
The load carrying capacity of the bracket (P_{max}) must be higher than the above determined bracket load (P).
Please note that the load carrying capacity of the cable tray depends on the width of the selected cable tray (B_2). The load carrying capacity tables always presume the respective size of cable tray / bracket ($L \approx B_1 \approx B_2$).
However, if the bracket is considerably longer and the cable tray is laid flush with the bracket tip, the following is valid by approximation: For example Konsole KWS 070 and cable ladder LGG 60-40:

KWS Wall bracket, heavy

Article number	B mm	L mm
F		
KWS 020	200	280
KWS 030	300	380
KWS 040	400	480
KWS 050	500	580
KWS 060	600	680
KWS 070	600	780

LGG 60 Cable ladder

Article number	H mm	B mm
S | F | E		
LGG 60-20	60	200
LGG 60-30	60	300
LGG 60-40	60	400
LGG 60-50	60	500
LGG 60-60	60	600



applies as follows:

$$P_{zul} \approx P_{max} \left(\frac{L - \frac{B_1}{2}}{L - \frac{B_2}{2}} \right)$$

L = Length of the bracket
B1 = verified width of the cable tray
(at L ≤ 580 mm B1 ≈ L;
at L > 580 mm B1 = 600 mm)
B2 = selected width of the cable tray

The load carrying capacity specifications correspond to the values verified and certified according to EN 61537.

2. Ceiling bracket support (stem)

Ceiling bracket supports are stressed mainly by bending forces in case of one sided mounting of cable trays. Each individual bracket causes a so-called bending moment (M_i) in the stem which is determined by the bracket load (P_i) and overhang length (l_i) - (M = P x l). The overhang length depends on the bracket length (L) and on the width of cable tray (B).

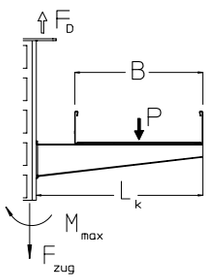
The sum of the individual bending moments (M_i) must not exceed the permissible moment (M_{max}). The Mmax for every stem is specified in the catalogue.

If cable trays are mounted to both stem sides, the above said must apply to each of the two sides, since a one-sided equipment with cables (during the laying of cables) can usually not be excluded.

In order to simplify the choice of the suitable stem, the maximum bracket load (P_{max}) is specified for every cable tray width (B) with the corresponding bracket length (L_K).

If only one cable tray is to be fastened to the stem on one side (or only cable trays of equal width), the table determines directly whether $P \leq P_{max}$ (resp. $\sum P_i \leq P_{max}$) applies.

Example: KDI



KDI Bracket support, heavy, profile

Article number	B mm	L_K mm	P_{max} L>1000 kN	P_{max} L<1000 kN	F_D/P
F					
KDI 01	100	120	20,0	14,5	1,3
KDI 02	200	220	13,8	10,0	1,6
KDI 03	300	320	10,5	7,6	1,9
KDI 04	400	420	8,5	6,2	2,3
KDI 05	500	520	7,1	5,2	2,6
KDI 06	600	620	6,1	4,4	3,0

L ≤ 1000: M_{max} = 1600 Nm

L > 1000: M_{max} = 2200 Nm F_{zug} = 20 kN

Example: LGG 60-40

B = 400, stem length < 1m

P_{max} = 6,2 kN

If cable trays of different widths require a one-sided mounting to the stem, the share of the maximum load must be calculated for each individual cable tray width: PB / PB_{max}.

The sum of all these shares for the selected stem must be ≤ 1,0:

$$\sum \frac{P_B}{P_{B\,max}} < 1$$

Example: Two cable ladders, type LGG 60, have to be mounted single-sided to brackets on a ceiling bracket support.

The distance between the supports (StA) is 1.5 meters.

LGG 60 Cable ladder, height = 60 mm

Article number	H mm	B mm	L mm	A cm^2	Q_{sk} kN/m	G kg/m
S | F | E						
LGG 60-20	60	200	6000	81	0,23	2,64
LGG 60-30	60	300	6000	122	0,34	2,87
LGG 60-40	60	400	6000	162	0,45	3,10
LGG 60-50	60	500	6000	203	0,57	3,33
LGG 60-60	60	600	6000	243	0,68	3,56

KDU 52 Bracket support

Article number	B mm	L_K mm	P_{max} kN	F_D/P
F | E				
KDU 52-01	100	120	7,2	1,4
KDU 52-02	200	220	4,7	1,9
KDU 52-03	300	320	3,5	2,3
KDU 52-04	400	420	2,8	2,8
KDU 52-05	500	520	2,3	3,3
KDU 52-06	600	620	2,0	3,8

cable ladder width	B_1 = 400 mm	B_2 = 600 mm
bracket length	L_1 = 420 mm	L_2 = 620 mm
cable load (based on catalogue):	Q_{LK} = 450 N/m	Q_2 = 680 N/m
plus weight of cable lader:	31 N/m	35,6 N/m
equals sum of load:	481 N/m	715,6 N/m
Sum of load	481 N/m	715,6 N/m
multiplied by distance between supports	x 1,5 m	x 1,5 m
equals bracket load:	P_1 = 721,5 N	P_2 = 1.073,4 N
For bracket support KDU 52 (based on catalogue):	$P_{max\ 400}$ = 2,8 kN	$P_{max\ 600}$ = 2,0 kN
The sum of shares equals:	$\sum \frac{P_B}{P_{B\,max}} = \frac{721{,}5\ N}{2.800\ N} + \frac{1.073{,}4\ N}{2.000\ N} = 0{,}8\ (< 1)$	

According to the above calculation, the selected bracket support may be used. However, if

$$\sum \frac{P_B}{P_{B\,max}} > 1$$

either a bracket support with a higher load capacity must be used or the support distance must be reduced.

The load capacity specifications correspond to the values verified and certified according to DIN EN 61537.

In the process of laying cables, high additional loads can occur. These additional loads may not be discharged into the cable support system.

All specifications for carrying capacity listed in this catalogue relate to the respective product. The carrying capacity of the installed system depends on the actual configuration and specifically on the operational discharge of load into the construction piece. In the process of laying cables, high additional loads can occur. These additional loads may not be discharged into the cable support system.

The following illustration can merely serve as additional support when applying dowel approvals; the approval specifications alone are binding.

Permissible dowal load F_{zul}

The vectorial overlay of various strength components effective at the anchorage point (e.g. shear force and vertical extraction force) yields the dowel load that must be lower /equal compared to the allowable dowel load listed in the approval (generally applies to all diagonal pull directions). The allowable dowel load depends on the anchorage ground material (concrete grade, brickwork stone type, etc.) as well as on its voltage load:

- cracked concrete tension zone
- verified concrete compression zone (e.g. concrete wall, support, the upper concrete beam half).

In cases of doubt, consult the responsible structural engineer.

Reduction

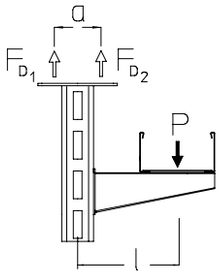
The allowable dowel load must be reduced,

– if several dowels have a smaller distance between each other than measure a (centre to centre distance).

– if the distance between the dowel and a structure edge or corner is smaller than measure ar (edge distance).

The factor for the calculation of the dowel load F_D is listed in the catalogue (applies to anchors with heavier loads).

Example: Ceiling bracket support



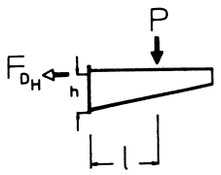
$$F_{D1} = \frac{P}{2} - P \cdot \frac{l}{a}$$

$$F_{D2} = \frac{P}{2} + P \cdot \frac{l}{a}$$

$$\rightarrow \frac{F_D}{P} = \frac{1}{2} + \frac{l}{a}$$

By a double-sided equipment of the bracket support the higher dowel load is always reduced.

Example: Wall bracket



$$F_{DV} = P$$

$$F_{DH} = P \cdot \frac{l}{h}$$

$$\rightarrow \frac{F_D}{P} = \sqrt{1 + (\frac{l}{h})^2}$$

When planning the route, please generally observe that the filling volume of the cable trays may exceed the carrying capacity of the cable trays. A sufficient extent of reserves must be included; if needed multi-layer reserves should be allowed for.

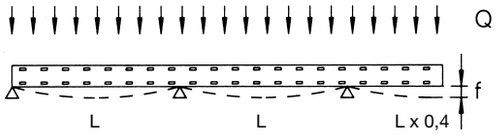
See the two examples from practice on the following pages!

Cable support systems

Among other things, the DIN EN 61537 regulates the following. The procedure in which mechanical characteristics of cable support elements are to be tested.

To be tested are:

a) Cable trays including connectors in specific configurations (end field, (without connector), middle field)



L = delivery length

The conditions do not correspond to those of the most advantageous continuous support applications.

b) Brackets as single construction components, i. e. without the stiffening effect of mounted cable trays.

The load bearing capacity specifications are based on the measured loads at a still permissible level of deformation (f_{zul}) of the test samples. Cable support elements in the particular standard version (Sendzimir / hot dip galvanized) were tested.

Cable trays

were tested under a specially developed testing condition ensuring that components which bend elastically under loads are strained evenly across the surface.

f_{zul} (longitudinal direction)= 0.01 x support spacing
f_{zul} (transverse direction) = 0.05 x cable tray width,

Arms/brackets

Under a vertical load the tips of the arms may lower by:

f_{zul} = 0,05 x arm length (however ≤ 30 mm)

Studs (bracket holders)

a) Studs are bent by the effects of sideway forces; the permitted offset is:

f_{zul} = 0.05 x stud length

b) tested in combination with beams under force effect,

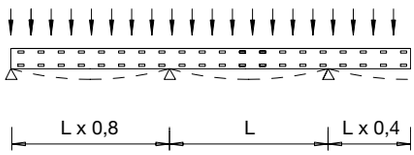
c) pulled by a centric load.

In each case the highest stud length was tested.

Safety

The tested elements must withstand a load that exceeds its permissible level by at least 70%. Possible failures are not equivalent to the breakage of the component (total failure) but rather consist of a deformation, significant enough that no further increase of load bearing capacity can be registered (hammock). Consequentially, cable support elements made of metal that indicates its load condition (including overloading) by deformation are preferable to spontaneously breaking support systems made of plastic.

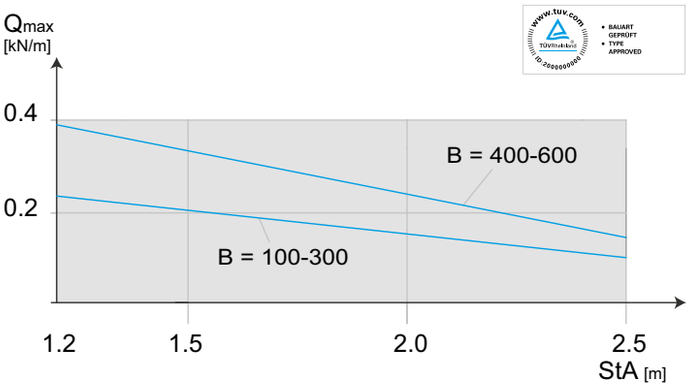
Wide-span systems are tested differently as follows:



according to IEC 61537 (DIN EN 61537) 10.3.2 testing method II

When planning the route, please generally observe that the filling volume of the cable trays may exceed the carrying capacity of the cable trays. A sufficient extent of reserves must be included; if needed multi-layer reserves should be allowed for.

Example wire tray G 50:



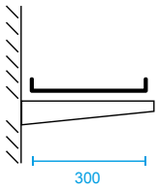
Q_{sk} Cable load based on filling volume A at maximum width B

Equipotential bonding

Cable ladders and cable trays are mounted with screw connections. The equipotential bonding is certified according to DIN EN 61537.

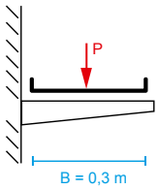
Example wall bracket
How to choose the right cable support system?

How to choose the right cable support system?



From the tender: cable tray perforated **B** = 300 mm, **H** = 60 mm, doweled to a concrete wall with a support distance **StA** = 1.5 m.

1. Selecting the cable tray



Specification: Cable tray with a height of 60 mm and a width of 300 mm, resulting in: **RG 60-30S.** In order to calculate the bracket load **P**, the cable load $\mathbf{Q_{SK}}$ = ? must be determined first.

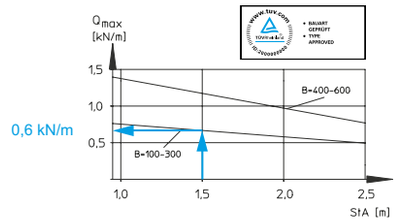
2. Determining the cable load Q_{SK}

RG 60 Cable tray, height = 60 mm

Article number	H mm	B mm	A cm^2	Q_{sk} kN/m	G kg/m
S					
RG 60-10	60	100	56	0,09	1,5
RG 60-20	60	200	113	0,17	1,93
RG 60-30	60	300	171	0,26	2,5
RG 60-40	60	400	228	0,34	3,57

The maximum cable load with regard to the loading capacity of cable trays is $\mathbf{Q_{SK}}$ = 0.26 kN/m.

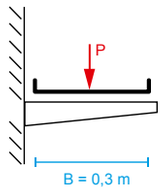
3. Determining the bearing capacity



With its 0.6 kN/m, the verified bearing capacity is significantly above the possible loading capacity of 0.26 kN/m.

Q_{max} 0,6 kN/m > Q_{SK} 0,26 kN/m ✓

4. Determining the bracket load P



The bracket load **P** is determined by the cable load $\mathbf{Q_{SK}}$ multiplied by the support distance **StA** (1.5 m from price list)
P = Qsk x StA
P = 0.26 (kN/m) x 1.50 (m) = 0.39 kN

5. Dimensioning the wall bracket

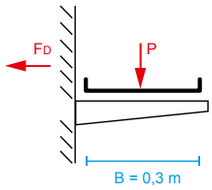
KW Wall bracket, standard

Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
F						
KW 010	34	100	120	1,4	3,1	0,13
KW 015	34	150	170	1,4	4,1	0,16
KW 020	56	200	220	2,0	3,0	0,35
KW 030	56	300	320	2,0	4,0	0,50
KW 040	75	400	420	2,4	3,6	0,80

Calculated bracket load **P = 0,39 kN,** verified bracket load $\mathbf{P_{max}}$ for **KW 030F = 2,0 kN.**

P_{max} = 2,0 kN > P = 0,39 kN ✓

6. Determining the dowel extraction force



The dowel extraction force **F_D** is determined based on statics and dowel approval for **B** = 300 mm.

7. Ratio dowel extraction force F_D to bracket load P

KW Wall bracket, standard

Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
F						
KW 010	34	100	120	1,4	3,1	0,13
KW 015	34	150	170	1,4	4,1	0,16
KW 020	56	200	220	2,0	3,0	0,35
KW 030	56	300	320	2,0	4,0	0,50
KW 040	75	400	420	2,4	3,6	0,80

With bracket load **P** = 0.39 kN, the dowel extraction force **F_D** is calculated as follows:

$F_D/P = 4.0 \Rightarrow F_D = P \times 4.0$
F_D = 0.39 (kN) x 4.0 = 1.56 KN

8. Choice of dowel

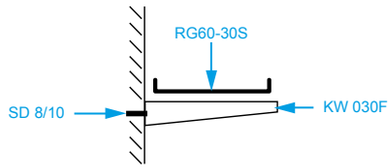
SD Straddling dowel

Article number	Ø mm	D mm	t mm	P_{zul} kN	L_{min} mm	G kg/100
GV						
SD 8/10	8	8	0-10	2,4	55	3,5
SD 8/30	8	8	0-30	2,4	55	4,4
SD 10/10	10	10	0-10	4,3	75	6,2

For **SD 8/10**, the dowel approval results in a permissible dowel extraction force in cracked concrete of **2.4 kN**. The calculated dowel extraction force is **1.56 kN**.

Pzul 2,40 kN > FD 1,56 kN ✓

Result of the dimensioned support system

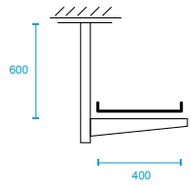


From the tender:
perforated cable tray **B** = 300 mm, **H** = 60 mm, support distance **StA** = 1.5 m

Result
– cable tray type **RG 60-30S**
– wall bracket type **KW 030F**
– dowel type **SD 8/10**

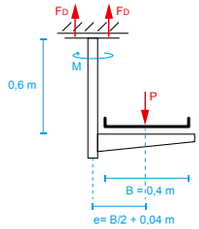
Example stem bracket
How to choose the right cable support system?

How to choose the right cable support system



From the tender: cable tray perforated **B** = 400 mm, **H** = 60 mm, doweled 600 mm below concrete ceiling with a support distance **StA** = 1.5 m.

1. Selecting the cable tray



Specification: Cable tray with a height of 60 mm and a width of 400 mm, resulting in:
RG 60-40S
In order to calculate **P**, the cable load $\mathbf{Q_{SK}}$ = ? must be determined first.

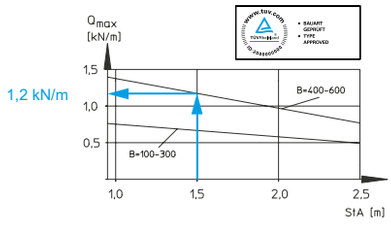
2. Determining the cable load Q_{SK}

RG 60 Cable tray, height= 60 mm

Article number	H mm	B mm	A cm^2	Q_{SK} kN/m	G kg/m
S					
RG 60-10	60	100	56	0,09	1,5
RG 60-20	60	200	113	0,17	1,93
RG 60-30	60	300	171	0,26	2,5
RG 60-40	60	400	228	0,34	3,57

The maximum cable load with regard to the loading capacity of cable trays is $\mathbf{Q_{SK}}$ = 0,34 kN/m.

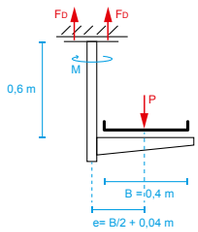
3. Determining the bearing capacity



At 1.2 kN/m, the verified bearing capacity with StA = 1.5 m is significantly above the possible loading capacity of 0.34 kN/m.

Q_{max} 1,2 kN/m > Q_{SK} 0,34 kN/m ✓

4. Determining the bracket load P



The bracket load **P** is determined by the cable load $\mathbf{Q_{SK}}$ multiplied by the support distance **StA** (1.5 m from price list)
$P = Q_{SK}$ x StA
P = 0.34 (kN/m) x 1.50 (m) = 0.51 kN

5. Dimensioning the stem bracket

KUM Bracket, standard

Article number	H mm	B mm	L mm	P_{max} kN	G kg
F					
KUM 010	35	100	120	1,1	0,19
KUM 015	35	150	170	1,1	0,23
KUM 020	56	200	220	2,3	0,40
KUM 030	56	300	320	2,3	0,52
KUM 040	75	400	420	2,1	0,83
KUM 050	96	500	520	2,1	1,30

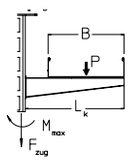
Calculated bracket load **P = 0.51 kN**, verified bracket load $\mathbf{P_{max}}$ for **KUM 040 F = 2.1 kN**

P_{max} = 2,1 kN > P = 0,51 kN ✓

6. Dimensioning the ceiling stem

KDU 50 Bracket support, 50 x 22 mm

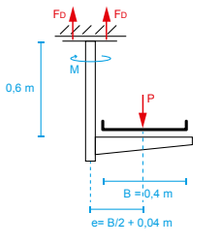
Article number	B mm	L_K mm	P_{max} kN	F_D/P
F | E				
KDU 50-01	100	120	3,8	1,4
KDU 50-02	200	220	2,5	1,9
KDU 50-03	300	320	1,9	2,3
KDU 50-04	400	420	1,5	2,8
KDU 50-05	500	520	1,2	3,3
KDU 50-06	600	620	1,1	3,8



M_{max} = 365 Nm
F_{zug} = 10 kN

P_{max} = 1,5 kN > P = 0,51 kN ✓

7. Determining the dowel extraction force



The dowel extraction force $\mathbf{F_D}$ is determined based on statics and dowel approval for **B** = 400 mm.

8. Dowel calculation

KDU 50 Bracket support, 50 x 22 mm

Article number	B mm	L_K mm	P_{max} kN	F_D/P
F | E				
KDU 50-01	100	120	3,8	1,4
KDU 50-02	200	220	2,5	1,9
KDU 50-03	300	320	1,9	2,3
KDU 50-04	400	420	1,5	2,8
KDU 50-05	500	520	1,2	3,3
KDU 50-06	600	620	1,1	3,8

Using bracket load **P** = 0.51 kN, the dowel extraction force F_D is calculated as follows:

$F_D/P = 2.8 \Rightarrow F_D = P \times 2.8$
$F_D = 0.51$ (kN) x 2.8 = 1.428 kN

9. Choice of dowel

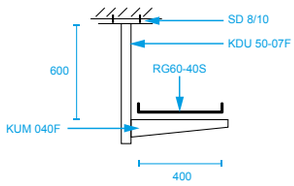
SD Straddling dowel

Article number	Ø mm	D mm	t mm	P_{zul} kN	L_{min} mm	G kg/100
GV						
SD 8/10	8	8	0-10	2,4	55	3,5
SD 8/30	8	8	0-30	2,4	55	4,4
SD 10/10	10	10	0-10	4,3	75	6,2

For **SD 8/10,** the dowel approval results in a permissible dowel extraction force in cracked concrete of **2.4 kN**.

2,40 kN > 1,428 kN ✓

Result of the dimensioned support system

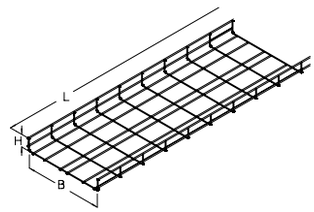


From the tender
Perforated cable tray **B** = 400 mm, **H** = 60 mm, doweled 600 mm below concrete ceiling, support distance **StA** = 1.5 m

– cable tray type **RG 60-40S**
– stem bracket type **KUM 040F**
– ceiling stem type **KDU-50-07F**
– dowel type **SD 8/10**

G 50 Wire-mesh cable tray, height = 53 mm

Article number	H mm	B mm	A cm²	Q_{SK} kN/m	G kg/m
S | F | E					
G 50-10	53	100	45	0,07	0,77
G 50-20	53	200	90	0,14	1,07
G 50-30	53	300	135	0,20	1,37
G 50-40	53	400	176	0,26	2,10
G 50-50	53	500	220	0,33	2,47
G 50-60	53	600	264	0,40	2,83



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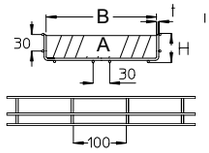
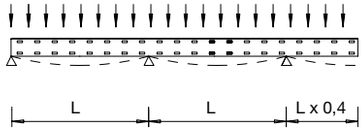
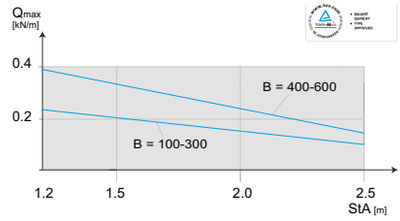


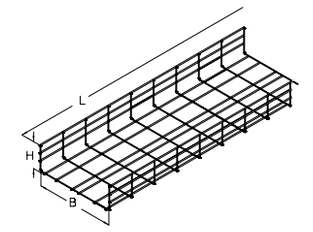




Q_{SK} Cable load based on filling volume A at maximum width B

G 100 Wire-mesh cable tray, height = 103 mm

Article number	H mm	B mm	A cm²	Q_{SK} kN/m	G kg/m
S | F | E					
G 100-10	103	100	95	0,14	1,07
G 100-20	103	200	190	0,29	1,37
G 100-30	103	300	282	0,42	2,10
G 100-40	103	400	376	0,56	2,47
G 100-50	103	500	470	0,71	2,83
G 100-60	103	600	564	0,85	3,20



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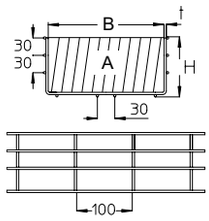
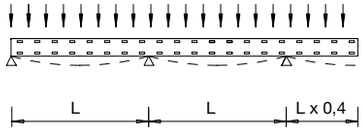
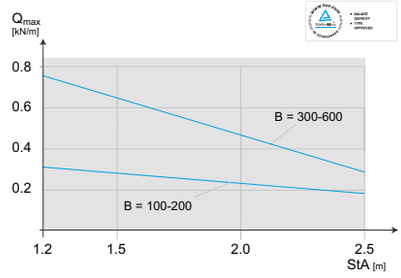


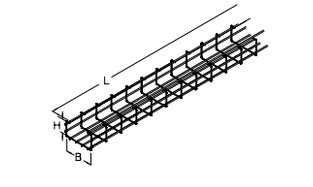




Q_{SK} Cable load based on filling volume A at maximum width B

GI Wire-mesh cable tray, height = 60 mm

Article number	H mm	B mm	A cm²	Q_{SK} kN/m	G kg/m
S | F | E					
GI 06	60	60	33	0,05	1,37
GI 12	60	120	67	0,10	1,73
GI 20	60	200	113	0,17	1,87
GI 30	60	300	165	0,25	2,27



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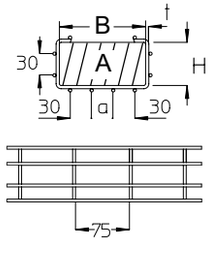
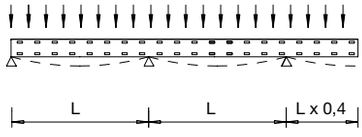
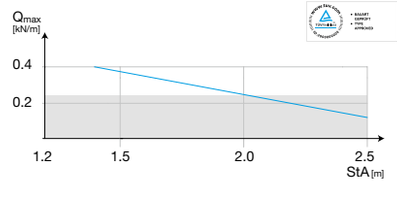
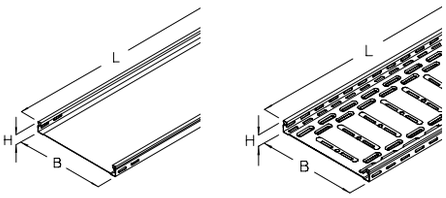






R / RG 35 Cable tray, height = 35 mm

Article number not perforated	perforated	H mm	B mm	A cm²	Q_{SK} kN/m	G kg/m
S | F						
R 35-10	**RG 35-10**	35	100	31	0,05	1,10
R 35-20	**RG 35-20**	35	200	63	0,10	1,70
R 35-30	**RG 35-30**	35	300	96	0,15	2,23



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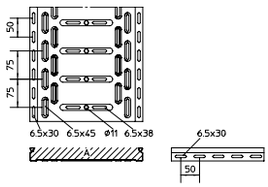
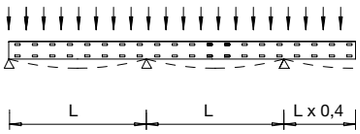
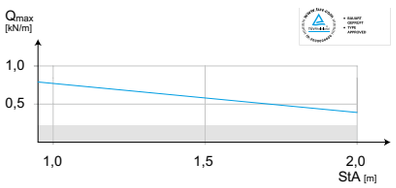


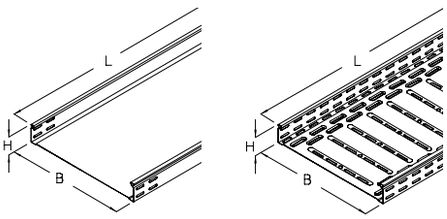




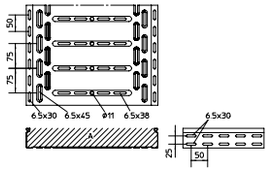
Q_{SK} Cable load based on filling volume A at maximum width B

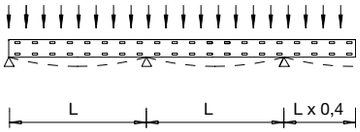
R / RG 60 Cable tray, height = 60 mm

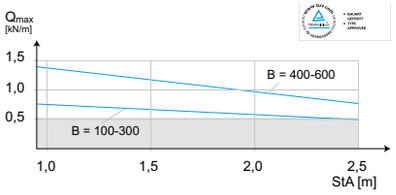
Article number not perforated	perforated	H mm	B mm	A cm²	Q_{SK} kN/m	G kg/m
S | F | E						
R 60-10	**RG 60-10**	60	100	56	0,09	1,50
R 60-20	**RG 60-20**	60	200	113	0,17	1,93
R 60-30	**RG 60-30**	60	300	171	0,26	2,50
R 60-40	**RG 60-40**	60	400	228	0,34	3,57
R 60-50	**RG 60-50**	60	500	286	0,43	4,77
R 60-60	**RG 60-60**	60	600	343	0,52	5,50



according to DIN EN 61537



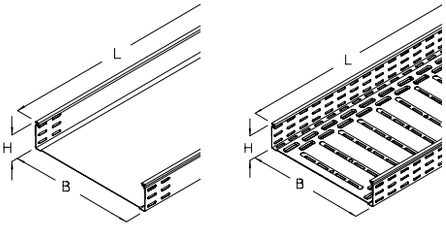




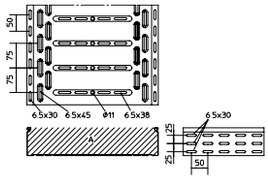
Q_{SK} Cable load based on filling volume A at maximum width B

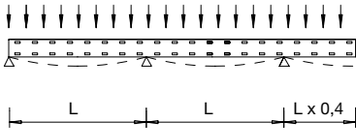
R / RG 85 Cable tray, height = 85 mm

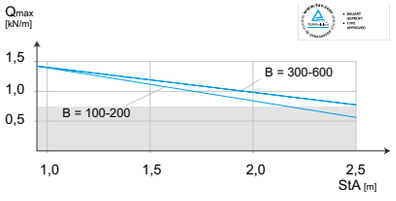
Article number not perforated	perforated	H mm	B mm	A cm²	Q_{SK} kN/m	G kg/m
S | F						
R 85-10	**RG 85-10**	85	100	81	0,12	1,60
R 85-20	**RG 85-20**	85	200	163	0,25	2,20
R 85-30	**RG 85-30**	85	300	246	0,37	3,20
R 85-40	**RG 85-40**	85	400	328	0,49	3,87
R 85-50	**RG 85-50**	85	500	411	0,62	5,10
R 85-60	**RG 85-60**	85	600	493	0,74	5,83



according to DIN EN 61537



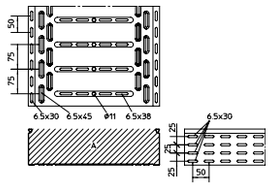


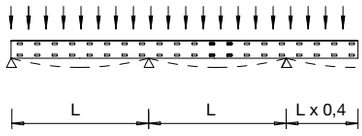


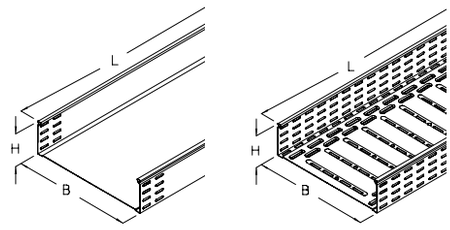
Q_{SK} Cable load based on filling volume A at maximum width B

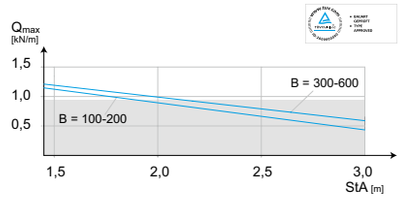
R / RG 110 Cable tray, height = 110 mm

Article number not perforated	perforated	H mm	B mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F | E						
R 110-10	**RG 110-10**	110	100	106	0,16	1,87
R 110-20	**RG 110-20**	110	200	213	0,32	2,43
R 110-30	**RG 110-30**	110	300	321	0,48	3,50
R 110-40	**RG 110-40**	110	400	428	0,64	4,70
R 110-50	**RG 110-50**	110	500	536	0,81	5,43
R 110-60	**RG 110-60**	110	600	643	0,97	6,17







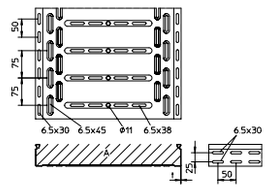


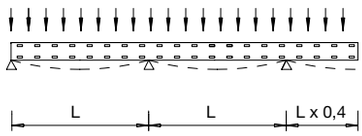
according to DIN EN 61537

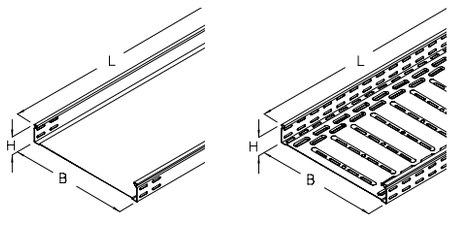
Q_{SK} Cable load based on filling volume A at maximum width B

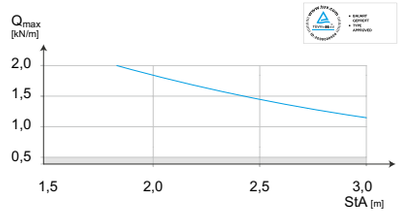
RS / RGS 60 Cable tray, height = 60 mm

Article number not perforated	perforated	H mm	B mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F						
RS 60-10	**RGS 60-10**	60	100	56	0,09	2,93
RS 60-20	**RGS 60-20**	60	200	113	0,17	3,80
RS 60-30	**RGS 60-30**	60	300	171	0,26	4,90
RS 60-40	**RGS 60-40**	60	400	228	0,34	6,00
RS 60-50	**RGS 60-50**	60	500	286	0,43	7,10
RS 60-60	**RGS 60-60**	60	600	343	0,52	8,20







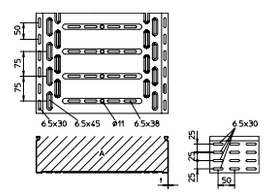


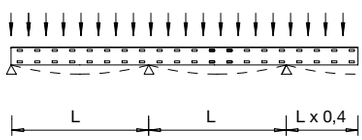
according to DIN EN 61537

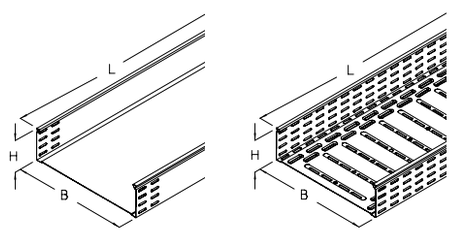
Q_{SK} Cable load based on filling volume A at maximum width B

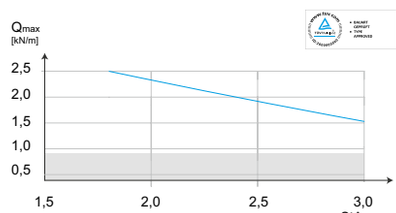
RS / RGS 110 Cable tray, height = 110 mm

Article number not perforated	perforated	H mm	B mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F						
RS 110-10	**RGS 110-10**	110	100	106	0,16	3,63
RS 110-20	**RGS 110-20**	110	200	213	0,32	4,83
RS 110-30	**RGS 110-30**	110	300	321	0,48	5,93
RS 110-40	**RGS 110-40**	110	400	428	0,64	7,03
RS 110-50	**RGS 110-50**	110	500	536	0,81	8,13
RS 110-60	**RGS 110-60**	110	600	643	0,97	9,23









according to DIN EN 61537

Q_{SK} Cable load based on filling volume A at maximum width B

RI Installation tray, height = 58 mm

Article number	H mm	B mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F					
RI 60-05	58	48	26	0,04	1,17
RI 60-10	58	98	55	0,08	1,50
RI 60-15	58	148	84	0,13	1,90
RI 60-20	58	198	113	0,17	2,10
RI 60-30	58	298	171	0,26	2,67

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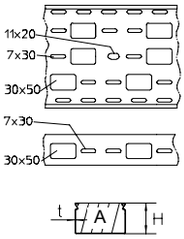
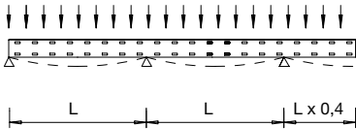
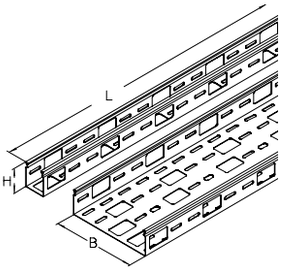
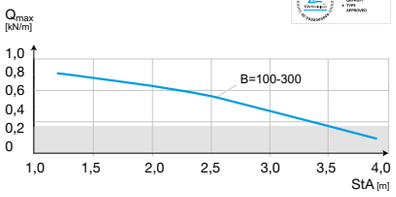
DIN EN 61537





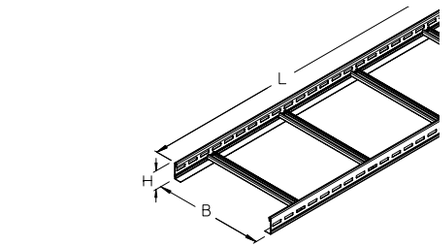
Q_{SK} Cable load based on filling volume A at maximum width B



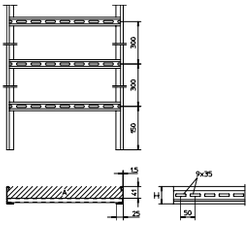


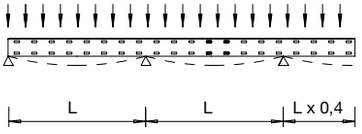
LGG 60 Cable ladder, height = 60 mm

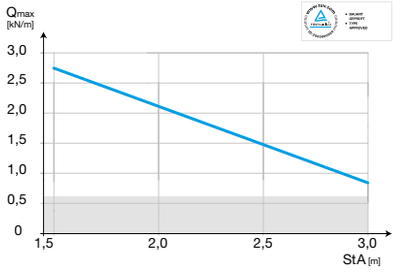
Article number	H mm	B mm	L mm	A cm^2	Q_{LK} kN/m	G kg/m
S | F | E						
LGG 60-20	60	200	6000	81	0,23	2,64
LGG 60-30	60	300	6000	122	0,34	2,87
LGG 60-40	60	400	6000	162	0,45	3,10
LGG 60-50	60	500	6000	203	0,57	3,33
LGG 60-60	60	600	6000	243	0,68	3,56



according to
DIN EN 61537



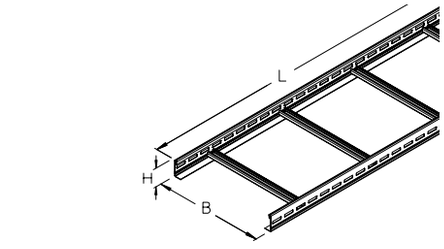




Q_{LK} Cable load based on filling volume A at maximum width B

LGGS 60 Cable ladder, height = 60 mm

Article number	H mm	B mm	A cm^2	Q_{LK} kN/m	G kg/m
S | F					
LGGS 60-20	60	200	81	0,23	3,47
LGGS 60-30	60	300	122	0,34	3,76
LGGS 60-40	60	400	162	0,45	4,06
LGGS 60-50	60	500	203	0,57	4,35
LGGS 60-60	60	600	243	0,68	4,65



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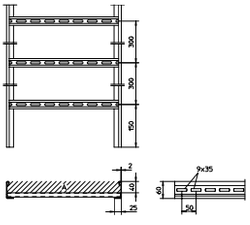
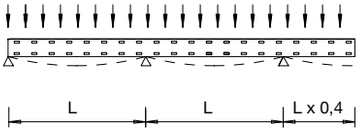
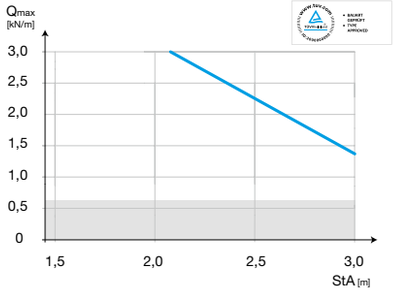


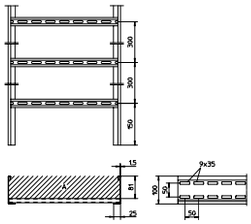


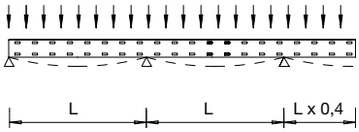


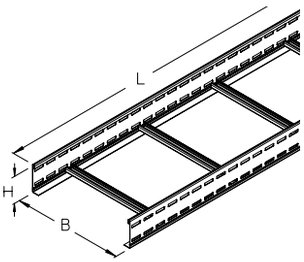
Q_{LK} Cable load based on filling volume A at maximum width B

LGG 100 Cable ladder, height = 100 mm

Article number	H mm	B mm	A cm²	Q_{LK} kN/m	G kg/m
S | F | E					
LGG 100-20	100	200	161	0,45	3,46
LGG 100-30	100	300	242	0,68	3,69
LGG 100-40	100	400	322	0,9	3,92
LGG 100-50	100	500	403	1,13	4,15
LGG 100-60	100	600	483	1,35	4,37







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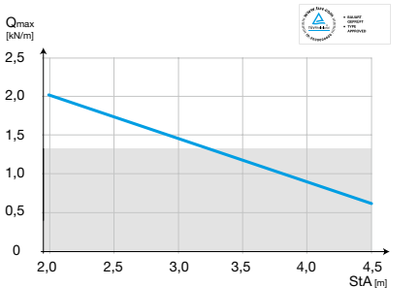
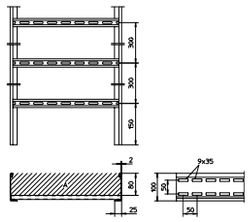
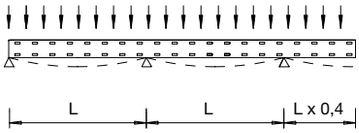


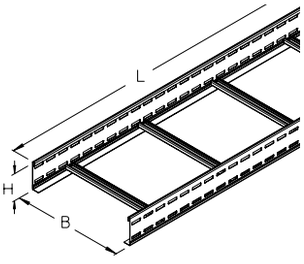
Q_{LK} Cable load based on filling volume A at maximum width B

LGGS 100 Cable ladder, height = 100 mm

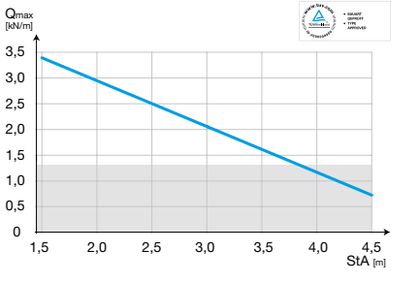
Article number	H mm	B mm	A cm²	Q_{LK} kN/m	G kg/m
S | F					
LGGS 100-20	100	200	161	0,45	4,53
LGGS 100-30	100	300	242	0,68	4,82
LGGS 100-40	100	400	322	0,9	5,12
LGGS 100-50	100	500	403	1,13	5,41
LGGS 100-60	100	600	483	1,35	5,71







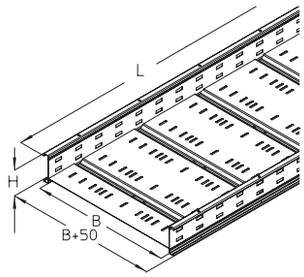
according to
DIN EN 61537

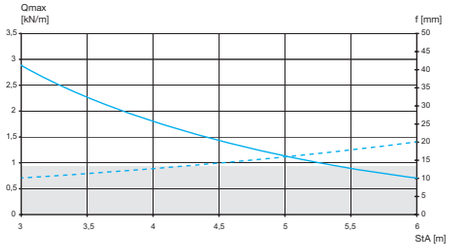


Q_{LK} Cable load based on filling volume A at maximum width B

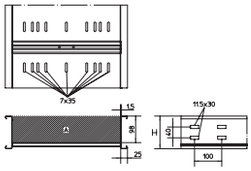
WPR 120 Wide-span cable tray, height = 120 mm

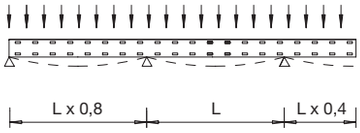
Article number	H mm	B mm	A cm^2	Q_{SK} kN/m	Q_{LK} kN/m	G kg/m
S | F						
WPR 120-20	120	200	196	0,29	0,55	6,07
WPR 120-30	120	300	294	0,44	0,82	7,02
WPR 120-40	120	400	392	0,59	1,10	7,99
WPR 120-50	120	500	490	0,74	1,37	8,97
WPR 120-60	120	600	588	0,88	1,65	9,95





according to
DIN EN 61537
(test method II 10.3.2)

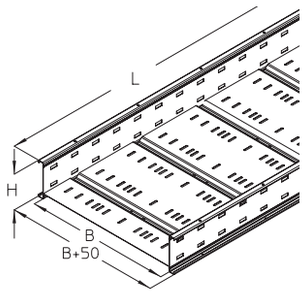


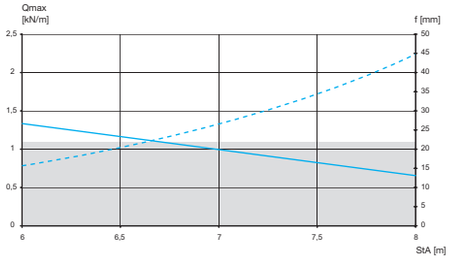


Q_{SK} Cable load based on filling volume A at maximum width B
Q_{LK} Cable load based on filling volume A at maximum width B

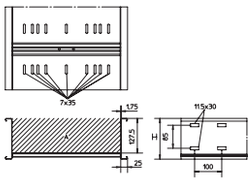
WPR 150 Wide-span cable tray, height = 150 mm

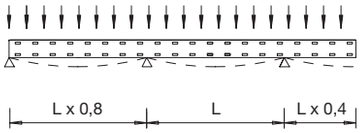
Article number	H mm	B mm	A cm^2	Q_{SK} kN/m	G kg/m
S | F					
WPR 150-20	150	200	256	0,38	7,14
WPR 150-30	150	300	384	0,58	7,90
WPR 150-40	150	400	512	0,77	8,69
WPR 150-50	150	500	640	0,96	9,48
WPR 150-60	150	600	768	1,15	10,26





according to IEC 61537
DIN EN 61537
(test method II 10.3.2)

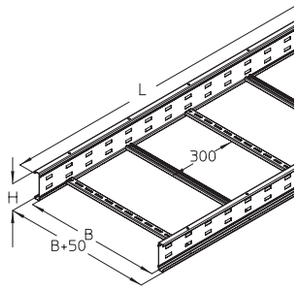




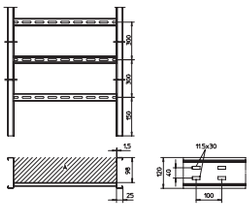
Q_{SK} Cable load based on filling volume A at maximum width B

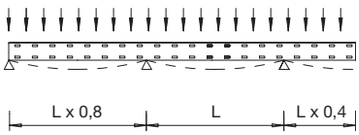
WPL 120 Wide-span cable tray, height = 120 mm

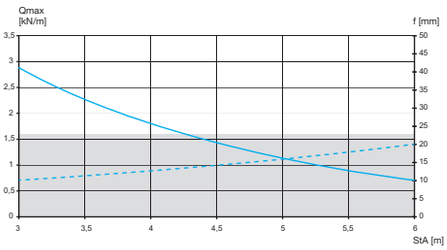
Article number	H mm	B mm	A cm²	Q_{SK} kN/m	Q_{LK} kN/m	G kg/m
S | F						
WPL 120-20	120	200	196	0,29	0,55	4,56
WPL 120-30	120	300	294	0,44	0,82	4,79
WPL 120-40	120	400	392	0,59	1,10	5,02
WPL 120-50	120	500	490	0,74	1,37	5,25
WPL 120-60	120	600	588	0,88	1,65	5,47



according to IEC 61537
DIN EN 61537
(test method II 10.3.2)



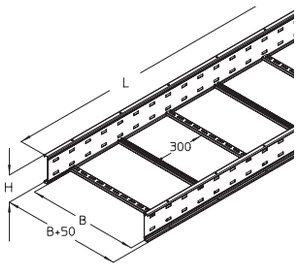




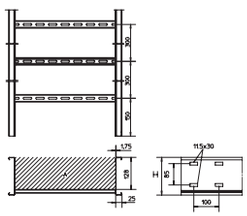
Q_{SK} Cable load based on filling volume A at maximum width B
Q_{LK} Cable load based on filling volume A at maximum width B

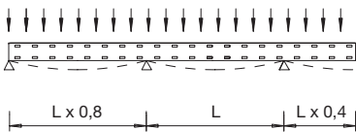
WPL 150 Wide-span cable tray, height = 150 mm

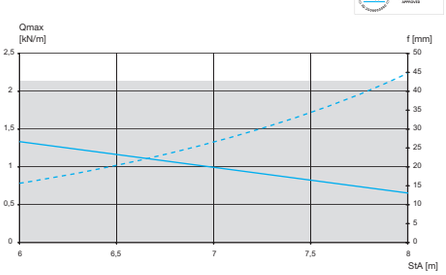
Article number	H mm	B mm	A cm²	Q_{LK} kN/m	G kg/m
S | F | E					
WPL 150-20	150	200	256	0,72	6,01
WPL 150-30	150	300	384	1,08	6,24
WPL 150-40	150	400	512	1,43	6,47
WPL 150-50	150	500	640	1,79	6,70
WPL 150-60	150	600	768	2,15	6,93



according to IEC 61537
DIN EN 61537
(test method II 10.3.2)



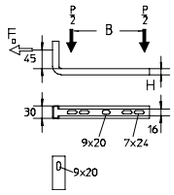


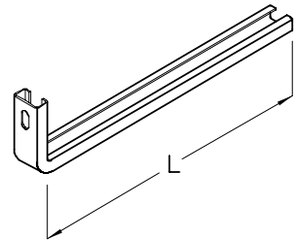


Q_{LK} Cable load based on filling volume A at maximum width B

KWLL Wall bracket, light

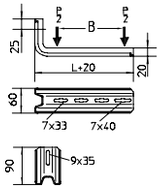
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
S | F						
KWLL 010	15	100	110	0,3	2	0,13
KWLL 020	15	200	210	0,3	3	0,20
KWLL 030	15	300	310	0,3	4	0,28

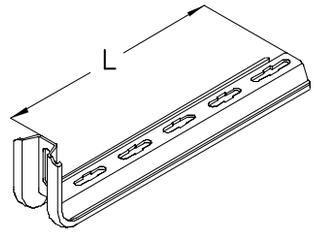




KSWL Wall bracket, light

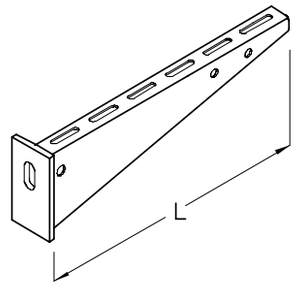
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
S | F						
KSLW 010	20	100	120	3	2,6	0,36
KSLW 015	20	150	170	2,4	3,3	0,45
KSLW 020	20	200	220	1,9	4	0,53
KSLW 025	20	250	270	1,4	4,7	0,61
KSLW 030	20	300	320	1,1	5,4	0,69
KSLW 040	20	400	420	0,8	6,9	0,86

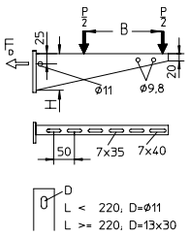




KW Wall bracket, standard

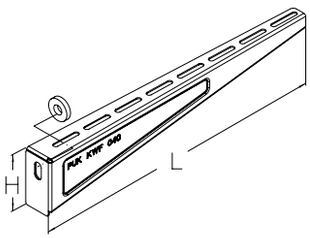
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
F						
KW 010	34	100	120	1,4	3,1	0,13
KW 015	34	150	170	1,4	4,1	0,16
KW 020	56	200	220	2,0	3,0	0,35
KW 030	56	300	320	2,0	4,0	0,50
KW 040	75	400	420	2,4	3,6	0,80
KW 050	96	500	520	2,1	3,4	1,40
KW 060	96	600	620	2,1	4,0	1,60
E						
KW 010	34	100	120	1,5	3,1	0,13
KW 015	34	150	170	1,5	4,1	0,16
KW 020	56	200	220	1,5	3,0	0,39
KW 030	56	300	320	1,5	4,0	0,47
KW 040	75	400	420	2,2	3,6	0,76
KW 050	95	500	520	2,2	3,4	1,20
KW 060	95	600	620	2,2	4,0	1,40

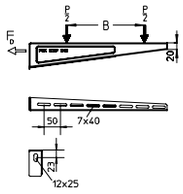




KWF Bracket, light

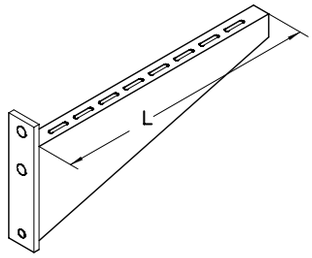
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
S						
KWF 010	80	100	120	1,2	1,58	0,23
KWF 020	80	200	220	1,2	2,33	0,30
KWF 030	80	300	320	1,2	3,15	0,45
KWF 040	80	400	420	1,2	3,99	0,51

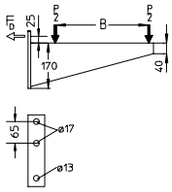




KWS Wall bracket, heavy

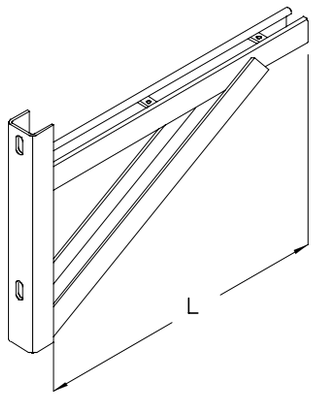
Article number	B mm	L mm	P_{max} kN	F_D/P	G kg
F					
KWS 020	200	280	7	1,31	2,04
KWS 030	300	380	6,7	1,49	2,40
KWS 040	400	480	6,5	1,69	2,78
KWS 050	500	580	6,3	1,91	3,32
KWS 060	600	680	6,1	2,13	3,68
KWS 070	600	780	5,2	2,60	4,04
KWS 080	600	880	4,4	3,07	4,41
KWS 090	600	980	3,6	3,56	4,77
KWS 100	600	1080	2,8	4,06	5,14

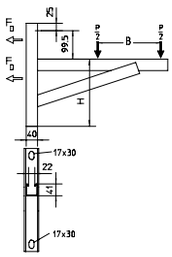




KWSS Wall bracket, very heavy

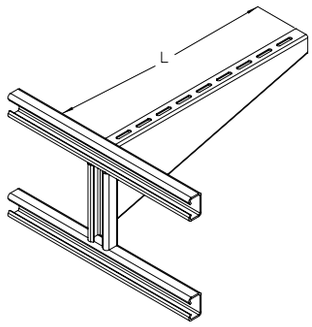
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
F						
KWSS 020	166	200	280	10	0,91	2,59
KWSS 030	196	300	380	10	0,99	3,37
KWSS 040	236	400	480	10	1,04	4,18
KWSS 020	266	500	580	10	1,09	4,96
KWSS 060	236	600	680	10	1,36	5,51
KWSS 070	266	600	780	10	1,39	6,28
KWSS 080	301	600	880	10	1,39	7,08
KWSS 090	331	600	980	10	1,39	7,85
KWSS 100	366	600	1080	10	1,38	8,65

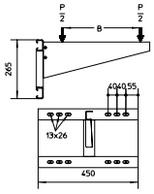


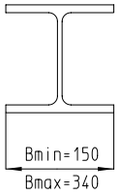


KIS Bracket

Article number	B mm	L mm	P_{max} kN	F_D/P	G kg
F					
KIS 020	200	280	7,0	0,66	4,32
KIS 030	300	380	6,7	0,76	4,65
KIS 040	400	480	6,5	0,86	5,00
KIS 050	500	580	6,3	0,97	5,34
KIS 060	600	680	6,1	1,09	5,68
KIS 070	600	780	5,2	1,33	6,02
KIS 080	600	880	4,4	1,57	6,36
KIS 090	600	980	3,6	1,83	6,70
KIS 100	600	1080	2,8	2,08	7,04

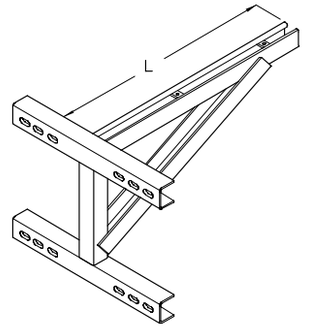


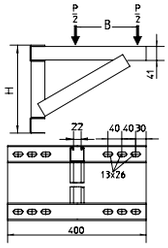


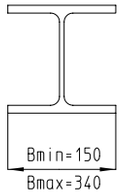


KISS Wall bracket, very heavy

Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
F						
KISS 020	150	200	280	10	0,93	4,66
KISS 030	185	300	380	10	0,91	5,42
KISS 040	215	400	480	10	0,92	6,17
KISS 050	250	500	580	10	0,92	6,93
KISS 060	280	600	680	10	0,92	7,70
KISS 070	315	600	780	10	0,99	8,44
KISS 080	345	600	880	10	1,06	9,21
KISS 090	380	600	980	10	1,10	9,96
KISS 100	410	600	1080	10	1,15	10,71

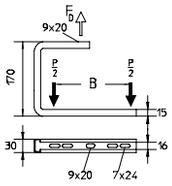


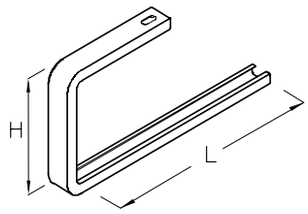




DB Ceiling-fixed bracket

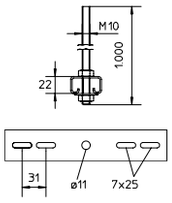
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
S						
DB 10	170	100	120	0,60	1,2	0,25
DB 20	170	200	220	0,40	1,1	0,36
DB 30	170	300	320	0,28	1,1	0,47
E						
DB 10	170	100	120	0,50	1,2	0,30
DB 20	170	200	220	0,35	1,1	0,44
DB 30	170	300	320	0,25	1,1	0,58

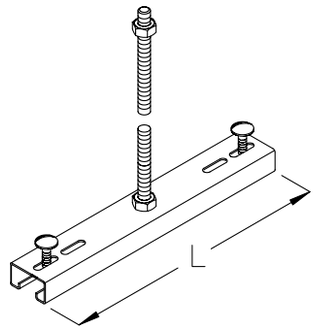




GBAR Central hanger

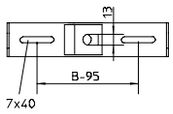
Article number	B mm	L mm	P_{max} kN	F_D/P	G kg
S | E					
GBAR 10	100	60	0,7	1	0,62
GBAR 20	200	160	0,7	1	0,75
GBAR 30	300	260	0,7	1	0,88

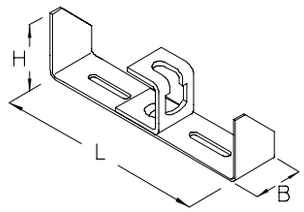




MA 60 Middle hanger

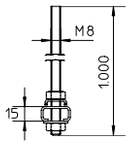
Article number	H mm	B mm	L mm	G kg
S				
MA 60-10	56	40	90	0,26
MA 60-20	56	40	190	0,36
MA 60-30	56	40	290	0,45

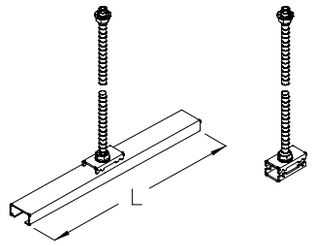




GBAG Central hanger

Article number	B mm	L mm	P_{max} kN	F_D/P	G kg
S | E					
GBAG 10	100	80	0,5	1	0,42
GBAG 20	200	180	0,5	1	0,50
GBAG 30	300	280	0,5	1	0,57



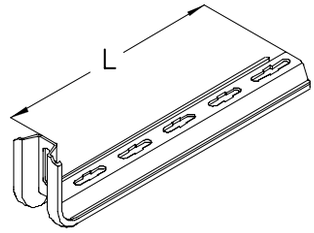


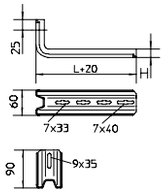
GBAG 20
GBAG 30

GBAG 10

KSL Bracket, light

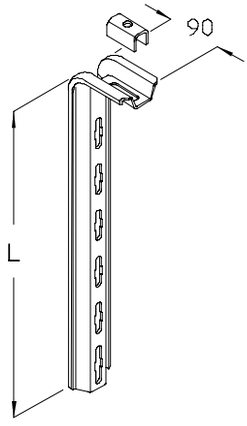
Article number	B mm	L mm	P_{max} kN	G kg
S | F				
KSL 010	100	120	3,0	0,36
KSL 015	150	170	2,4	0,45
KSL 020	200	220	1,9	0,53
KSL 025	250	270	1,5	0,61
KSL 030	300	320	1,1	0,69
KSL 040	400	420	0,8	0,86

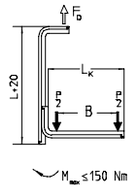




KSLW Bracket, light

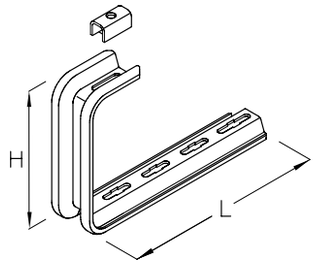
Article number	B mm	L_K mm	P_{max} kN	G kg
S | F				
KSL 010	100	120	0,9	3,1
KSL 015	150	170	0,7	3,8
KSL 025	250	270	0,5	4,5
KSL 030	300	320	0,4	5,9
KSL 040	400	420	0,3	7,4

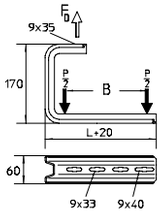




DKSL Ceiling-fixed bracket, light

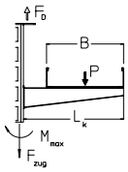
Article number	H mm	B mm	L mm	P_{max} kN	F_D/P	G kg
S						
DKSL 010	170	100	120	0,9	3,1	0,59
DKSL 020	170	200	220	0,5	2,1	0,76
DKSL 030	170	300	320	0,4	2,7	0,91
DKSL 040	170	400	420	0,3	3,3	1,08



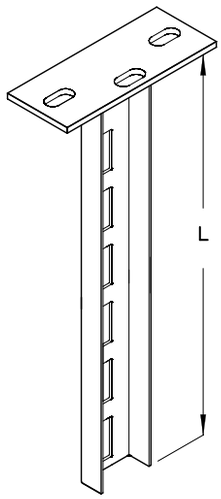


KDU 50 Bracket support, 50 x 22 mm

Article number	B mm	L_K mm	P_{max} kN	F_D/P
F | E				
KDU 50-01	100	120	3,8	1,4
KDU 50-02	200	220	2,5	1,9
KDU 50-03	300	320	1,9	2,3
KDU 50-04	400	420	1,5	2,8
KDU 50-05	500	520	1,2	3,3
KDU 50-06	600	620	1,1	3,8

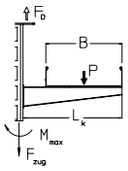


M_{max} = 365 Nm
F_{zug} = 10 kN

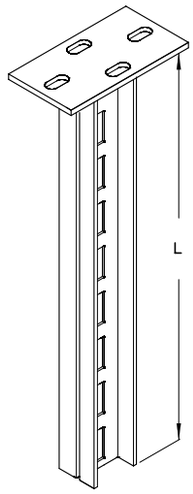


KDU 52 Bracket support

Article number	B mm	L_K mm	P_{max} kN	F_D/P
F | E				
KDU 52-01	100	120	7,2	1,4
KDU 52-02	200	220	4,7	1,9
KDU 52-03	300	320	3,5	2,3
KDU 52-04	400	420	2,8	2,8
KDU 52-05	500	520	2,3	3,3
KDU 52-06	600	620	2,0	3,8

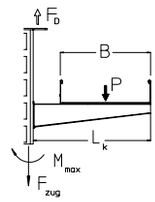


M_{max} = 900 Nm
F_{zug} = 10 kN

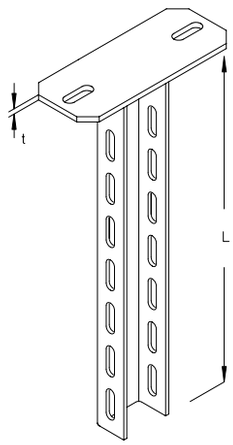


KDU 60 Bracket support, heavy

Article number	B mm	L_K mm	$P_{max\ L>1000}$ kN	$P_{max\ L<1000}$ kN	F_D/P
F | E					
KDU 60-01	100	120	19,3	12,5	1,2
KDU 60-02	200	220	12,9	8,3	1,5
KDU 60-03	300	320	9,7	6,2	1,9
KDU 60-04	400	420	7,7	5	2,2
KDU 60-05	500	520	6,4	4,2	2,6
KDU 60-06	600	620	5,5	3,6	2,9

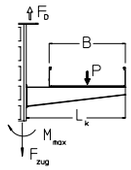


L ≤ 1000: M_{max} = 1000 Nm
L > 1000: M_{max} = 1250 Nm
F_{zug} = 16 kN

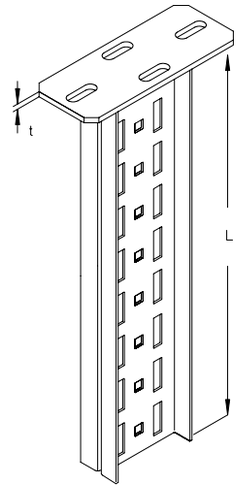


KDU 102 Bracket support, 100 x 22 mm

Article number	B mm	L_K mm	P_{max} kN	F_D/P
F | E				
KDU 102-01	100	120	14,2	1,3
KDU 102-02	200	220	10,0	1,7
KDU 102-03	300	320	7,7	2,0
KDU 102-04	400	420	6,3	2,3
KDU 102-05	500	520	5,3	2,7
KDU 102-06	600	620	4,6	3,0

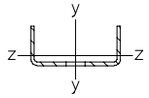


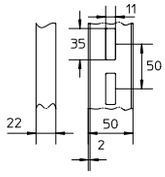
M_{max} = 1700 Nm
F_{zug} = 20 kN

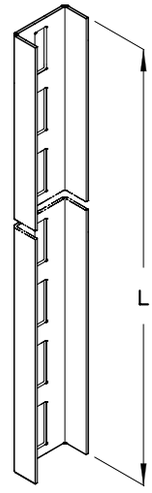


KHU 50 Bracket support

Article number	H mm	B mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
S | F | E								
KHU 50	50	22	1,52	2,57	0,49	6,41	0,73	1,45

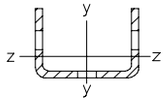


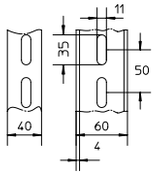


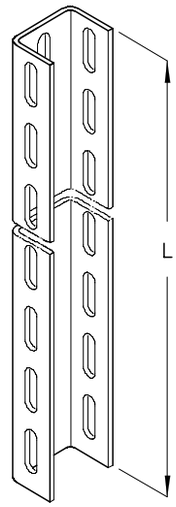


KHU 60 Bracket support

Article number	H mm	B mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F | E								
KHU 60	60	40	3,75	7,03	2,47	21,1	6,73	3,52

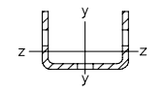


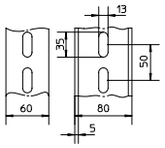


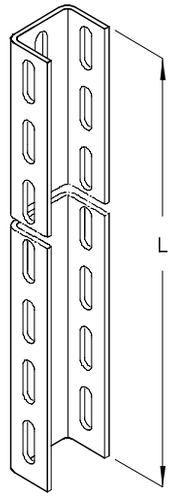


KHU 80 Bracket support

Article number	H mm	B mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F								
KHU 80	80	60	7,23	18,87	7,61	75,48	30,12	6,65

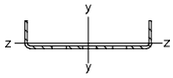


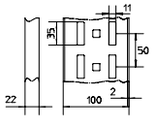


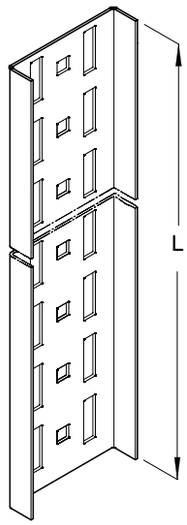


KHU 100 Bracket support, profil U100

Article number	H mm	B mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
S | F | E								
KHU 100	100	22	2,1	6,4	0,52	32,01	0,87	1,89

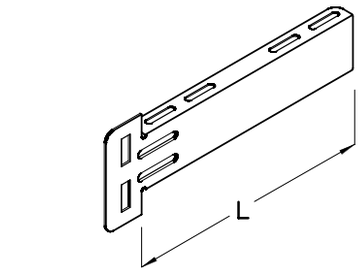


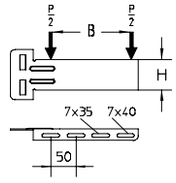




KUL Bracket, light

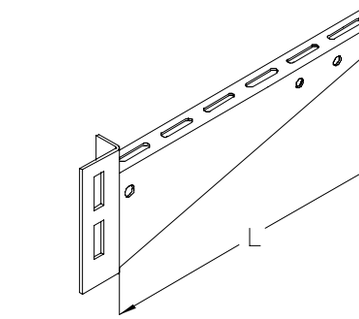
Article number	H mm	B mm	L mm	P_{max} kN	G kg
S					
KUL 010	60	100	110	0,85	0,16
KUL 015	60	150	160	0,85	0,21
KUL 020	60	200	210	0,85	0,27
KUL 030	60	300	310	0,85	0,37



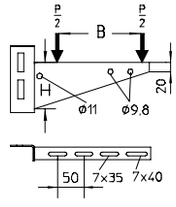


KUM Bracket, standard

Article number	H mm	B mm	L mm	P_{max} kN	G kg
F					
KUM 010	35	100	120	1,1	0,19
KUM 015	35	150	170	1,1	0,23
KUM 020	56	200	220	2,3	0,40
KUM 030	56	300	320	2,3	0,52
KUM 040	75	400	420	2,1	0,83
KUM 050	96	500	520	2,1	1,30
KUM 060	96	600	620	2,1	1,45

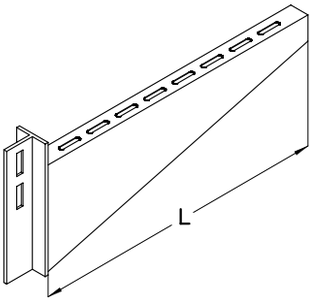


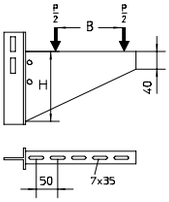
E					
KUM 010	35	100	120	1	0,19
KUM 020	56	200	220	1,5	0,37
KUM 030	56	300	320	1,5	0,52
KUM 040	75	400	420	2,1	0,79
KUM 050	95	500	520	1,1	1,07
KUM 060	95	600	620	1,1	1,25



KUS Bracket, heavy

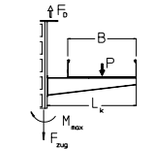
Article number	H mm	B mm	L mm	P_{max} kN	G kg
F					
KUS 020	163	200	280	8,1	1,84
KUS 030	163	300	380	7,2	2,20
KUS 040	163	400	480	6,5	2,58
KUS 050	163	500	580	5,7	2,94
KUS 060	163	600	680	5,0	3,31
KUS 070	163	600	780	4,2	3,67
KUS 080	163	600	880	3,5	4,04
KUS 090	163	600	980	2,7	4,40
KUS 100	163	600	1080	2,0	4,76



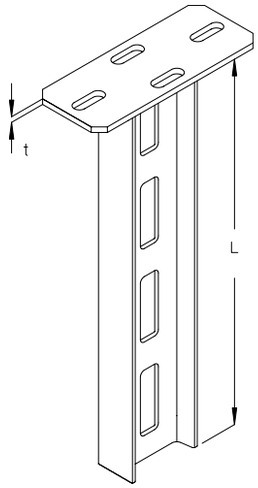


KDI Bracket support, heavy, profile I00

Article number	B mm	L_K mm	$P_{max\ L>1000}$ kN	$P_{max\ L<1000}$ kN	F_D/P
F					
KDI 01	100	120	20,0	14,5	1,3
KDI 02	200	220	13,8	10,0	1,6
KDI 03	300	320	10,5	7,6	1,9
KDI 04	400	420	8,5	6,2	2,3
KDI 05	500	520	7,1	5,2	2,6
KDI 06	600	620	6,1	4,4	3,0

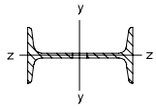


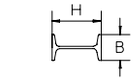
$L \leq 1000$: M_{max} = 1600 Nm
$L > 1000$: M_{max} = 2200 Nm
F_{zug} = 20 kN

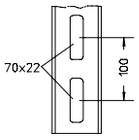


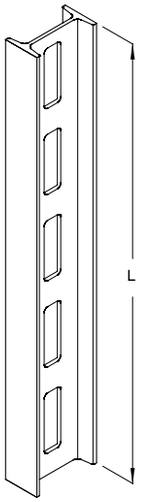
KHI Bracket support, Type KT

Article number	H mm	B mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F								
KHI	80	42	6,71	19,5	3,0	77,8	6,29	5,85



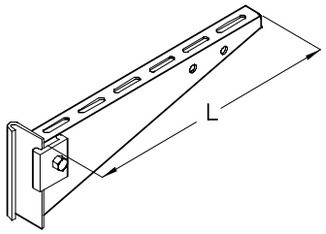


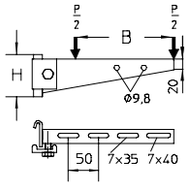




KT Bracket, standard, profil I80

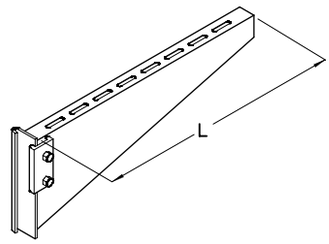
Article number	H mm	B mm	L mm	P_{max} kN	G kg
F					
KT 010	50	100	120	2,00	0,24
KT 020	70	200	220	2,00	0,56
KT 030	70	300	320	2,00	0,77
KT 040	90	400	420	2,00	0,87
KT 050	110	500	520	2,00	1,40
KT 060	110	600	620	2,00	1,55

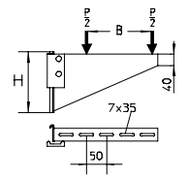




KTS Bracket, heavy, for ceiling-fixed bracket support systems, profile I80

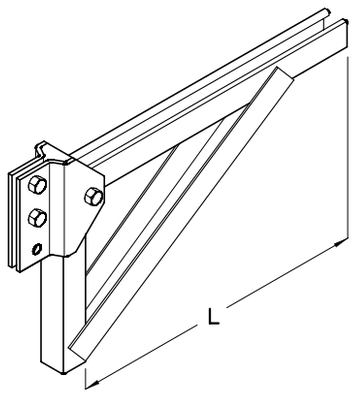
Article number	H mm	B mm	L mm	P_{max} kN	G kg
F					
KTS 020	180	200	280	7,0	1,64
KTS 030	180	300	380	6,3	2,00
KTS 040	180	400	480	5,5	2,38
KTS 050	180	500	580	4,9	2,74
KTS 060	180	600	680	4,3	3,10
KTS 070	180	600	780	3,6	3,47
KTS 080	180	600	880	3,0	3,83
KTS 090	180	600	980	2,3	4,19
KTS 100	180	600	1080	1,7	4,56

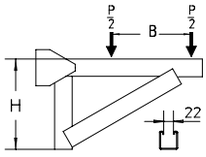




KTSS Bracket, very heavy

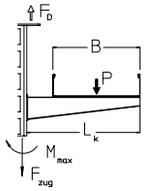
Article number	H mm	B mm	L mm	P_{max} kN	G kg
F					
KTSS 020	100	200	280	12	2,94
KTSS 030	135	300	380	12	3,53
KTSS 040	165	400	480	12	4,12
KTSS 050	200	500	580	12	4,71
KTSS 060	230	600	680	12	6,34



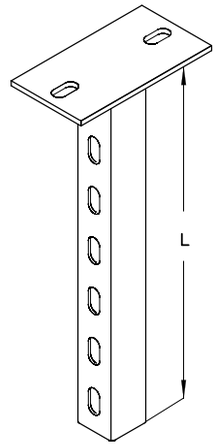


KDAG 41 Ceiling fixed bracket, profile 41

Article number	B mm	L_K mm	P_{max} kN	F_D/P
F				
KDAG 41	100	125	4,2	1,4
KDAG 41	200	225	2,7	1,9
KDAG 41	300	325	2,0	2,3
KDAG 41	400	425	1,6	2,8
KDAG 41	500	525	1,4	3,3
KDAG 41	600	625	1,2	3,8

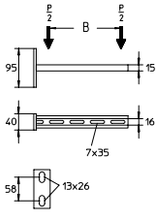


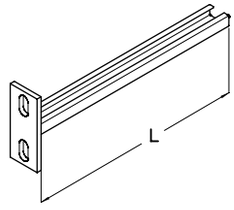
M_{max} = 700 Nm
F_{zug} = 16 kN



KA 30 Bracket, light for ceiling-fixed bracket support systems, profile 41

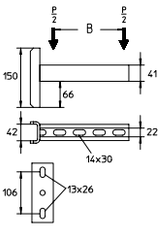
Article number	B mm	L mm	P_{max} kN	G kg
F				
KA 30-010	100	125	0,5	0,2
KA 30-015	150	175	0,5	0,3
KA 30-020	200	225	0,5	0,3
KA 30-025	250	275	0,5	0,4
KA 30-030	300	325	0,5	0,4
KA 30-040	400	425	0,5	0,5

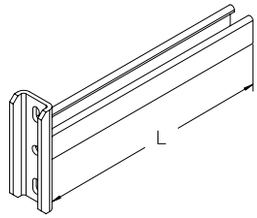




KA 41 Bracket, standard, for ceiling-fixed bracket support systems, profile 41

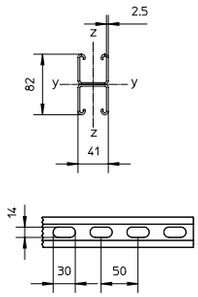
Article number	B mm	L mm	P_{max} kN	G kg
F				
KA 41-010	100	125	3,7	1,0
KA 41-015	150	175	3,7	1,1
KA 41-020	200	225	3,7	1,2
KA 41-025	250	275	3,7	1,4
KA 41-030	300	325	3,7	1,5
KA 41-040	400	425	3,7	1,6
KA 41-050	500	525	3,7	1,8
KA 41-060	600	625	3,7	1,9

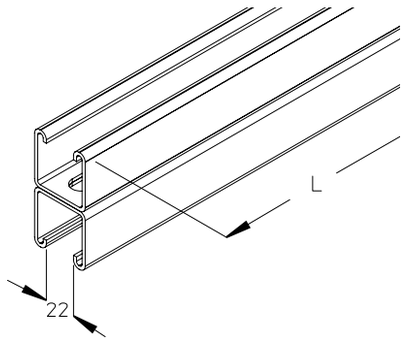




KHA 82 Profile rail, 41 x 82 mm, perforated

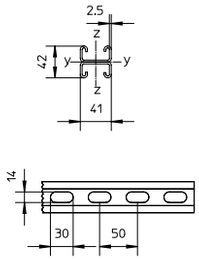
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F							
KHA 82	82	5,98	8,64	8,76	35,41	18	5,22

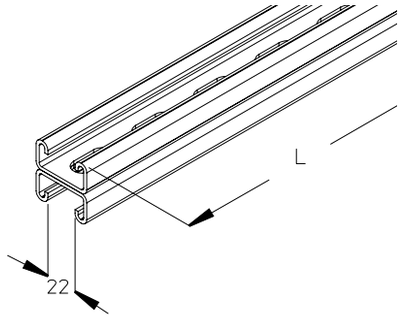




KHA 42 Profile rail, 41 x 42 mm, perforated

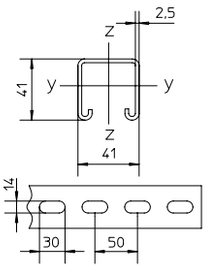
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F							
KHA 42	42	3,9	2,8	5,1	5,9	10,5	4,96

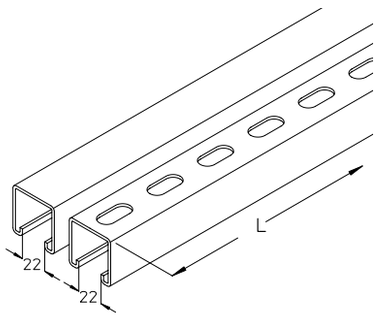




A 41 / KHA 41 Profile rail, 41 x 41 mm, perforated

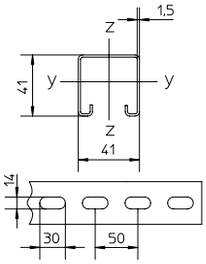
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
B | F							
A 41	41	2,95	2,8	4,4	6	9	2,76
F							
KHA 41	41	2,95	2,8	4,4	6	9	2,48

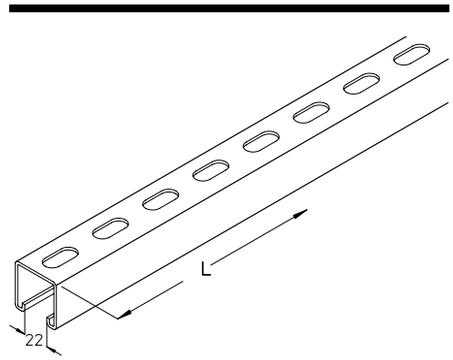




KHAL 41 Profile rail, 41 x 41 mm, perforated

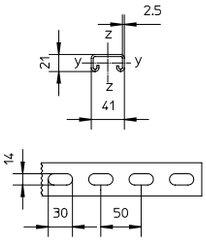
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
S | F							
KHAL 41	41	1,89	2	2,9	4,2	6	1,56

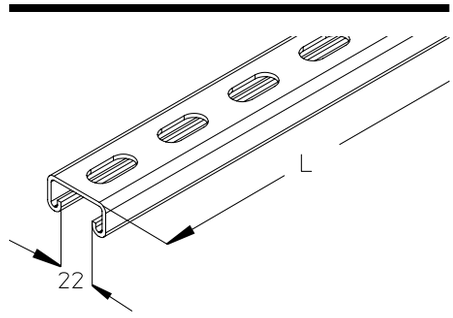




KHA 21 Profile rail 41 x 21 mm, perforated

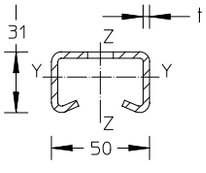
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F | E4							
KHA 21	21	1,95	0,9	2,6	1	5,3	2,48

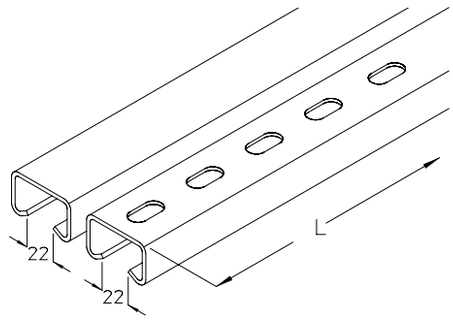




A 2 / KHA 2 Profile rail, 50 x 31 mm, not perforated / perforated

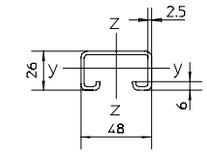
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
B | F							
A 2	31	3,4	2,4	5,1	4,4	12,9	3,13
F							
KHA 2	31	3,4	2,3	5,1	3,8	12,9	3,02

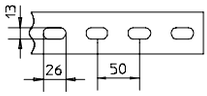


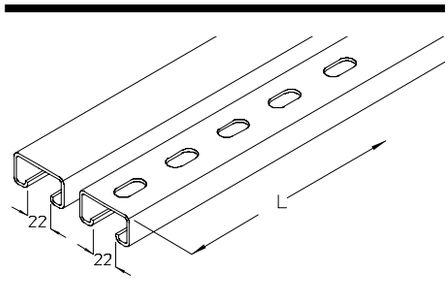


A 4 / KHA 4 Profile rail, 48 x 26 mm, not perforated / perforated

Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
B | F							
A 4	26	2,85	1,7	3,8	2,6	9,2	2,40
F							
KHA 4	26	2,85	1,81	3,9	2,7	9,36	2,24

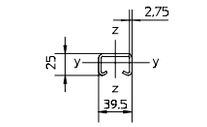


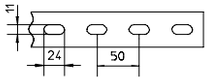


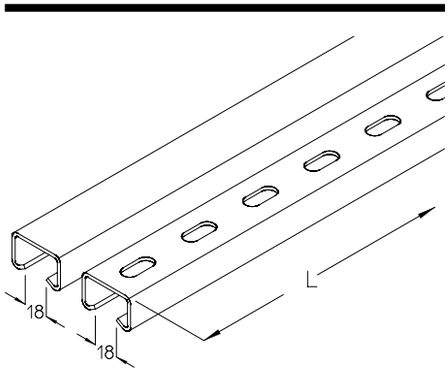


A 9 / KHA 9 Profile rail 40 x 25 mm. not perforated / perforated

Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
B | F							
A 9	25	2,56	1,3	2,7	1,90	5,40	2,15
F							
KHA 9	25	2,56	1,33	2,86	1,97	5,65	2,04

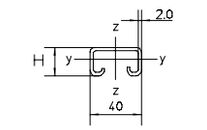


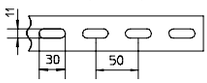


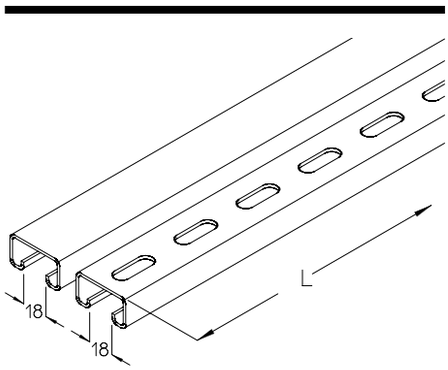


A 8 / KHA 8 Profile rail, 40 x 22 mm, not perforated / perforated

Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
B | F							
A 8	22	1,74	1	2,2	1,3	4,40	1,65
F							
KHA 8	22	1,74	1	2,2	1,2	4,48	1,35

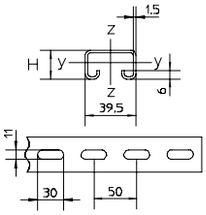


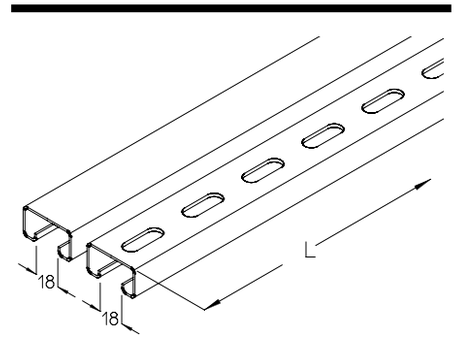




A 7 / KHA 7 Profile rail, 40 x 22 mm, not perforated / perforated

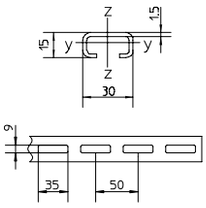
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
S | E							
A 7	22	1,34	0,9	1,7	1,1	3,5	1,30
KHA 7	22	1,34	0,8	1,7	0,9	3,34	1,05

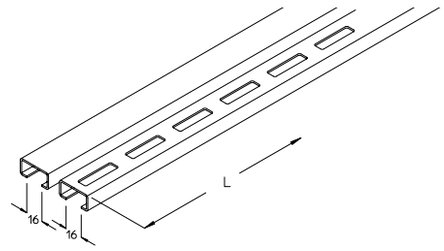




B 7 / KHB 7 Profile rail, 30 x 15 mm, not perforated / perforated

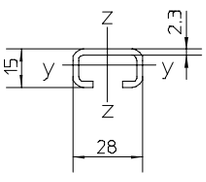
Article number	H mm	A cm^2	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
S | F | E | B							
B 7	15	0,88	0,3	0,8	0,30	1,30	0,75
S | F | E							
KHB 7	15	0,88	0,3	0,8	0,30	1,30	0,69

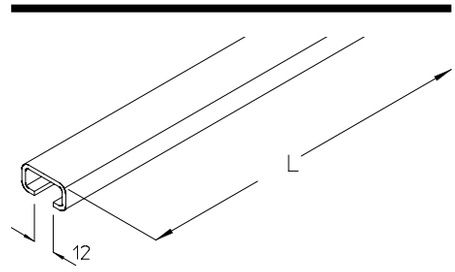




B 6 Profile-rail, 28 x 15 mm, not perforated

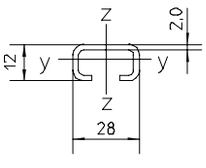
Article number	H mm	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F | E | E4 | B						
B 6	15	0,5	1,1	0,40	1,50	1,12

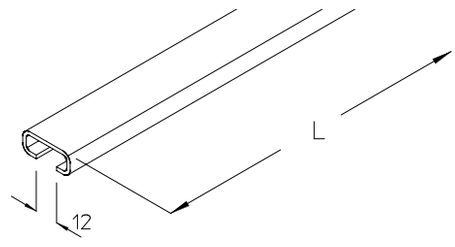




B 3 Profile-rail, 28 x 12 mm, not perforated

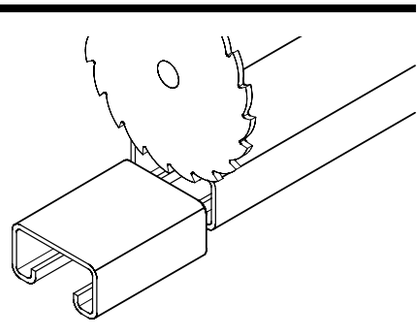
Article number	H mm	G kg	W_y cm^3	W_z cm^3	I_y cm^4	I_z cm^4	G kg/m
F | E4 | B							
B 3	12	5,3	0,3	0,8	0,2	1,1	0,88





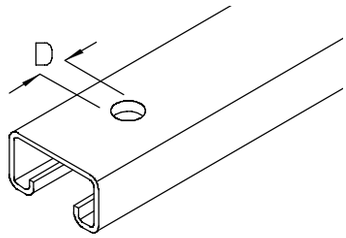
PRS Cut

Article number			A 2 A 4 A 41	A 7 A 8 A 9	B 3 B 6 B 7	B 12 B15
PRS A			•	•		
PRS B					•	•



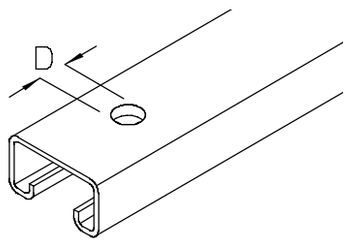
RL Round hole

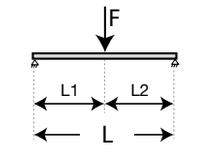
Article number	D mm	L mm	A 2 A 4 A 41	A 7 A 8 A 9	B 3 B 6 B 7	B 12 B15
RL 7	7		•	•	•	•
RL 9	9		•	•	•	
RL 11	11		•	•		
RL 13	13		•	•		

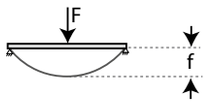


LGL Elongated hole

Article number	D mm	L mm	A 2 A 4 A 41	A 7 A 8 A 9	B 3 B 6 B 7	B 12 B15
LGL 7x10	7	10	•	•	•	•
LGL 9x20	9	20	•	•	•	
LGL 11x24	11	24	•	•		
LGL 13x26	13	26	•	•		



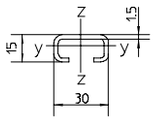




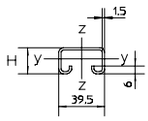
The values in the table are valid for hot-dip galvanised profiles with a centric force application F, allowing for the maximum permissible tension σzul, respectively the maximum permissible deflexion f (L/100).

The values include a safety factor of 1,35 against failure load.

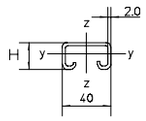
Maximum load F_{max} [N] and the corresponding deflexion f [mm]



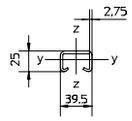
KHB 7



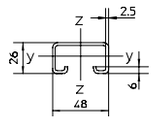
KHA 7



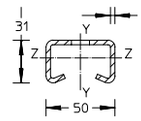
KHA 8



KHA 9

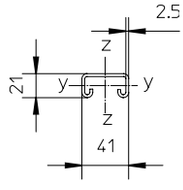


KHA 4

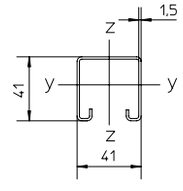


KHA 2

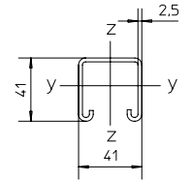
Span L cm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm
25	757	0,4	2023	0,3	2528	0,3	3362	0,2	4577	0,2	5816	0,2
50	376	1,5	1007	1,3	1259	1,3	1673	1,0	2280	1,0	2896	0,9
75	248	3,4	667	3,1	834	2,9	1107	2,3	1511	2,3	1918	2,1
100	183	6,0	496	5,4	619	5,1	822	4,1	1123	4,1	1426	3,7
125	143	9,2	392	8,4	489	7,9	648	6,3	889	6,3	1127	5,7
150	116	12,9	322	11,9	402	11,2	531	9,0	730	9,1	926	8,1
175	96	17,1	271	16,0	338	15,0	446	12,0	616	12,1	780	10,9
200	75	20,0	227	20,0	290	19,1	381	15,3	528	15,5	668	13,9
225	60	22,5	179	22,5	239	22,5	329	18,9	459	19,2	580	17,2
275	40	27,5	120	27,5	160	27,5	251	26,3	356	27,2	447	24,3
300	34	30,0	101	30,0	134	30,0	220	30,0	302	30,0	396	27,9



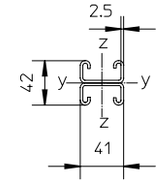
KHA 21



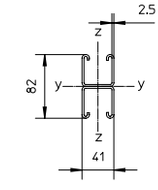
KHAL 41



KHA 41



KHA 42



KHA 82

Span L cm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm	F_{max} N	f mm
25	2272	0,3	5060	0,2	7083	0,2	7077	0,2	21863	0,1
50	1127	1,3	2524	0,7	3532	0,7	3525	0,7	10912	0,4
75	741	3,1	1676	1,7	2344	1,6	2326	1,7	7253	0,9
100	545	5,4	1250	3,0	1748	2,9	1723	3,0	5417	1,5
125	425	8,2	993	4,6	1387	4,5	1357	4,5	4311	2,4
150	343	11,4	821	6,5	1145	6,4	1108	8,4	3569	3,4
175	282	15,0	696	8,8	970	8,6	927	8,4	3035	4,6
200	236	18,7	602	11,3	837	11,1	788	10,6	2632	5,9
225	198	22,4	528	14,2	732	13,8	678	13,0	2315	7,4
275	133	27,5	418	20,5	577	19,9	510	17,9	1847	10,8
300	112	30,0	376	24,0	517	23,1	444	20,2	1669	12,6