Cable ladders

Technical information

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Cable ladders

Product description
As a solution for horizontally routing pipes or cables with medium to large diameters, cable ladders are a great asset to the product category of cable management systems. They are not only used in industrial plants and production halls but also in the construction of tunnels, power stations and plants. Thanks to their sturdy design and the holes that run all the way along the sides, cable ladders can be mounted virtually anywhere on ceilings and walls – quickly, with minimal effort and without any fuss.

Cable ladders enable a high level of air circulation so that the heat from power cables dissipates into the environment without any problems, thereby safeguarding the flow of electricity. In addition, cable ladders protect cables against damage and ensure that existing cables can be replaced and extended.

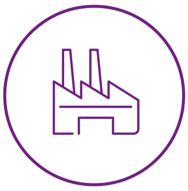
As standard, our cable ladders are available with continuously perforated side rails (LGG) in lengths of 3.000 mm and 6.000 mm. With side rail heights of 60 mm and 100 mm, as well as the usual cable ladder widths ranging from 200 mm to 600 mm, PUK's standard range can accommodate the most common applications. If a more customised solution is required, various surface coatings and types of stainless steel can be selected for any project. All our cable ladders are tested in accordance with DIN EN 61537.

Benefits

- Cables can be routed horizontally along ceilings and walls
- A secure and sturdy system
- For medium to large support distances
- Ensures a high level of air circulation
- Can be used to maintain circuit integrity
- Customisable on request

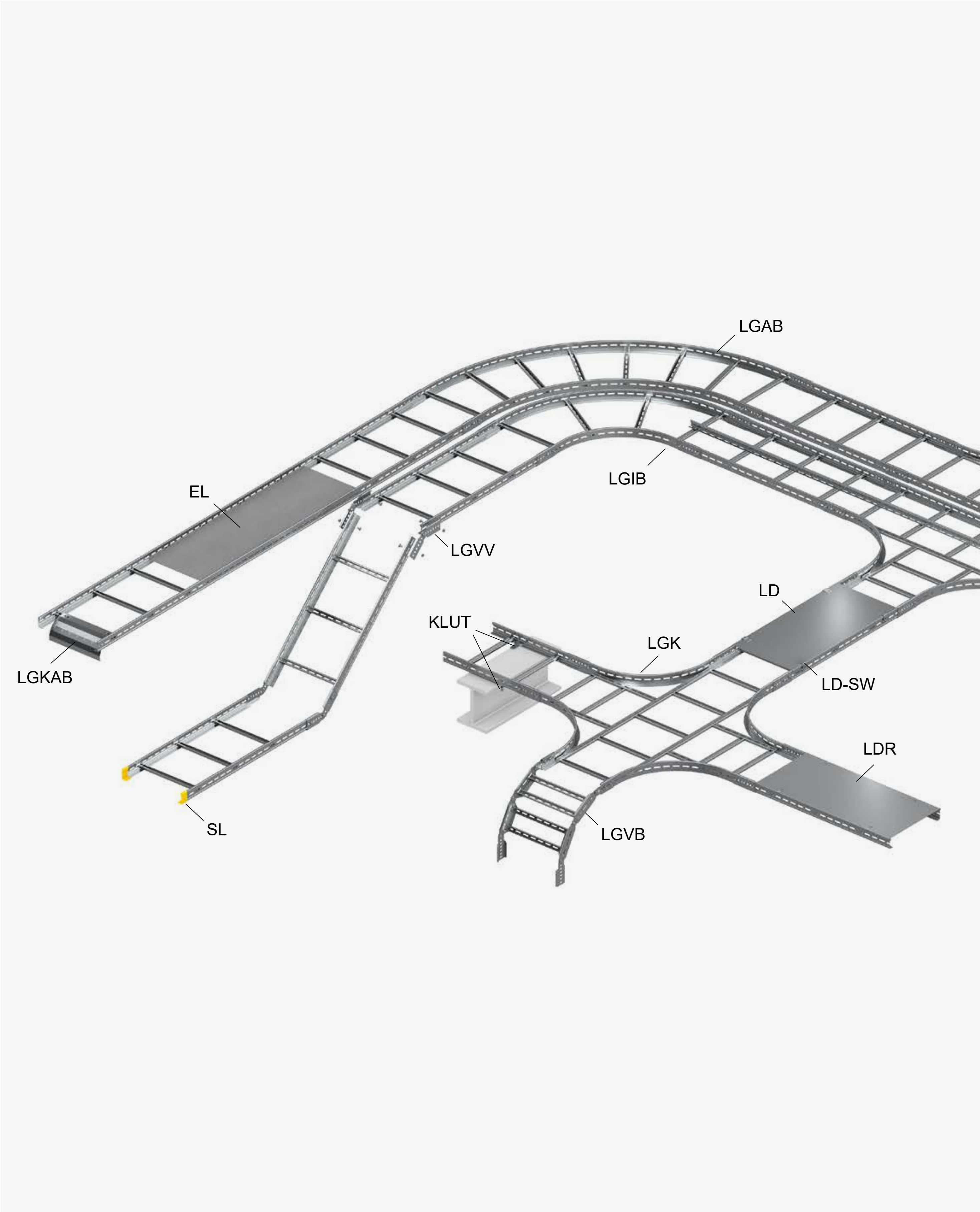
Areas of application

On walls and ceilings in the context of technical building equipment – indoors and outdoors



Often used in industrial buildings, e.g. production facilities

Power station and plant construction


LGAB
LGIB
EL
LGVV
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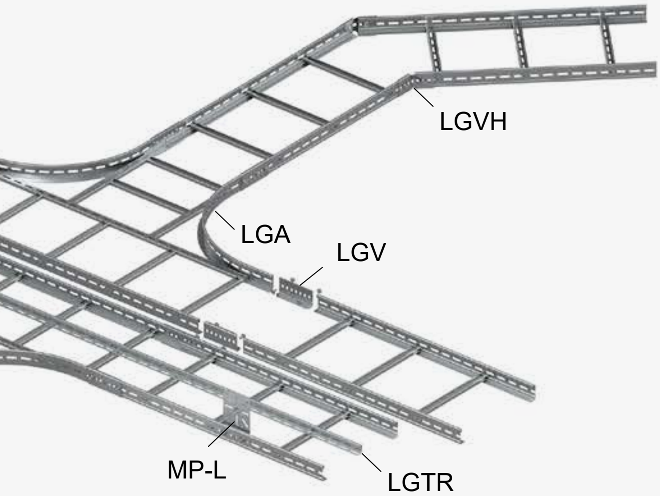
KLUT
LGK
LGKAB
LD-SW
LDR
SL
LGVB



System overview

Cable ladders with side rails and rungs (30 x 15 mm profile rail) can be custom combined with other accessories, such as formed parts. In conjunction with LGIB cable ladder inside bends, LGAB cable ladder outside bends, LAB cable ladder branches, LGK cable ladder crossings and other connection elements, they provide a tried-and-tested system for routing pipes or cables with medium to large diameters through buildings. They can easily handle medium support distances.

LGG 60

Perforated, welded cable ladders

Product features

- Side rail height: 60 mm
- Available tray widths: 200 to 600 mm
- Length: 3.000 and 6.000 mm
- Cross-sectional areas of 81 to 243 cm^2

Special solutions

Further versions in other lengths are available on request.
In addition to the standard length (6.000 mm), the LGG 60 can also be supplied in a length of 3.000 mm.

Keep off!

Available surface coatings and materials

S – Sendzimir hot-dip galvanised in accordance with DIN EN 10346 (continuous strip galvanising)

F – Hot-dip galvanised in accordance with DIN EN ISO 1461 (batch galvanising)

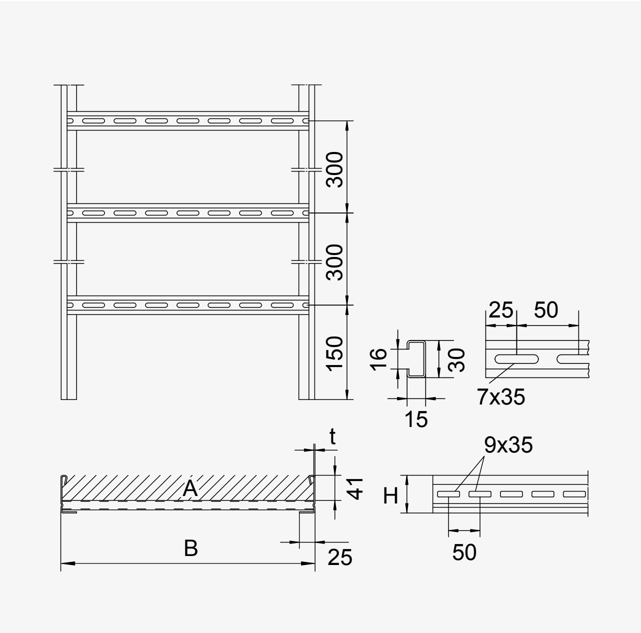
E – Stainless steel, material no. 1.4301 (V2A)

E4 – Stainless steel, material no. 1.4571/1.4404 (V4A) (on request)

XC – XC coating for reliable protection in highly corrosive environments (on request)

Colour coatings (on request)

Technical data

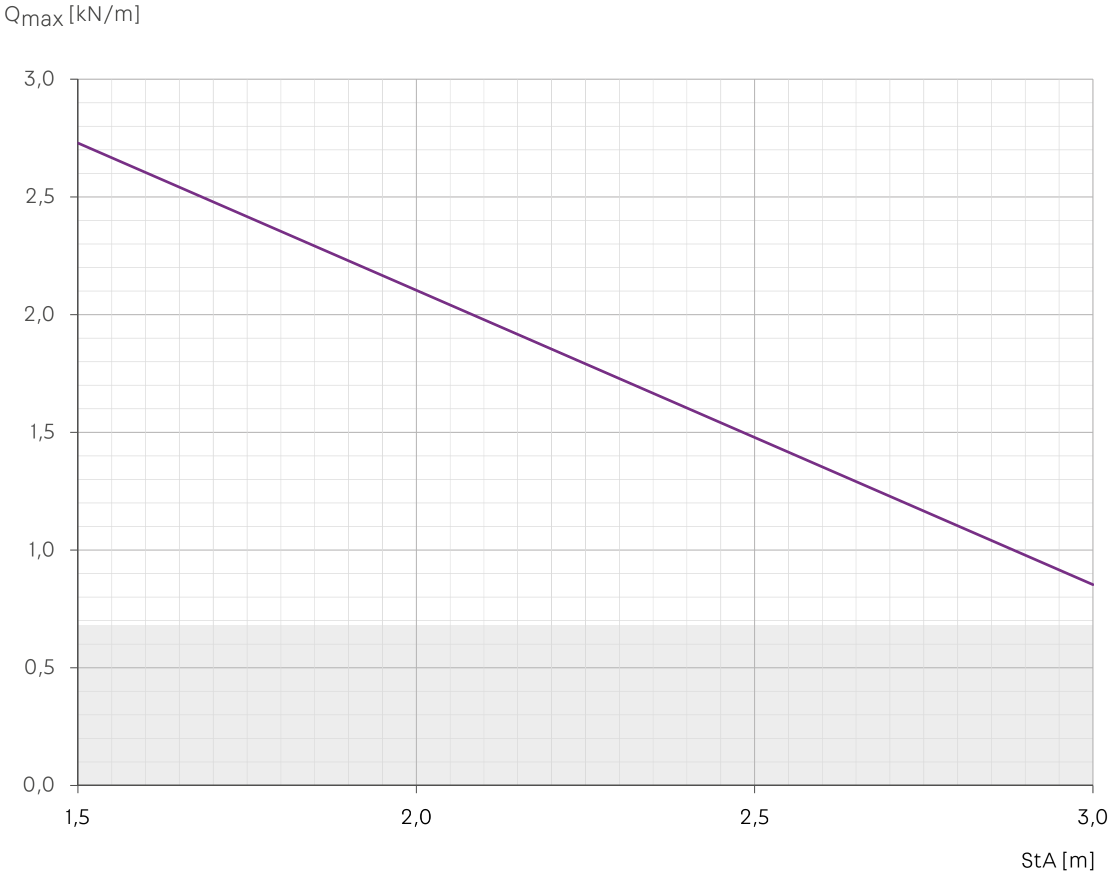


Model	B mm	L mm	t mm	A cm²	Q_{LK} kN/m	G S kg	G F kg	G E kg
LGG 60-20-3*	200	3,000	1.5	81	0.23	**7.9**	**8.5**	**8.0**
LGG 60-30-3*	300	3,000	1.5	122	0.34	**8.6**	**9.2**	**8.7**
LGG 60-40-3*	400	3,000	1.5	162	0.45	**9.3**	**10.0**	**9.4**
LGG 60-50-3*	500	3,000	1.5	203	0.57	**10.0**	**10.7**	**10.1**
LGG 60-60-3*	600	3,000	1.5	243	0.68	**10.7**	**11.4**	**10.7**
LGG 60-20	200	6,000	1.5	81	0.23	**15.8**	**17.0**	**16.0**
LGG 60-30	300	6,000	1.5	122	0.34	**17.2**	**18.4**	**17.3**
LGG 60-40	400	6,000	1.5	162	0.45	**18.6**	**19.9**	**18.7**
LGG 60-50	500	6,000	1.5	203	0.57	**20.0**	**21.4**	**20.1**
LGG 60-60	600	6,000	1.5	243	0.68	**21.3**	**22.8**	**21.5**

B: Width | L: Length | A: Cross-sectional area | Q_{LK}: Power cable distributed load | G: Weight (per surface)

Example order
Model/version: LGG 60-20-3S
*Only the special length of 3 m is explicitly stated in the item no.

Load diagram
LGG 60 S F E



Tray width: 100 to 600 mm

Q_{max}: Max. distributed load

StA: Support distance

The filling capacity of cable ladders may exceed their load-bearing capacity. You must build in sufficient reserves and, where applicable, plan using a multi-layered approach.

UL classified

LGGS 60

Heavy-duty, perforated, welded cable ladders

Product features

- Side rail height: 60 mm
- Available tray widths: 200 to 600 mm
- Length: 3.000 and 6.000 mm
- Cross-sectional areas of 81 to 243 cm²
- Heavy-duty design for higher load levels

Special solutions

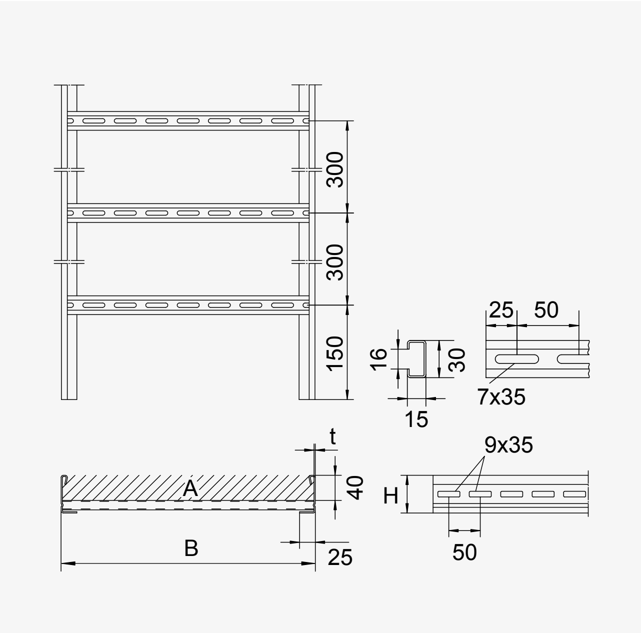
Further versions in other lengths are available on request. In addition to the standard length (6.000 mm), the LGGS 60 can also be supplied in a length of 3.000 mm.

Keep off!

Available surface coatings and materials

- **S** Sendzimir hot-dip galvanised in accordance with DIN EN 10346 (continuous strip galvanising)
- **F** Hot-dip galvanised in accordance with DIN EN ISO 1461 (batch galvanising)
- **E** Stainless steel, material no. 1.4301 (V2A) (on request)
- **E4** Stainless steel, material no. 1.4571/1.4404 (V4A) (on request)
- **XC** XC coating for reliable protection in highly corrosive environments (on request)
- Colour coatings (on request)

Technical data

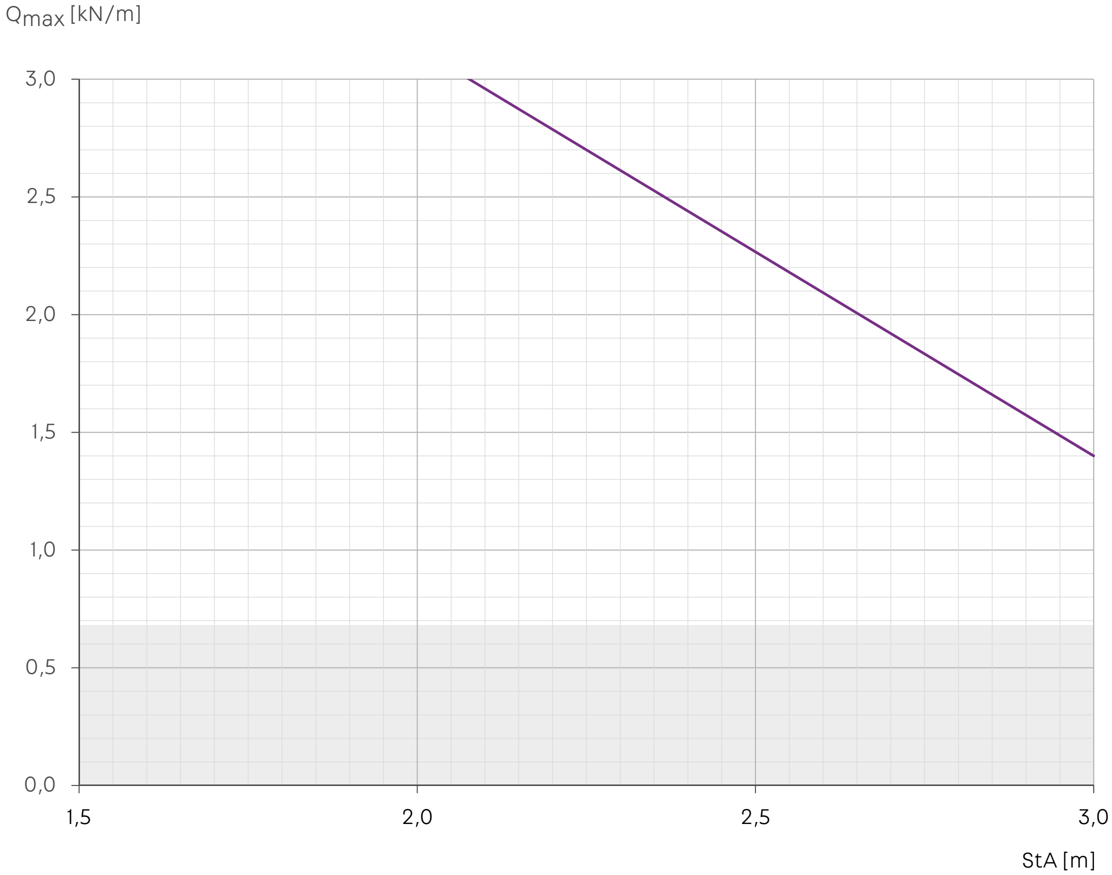


Model	B mm	L mm	t mm	A cm²	Q_{LK} kN/m	G S kg	G F kg
LGGS 60-20-3*	200	3,000	2.0	81	0.23	**10.4**	**11.1**
LGGS 60-30-3*	300	3,000	2.0	122	0.34	**11.3**	**12.1**
LGGS 60-40-3*	400	3,000	2.0	162	0.45	**12.2**	**13.0**
LGGS 60-50-3*	500	3,000	2.0	203	0.57	**13.1**	**14.0**
LGGS 60-60-3*	600	3,000	2.0	243	0.68	**13.9**	**14.9**
LGGS 60-20	200	6,000	2.0	81	0.23	**20.8**	**22.3**
LGGS 60-30	300	6,000	2.0	122	0.34	**22.6**	**24.2**
LGGS 60-40	400	6,000	2.0	162	0.45	**24.4**	**26.1**
LGGS 60-50	500	6,000	2.0	203	0.57	**26.1**	**28.0**
LGGS 60-60	600	6,000	2.0	243	0.68	**27.9**	**29.8**

B: Width | L: Length | A: Cross-sectional area | Q_{LK}: Power cable distributed load | G: Weight (per surface)

Example order
Model/version: LGGS 60-20-3S
*Only the special length of 3 m is explicitly stated in the item no.

Load diagram LGGS 60 S F



Tray width: 100 to 600 mm

Q_{max}: Max. distributed load

StA: Support distance

The filling capacity of cable ladders may exceed their load-bearing capacity. You must build in sufficient reserves and, where applicable, plan using a multi-layered approach.

UL classified

LGG 100

Perforated, welded cable ladders

Product features

- Side rail height: 100 mm
- Available tray widths: 200 to 600 mm
- Length: 3.000 and 6.000 mm
- Cross-sectional areas of 161 to 483 cm²

Special solutions

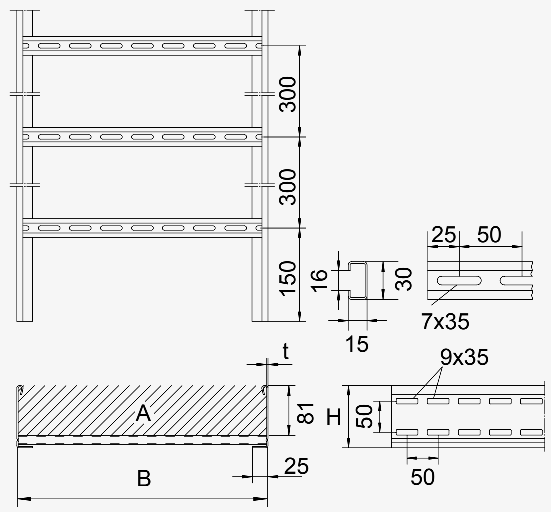
Further versions in other lengths are available on request. In addition to the standard length (6.000 mm), the LGG 100 can also be supplied in a length of 3.000 mm.

Keep off!

Available surface coatings and materials

- **S** Sendzimir hot-dip galvanised in accordance with DIN EN 10346 (continuous strip galvanising)
- **F** Hot-dip galvanised in accordance with DIN EN ISO 1461 (batch galvanising)
- **E** Stainless steel, material no. 1.4301 (V2A)
- **E4** Stainless steel, material no. 1.4571/1.4404 (V4A) (on request)
- **XC** XC coating for reliable protection in highly corrosive environments (on request)
- Colour coatings (on request)

Technical data

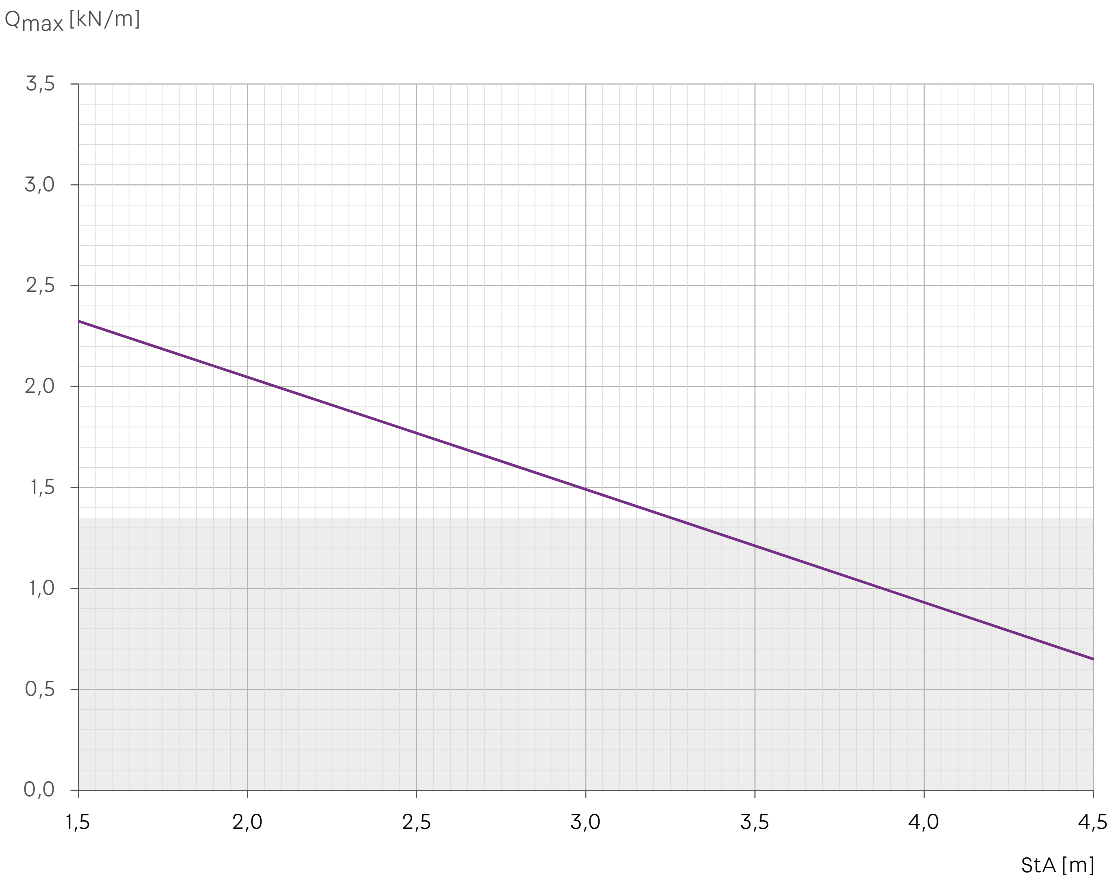


Model	B mm	L mm	t mm	A cm²	Q_{LK} kN/m	G S kg	G F kg	G E kg
LGG 100-20-3*	200	3,000	1.5	161	0.45	10.4	11.1	10.4
LGG 100-30-3*	300	3,000	1.5	242	0.68	11.1	11.8	11.1
LGG 100-40-3*	400	3,000	1.5	322	0.90	11.8	12.6	11.8
LGG 100-50-3*	500	3,000	1.5	403	1.13	12.4	13.3	12.5
LGG 100-60-3*	600	3,000	1.5	483	1.35	13.1	14.0	13.2
LGG 100-20	200	6,000	1.5	161	0.45	20.8	22.2	20.9
LGG 100-30	300	6,000	1.5	242	0.68	22.1	23.7	22.3
LGG 100-40	400	6,000	1.5	322	0.90	23.5	25.1	23.6
LGG 100-50	500	6,000	1.5	403	1.13	24.9	26.6	25.0
LGG 100-60	600	6,000	1.5	483	1.35	26.2	28.1	26.4

B: Width | L: Length | A: Cross-sectional area | Q_{LK}: Power cable distributed load | G: Weight (per surface)

Example order
Model/version: LGG 100-20-3S
*Only the special length of 3 m is explicitly stated in the item no.

Load diagram
LGG 100 S F E



Tray width: 100 to 600 mm

Q_{max}: Max. distributed load

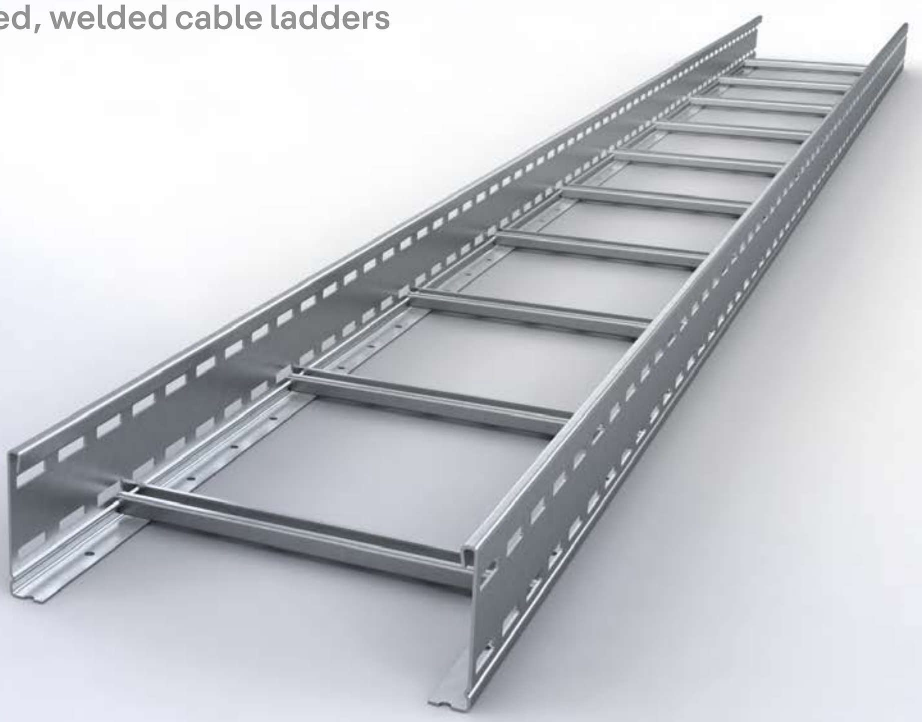
StA: Support distance

The filling capacity of cable ladders may exceed their load-bearing capacity. You must build in sufficient reserves and, where applicable, plan using a multi-layered approach.

UL classified

LGGS 100

Heavy-duty, perforated, welded cable ladders



Product features

- Side rail height: 100 mm
- Available tray widths: 200 to 600 mm
- Length: 3.000 and 6.000 mm
- Cross-sectional areas of 161 to 483 cm²
- Heavy-duty design for higher load levels

Special solutions

Further versions in other lengths are available on request. In addition to the standard length (6.000 mm), the LGGS 100 can also be supplied in a length of 3.000 mm.

Keep off!

Available surface coatings and materials

S Sendzimir hot-dip galvanised in accordance with DIN EN 10346 (continuous strip galvanising)

F Hot-dip galvanised in accordance with DIN EN ISO 1461 (batch galvanising)

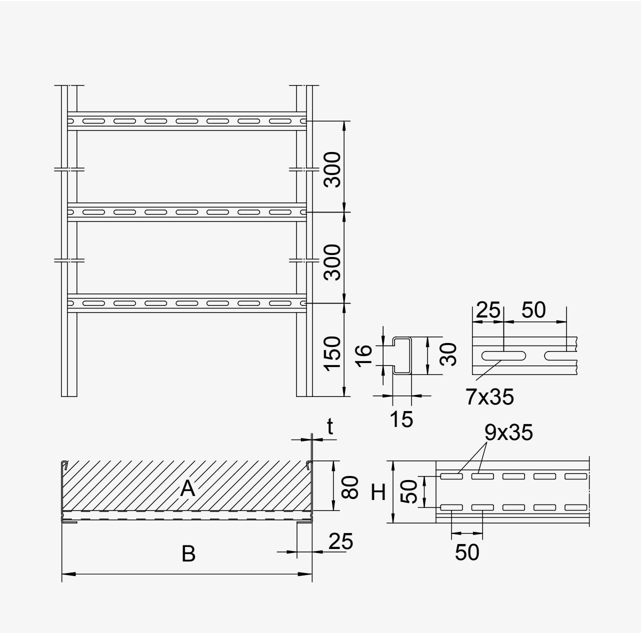
E Stainless steel, material no. 1.4301 (V2A)
(on request)

E4 Stainless steel, material no. 1.4571/1.4404 (V4A) (on request)

XC XC coating for reliable protection in highly corrosive environments (on request)

Colour coatings (on request)

Technical data

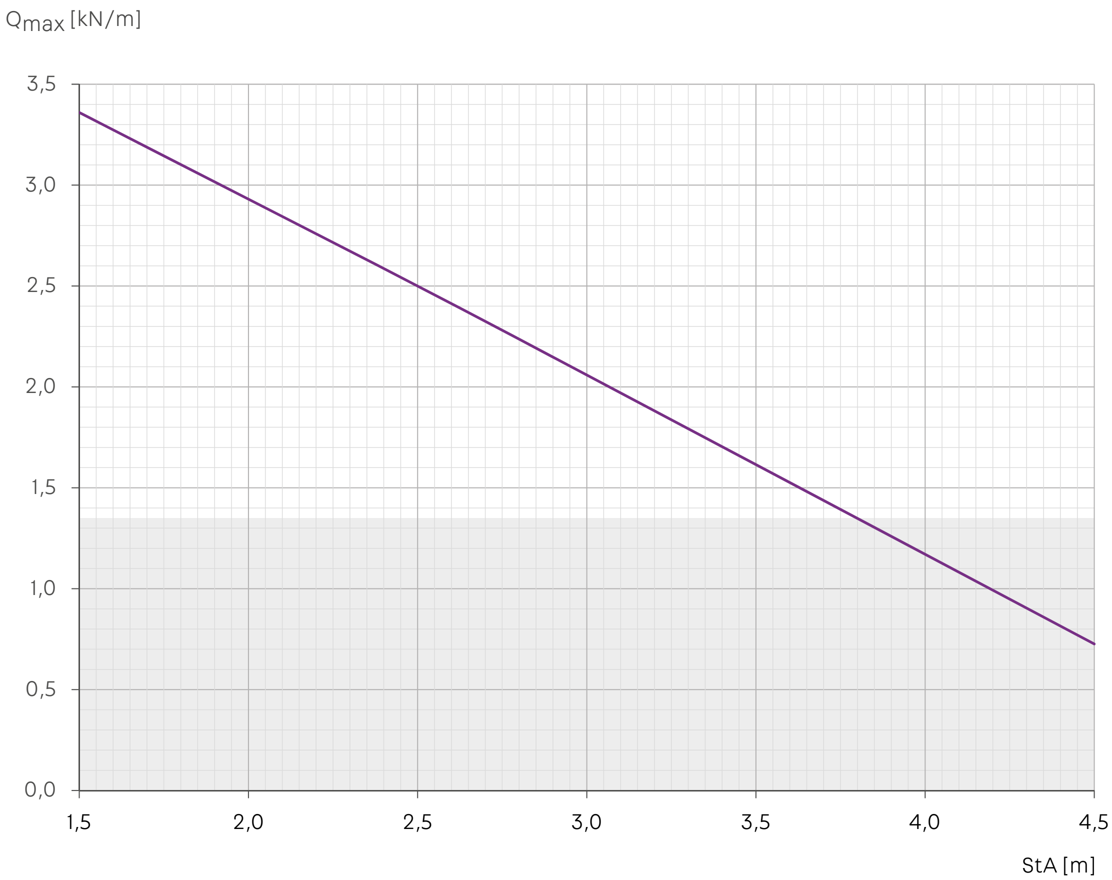


Model	B mm	L mm	t mm	A cm²	Q_{LK} kN/m	G S kg	G F kg
LGGS 100-20-3*	200	3,000	2.0	161	0.45	13.6	14.5
LGGS 100-30-3*	300	3,000	2.0	242	0.68	14.5	15.5
LGGS 100-40-3*	400	3,000	2.0	322	0.90	15.4	16.4
LGGS 100-50-3*	500	3,000	2.0	403	1.13	16.2	17.4
LGGS 100-60-3*	600	3,000	2.0	483	1.35	17.1	18.3
LGGS 100-20	200	6,000	2.0	161	0.45	27.2	29.1
LGGS 100-30	300	6,000	2.0	242	0.68	28.9	31.0
LGGS 100-40	400	6,000	2.0	322	0.90	30.7	32.9
LGGS 100-50	500	6,000	2.0	403	1.13	32.5	34.7
LGGS 100-60	600	6,000	2.0	483	1.35	34.2	36.6

B: Width | L: Length | A: Cross-sectional area | Q_{LK}: Power cable distributed load | G: Weight (per surface)

Example order
Model/version: LGGS 100-20-3S
*Only the special length of 3 m is explicitly stated in the item no.

Load diagram
LGGS 100 S F



Tray width: 100 to 600 mm

Q_{max}: Max. distributed load

StA: Support distance

The filling capacity of cable ladders may exceed their load-bearing capacity. You must build in sufficient reserves and, where applicable, plan using a multi-layered approach.

UL classified

Formed parts, covers and installation components

Formed parts with integrated connectors.

LGIB 60/100
Cable ladder inside bend

LGAB 60/100
Cable ladder outside bend

LGVB 60/100
Variable cable ladder vertical bend

LGA 60/100
Cable ladder branch

LGK 60/100
Cable ladder crossing

LD
Cable ladder cover

LDR
Cable ladder cover with turning bolts

LIBD
Cable ladder inside bend cover

LIBDR
Cable ladder inside bend cover with turning bolts

LAD
Cable ladder branch cover

LADR
Cable ladder branch cover with turning bolts

LKD
Cable ladder crossing cover

LKDR
Cable ladder crossing cover with turning bolts

LD-SW
Storm protection angle

LGV 60/100
Cable ladder connector

LGVH 60/100
Horizontal cable ladder connector

LGVV 60/100
Vertical cable ladder connector

LGTR 60/100
Cable ladder separating strip

LGKAB
Cable ladder drop-out plate

SL 60/100
Protection end cap

KLU
Clamp fastening set

H
Cable clamp for fastening to profile rails

MP-L
Assembly plate

Fastening screws are included with separating strips on delivery.

Support systems
In addition to the optional accessories (such as formed parts), support structures are also required for fastening the cable ladders. We can offer you appropriate support elements for any cable management system to enable fastening to a wall or ceiling. These elements are available with various load-bearing characteristics.

Planning advices

Standards and certificates

Standards

Test standard DIN EN 61537 provides the technical basis for cable management systems.
This standard determines which test procedure is to be followed when testing the mechanical properties of the cable management elements. PohlCon constantly carries out extensive tests to ensure that the cable management systems it produces remain functional and fit for use at all times.

Retention of function in the event of a fire

Our assembly instructions and technical information contain important safety details that must be heeded during assembly and use. Adhering to these ensures optimum safety of the cable management system used.

The maintenance of function of the normed supporting constructions and the system-specific-specified support systems in the event of fire are designed in accordance with DIN 4102-12. DIN 4102-12 specifies the requirements and testing for the maintenance of function of electrical cable systems in the event of fire.

Certificates

As a manufacturer of cable management systems and associated components, PohlCon attaches great importance to product quality. Throughout the entire value chain, high standards of quality apply across all departments with a view to developing the best possible system for a range of complex application areas. In order for this quality standard to be achieved and monitored long term, PUK cable management systems are externally monitored and subject to in-house inspections.

On our own test benches, we test our cable management systems according to the strict specifications of DIN EN 61537, especially with regard to load-bearing capacity and functionality. This is supplemented by our quality management system, which has been established in the company since 1995.

Our quality management system is also capable of accommodating higher requirements, such as those in the petrochemical industry, and it is backed up by the SCCP certificate.

Corrosion protection

Basic information

Corrosion is the reaction of a metallic material with its environment. This leads to a change in the material and impairs the ability of a metallic component – or an entire system – to function. Corrosive media can take the form of room air, contamination in the air, water, a marine atmosphere or other chemicals. Interactions between these corrosive media cause a corrosive layer to form, leading to metal attack.

If corrosion damage does occur, very high costs can sometimes be incurred. To avoid corrosion damage, we recommend selecting a suitable material and an appropriate surface coating. The environmental conditions of the products should therefore always be taken into account during planning in addition to their intended use to ensure that the relevant corrosion protection classes are adhered to.

Table 1: Atmospheric corrosivity categories and examples of typical environments

Corrosivity category	Mass loss/thickness loss per unit surface area (after first year of exposure)				Examples of typical environments (for information purposes only)	
	Unalloyed steel		Zinc		Exterior	Interior
	Mass loss g/m²	Thickn. loss µm	Mass loss g/m²	Thickn. loss µm		
C1 Negligible	≤ 10	≤ 1.3	≤ 0.7	≤ 0.1	-	Heated buildings with neutral atmospheres, e.g. offices, shops, schools, hotels
C2 Low	> 10 to 200	> 1.3 to 25	> 0.7 to 5	> 0.1 to 0.7	Atmospheres with low level of pollution. Mostly rural areas	Unheated buildings where condensation may occur, e.g. warehouses, sports halls
C3 Medium	> 200 to 400	> 25 to 50	> 5 to 15	> 0.7 to 2.1	Urban and industrial atmospheres with moderate sulphur dioxide pollution; coastal atmospheres with low salinity	Production areas with high humidity and some air pollution, e.g. food processing plants, laundries, breweries, dairies
C4 High	> 400 to 650	> 50 to 80	> 15 to 30	> 2.1 to 4.2	Industrial atmospheres and coastal atmospheres with moderate salinity	Chemical plants, swimming pools, coastal shipyards and boat harbours
C5 Very high	> 650 to 1,500	> 80 to 200	> 30 to 60	> 4.2 to 8.4	Industrial areas with high humidity and aggressive atmospheres, and coastal atmospheres with high salinity	Buildings or areas with almost permanent condensation and with high pollution
CX Extreme	> 1,500 to 5,500	> 200 to 700	> 60 to 180	> 8.4 to 25	Offshore areas with high salinity and industrial areas with extreme humidity and aggressive atmosphere, and subtropical and tropical atmospheres	Industrial areas with extreme humidity and aggressive atmosphere

Source: DIN EN ISO 12944-2:2018-04
Note: The loss values for the corrosivity categories are identical to the values in ISO 9223.
Conversion: 10 N corresponds to approx. 1 kg.

Surface coatings and materials

Several measures can be taken to protect components against the corrosive conditions prevailing at the place of use. When deciding on a particular cable management system, care must therefore be taken to select suitable materials and a design that ensures proper corrosion protection while also paying careful attention to the protective layers and metallic coatings.

For installations in normal environments, zinc coatings have proven themselves to be an effective corrosion inhibitor for steel. However, the protective zinc layer gets worn away by various climatic influences over time.
Calculating the thickness of the zinc layer required for different environmental conditions is a question of multiplying the erosion rate by the planned service life of the system.

DIN EN ISO 12944-2:2018-04 (Table 1) provides an overview of how the corrosion categories are assigned while taking account of the environment and the associated annual thickness loss of the zinc layer.

PohlCon offers several coating systems that differ from one another in terms of layer thickness, adhesion and appearance. In addition, most of our cable management systems can be supplied as stainless steel versions.

Alternatively, the PUK brand XC Duplex Coating System can be used for highly corrosive environments (corrosion category C5). The XC coating has been successfully tested in accordance with the DIN EN ISO 12944-6 standard and offers great flexibility with regard to use. With its specially developed formula, it provides a smooth, bubble-free and even coating surface.

Zinc electroplating (DIN EN ISO 4042)

The components to be coated are placed in an electrolytic bath, where zinc ions are deposited very evenly on the material being galvanised. This results in the formation of a bright and shiny zinc layer with a thickness of approximately 5 µm. To protect this layer against abrasion, it subsequently undergoes bichromate coating process. Within our product range, the relevant bolting fasteners/bolts and nuts are identified by the code GV. These are used to connect components galvanised using the sendzimir process.

Hot galvanisation according to the Sendzimir process (DIN EN 10346, DIN EN 10244-2)

In the rolling mill itself, a wide strip (sheet thickness ≤ 2.0 mm) is coated with zinc continuously as it passes through. This results in an even and strongly adhering zinc layer with an average thickness of 19 µm. Damage to the zinc layer by cutting, piercing/perforation, drilling, etc. does not lead to any progression of the corrosion because the adjacent zinc forms into solution due to the effect of (air) humidity, causing a brownish layer of protective zinc hydroxide to form on the bare cut surfaces. The “migration” of zinc ions protects exposed surfaces up to a width of approximately 2.0 mm.
Steel wire and wire products are galvanised in accordance with DIN EN 10244-2.
Products with this type of coating are identified by the code S.

Batch galvanisation (DIN EN ISO 1461)

Hot-dip galvanisaton (DIN EN ISO 1461)
Once they have been worked, the parts that are to be coated are immersed in molten zinc (approx. 450°C). Chemical reactions create various zinc-iron alloys that have a particularly strong bond with the steel core. These alloys are usually coated with a “pure zinc” layer. However, depending on the reaction rate, composition of the steel, immersion time, cooling process, etc., the zinc-iron alloys can run right through to the surface level due to a sort of “marbling” effect. For this reason, the surface appearance can vary from bright and shiny through to matt dark grey, although nothing can be inferred about the thickness of the zinc layer or the quality of corrosion protection from this. In addition, humid environments lead to the formation of zinc hydroxide carbonate (known as white rust), particularly on new zinc surfaces. This has absolutely no impact on the corrosion protection properties. Cut surfaces have to be protected with cold zinc paint.

According to DIN EN ISO 1461, the average layer thickness is

at least the following for steel and non-centrifuged parts:
- 45 µm for material thicknesses <1.5 mm
- 55 µm for material thicknesses ≥ 1.5 mm and ≤ 3 mm
- 70 µm for material thicknesses > 3 mm and ≤ 6 mm

at least the following for centrifuged parts (incl. castings):
- 45 µm for material thicknesses <3 mm
- 55 µm for material thicknesses ≥ 3 mm

DIN EN ISO 1461 essentially corresponds to BS EN ISO 1461 in the UK, to EN ISO 1461 in France and to NEN EN 1461 in the USA. All cable tray types and all medium to heavy-duty support systems are available in a hot-dip galvanised version. Products with this type of coating are identified by the code F.

Stainless steel
In view of its high corrosion resistance, ease of surface cleaning, recyclability and reaction to fire, stainless steel is increasingly becoming the material of choice. Its use is predominantly on the rise in the chemicals, paper, textile and food industries, as well as in wastewater treatment plants, refineries, vehicle tunnels and offshore plants. Compared to various types of plastic, the advantages of stainless steel are its high strength, temperature and fire resistance, and the fact that it does not produce any emissions in the event of fire or during machining.

PohlCon offers two stainless steel versions of its cable management systems as standard.

The most commonly used type is material no. 1.4301 (V2A), which has the short designation X5CrNi 18-10 according to EN 10088-2. It is approved by the Deutsches Institut für Bautechnik (DIBt) in Berlin under general technical approval Z-30.3-6. The following standards are related:
- EN 10088-2 1.4301 X5CrNi 18-10
- AISI 304
- UNS S 30400
- BS 304 S31
- AFNOR Z7CN 18-09
- DIN 17441

PohlCon offers a complete range of stainless steel products: bracket supports, brackets, cable trays, cable ladders, vertical ladders, profile rails and cable clamps. The bolting fasteners/bolts and nuts correspond to steel group A2 (according to DIN ISO 3506). The products made from this material are identified by the code E.

On request, products from the stainless steel range are also available in versions made from the material with no. 1.4571/1.4404 (V4A), which has the short designation X6CrNiMoTi17-12-2 according to EN 10088-2. This is likewise approved by the Deutsche Institut für Bautechnik (DIBt) in Berlin. The bolting fasteners/bolts and nuts meet the requirements of steel group A4 (according to DIN ISO 3506). This material is referred to in the following standards:
- 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

1.4571 is available as an alternative to this material. This type of steel is identified by the code E4.

Other materials with the same corrosion class can be supplied on request. To cater for special applications (lighting and cable support systems in road tunnels according to ZTV-ING), the high-alloy stainless steel with material no. 1.4529 is available for the relevant product versions.

XC coating for highly corrosive environments
The XC Duplex Coating System enables reliable protection in highly corrosive environments. With its XC system – which has been successfully tested for corrosion category C5-M – PohlCon offers the longest lasting corrosion protection (up to 25 years) for cable management systems available on the market.

XC consists of a zinc layer and a single-layer powder coating, which together adhere extremely well to the component. With powder coating thicknesses starting from 150 µm and zinc layer thicknesses from 55 µm, XC can be used to achieve an exceptionally smooth and even surface that is free of bubbles. In the event that it should become damaged, the XC coating can be touched up in the case of (more extensive) damage.

We recommend the use of XC coatings in offshore areas with high salinity, in industrial zones with extreme air humidity and in aggressive, subtropical and tropical atmospheres.

Calculations for selecting the right system

Cable selection

To be selected on the basis of:

1. The quantity or volume of cables that a cable tray is intended to hold **(capacity or size of cable tray)**
2. The weight of the cables that a cable tray is intended to hold **(type of cable tray)**
3. The distance between the cable tray support points **(load-bearing capacity of cable tray)**

Capacity/useful cross section

If the cable volume (types, sizes and number of cables) is unknown, you can estimate it using Table 2 "Space requirements and weight of NYY-type cables".

For each size of cable, the amount of space required must be multiplied by the number of cables of that size. These values must then be added together to give the grand total. This results in the minimum cross-sectional area (A) of the cable tray you are looking for. Where necessary, we recommend working with a reserve factor. Regardless of this, the stipulations of VDE 0100 on the occupancy of cable trays must always be observed.

The usable cross-sectional area (A) of each cable tray is specified in the product tables. Depending on the application, several cable trays may be laid parallel to one another.

Cable weight

The exact details provided by the cable manufacturer can usually be used for this purpose. Relevant lists or tables can generally be requested directly from the manufacturer so that the cable weights can be calculated as accurately as possible.

If the total weight of the cables is unknown, you can estimate it using Table 2 "Space requirements and weight of NYY-type cables".

For each cable size, the cable weight must be multiplied by the number of cables. These values must then be added together to give the grand total. This results in the estimated cable load (Q).

Load-bearing capacity/support distance

All stated load-bearing capacities relate to the product concerned.

The load-bearing capacity of the installed system depends on how the system is filled/loaded and, in particular, how the load is applied to the supporting structure.

However, from a safety perspective, the maximum possible cable load is crucial. DIN VDE 0639-1 is a good source of reference if you require further design and calculation criteria. The result of the distributed load for the respective cable type (control cable Q_{SK} or power cable Q_{LK}) is specified for each cable tray in the tables.

Support distance

The recommended standard support spacing is 1.5 m. However, a greater spacing may actually be possible depending on the specified fastening options (pillars, purlins, etc.). The load diagrams must be used to determine the maximum load (Q_{max}) that the cable tray can support with the given support spacing.

Table 2: Space requirements and weight of NYY-type cables

NYY cable	**Diameter** mm	**Space required per cable** cm² (approx.)	**Cable weight** N/m (approx.)	**Number of cables**
4 x 1.5	12.5	1.5	2.3	n
4 x 2.5	14.0	1.8	3.0	n
4 x 6	16.5	3.0	5.2	n
4 x 16	22.0	5.0	11.0	n
4 x 35	31.0	12.0	22.0	n
4 x 70	41.0	16.0	41.0	n

Conversion: 10 N corresponds to approx. 1 kg.

Example 1

Determining the maximum permissible additional load Q_{Zus} or load reserve based on the example of the LGG 60-40S with a support distance StA of 2.0 m

The load diagram data and Table 3 data are known from the product documentation:

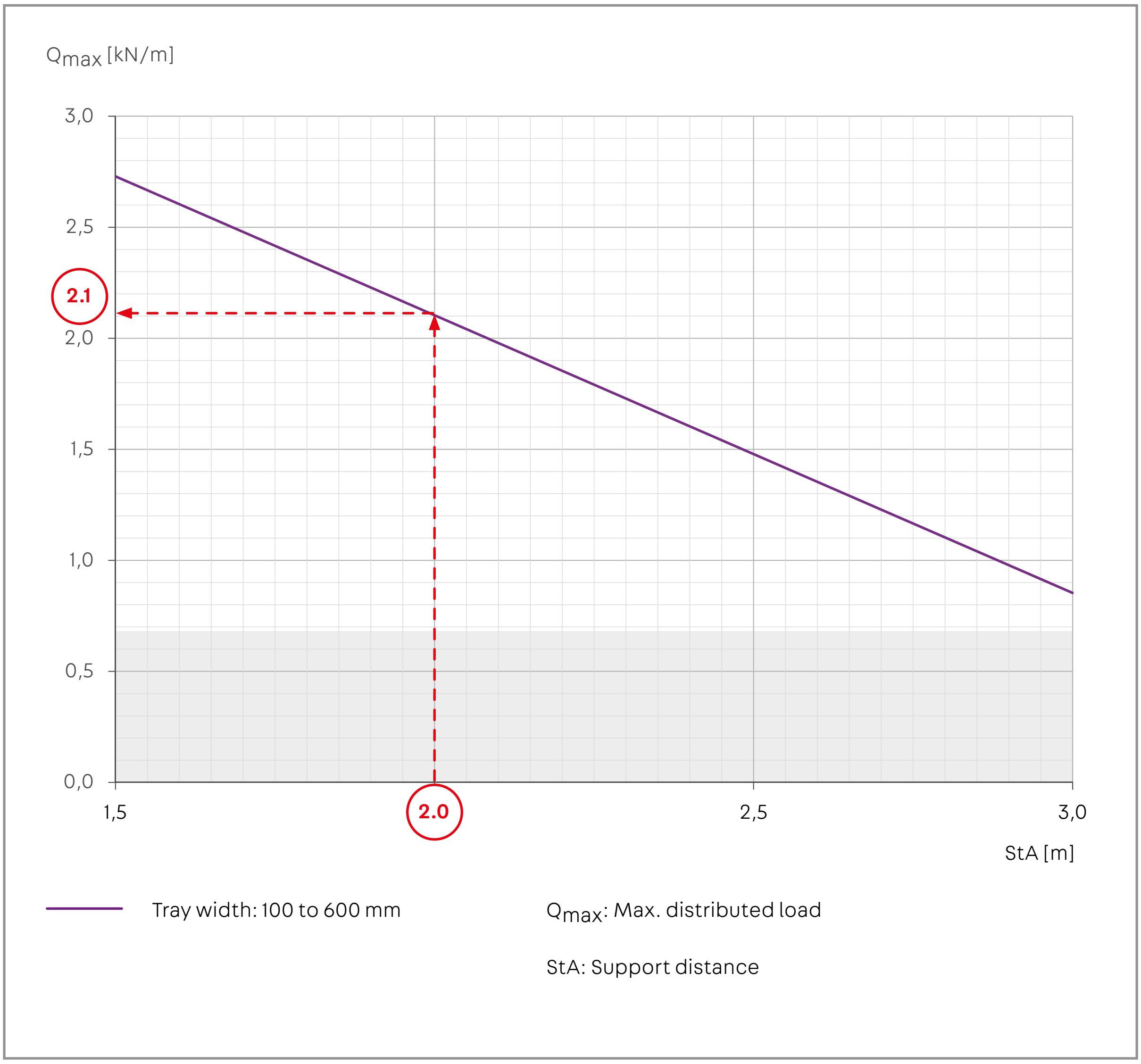


Figure 1: LGG 60 load diagram with the support distance of 2.0 m marked

Item number	B mm	A cm²	Q_{LK} kN/m
LGG 60-40S	400	162	0.45

Table 3: Data for the LGG 60-40S from the LGG 60 product table

For a support distance StA = 2.0 m, the load diagram reveals that:

Q_{max} = 2.10 kN/m

The maximum permissible additional load being sought is the difference between the maximum load and the potential cable load:

$Q_{max} - Q_{SK} = Q_{Zus}$

2.10 kN/m - 0.45 kN/m = 1.65 kN/m

Thus, with StA = 2.0 m, the maximum permissible additional load is 1.65 kN/m.

Example 2

Determining the maximum support distance StA based on the example of the LGG 60-60F with an additional load of 0.4 kN/m.

The load diagram data and Table 4 data are known from the product documentation:

Item number	B mm	A cm²	Q_{LK} kN/m
LGG 60-60F	**600**	243	0.68

Table 4: Data for the LGG 60-60F from the LGG 60 product table

According to Table 4, the distributed load of the control cable is:

$Q_{LK} = 0.68$ kN/m

The maximum load is calculated by rearranging the equation from example 1:

$Q_{max} = Q_{Zus} + Q_{LK}$

1.08 kN/m = 0.4 kN/m + 0.68 kN/m

Thus, with a maximum permissible additional load of 0.4 kN/m, the maximum load Q_{max} is 0.49 kN/m.

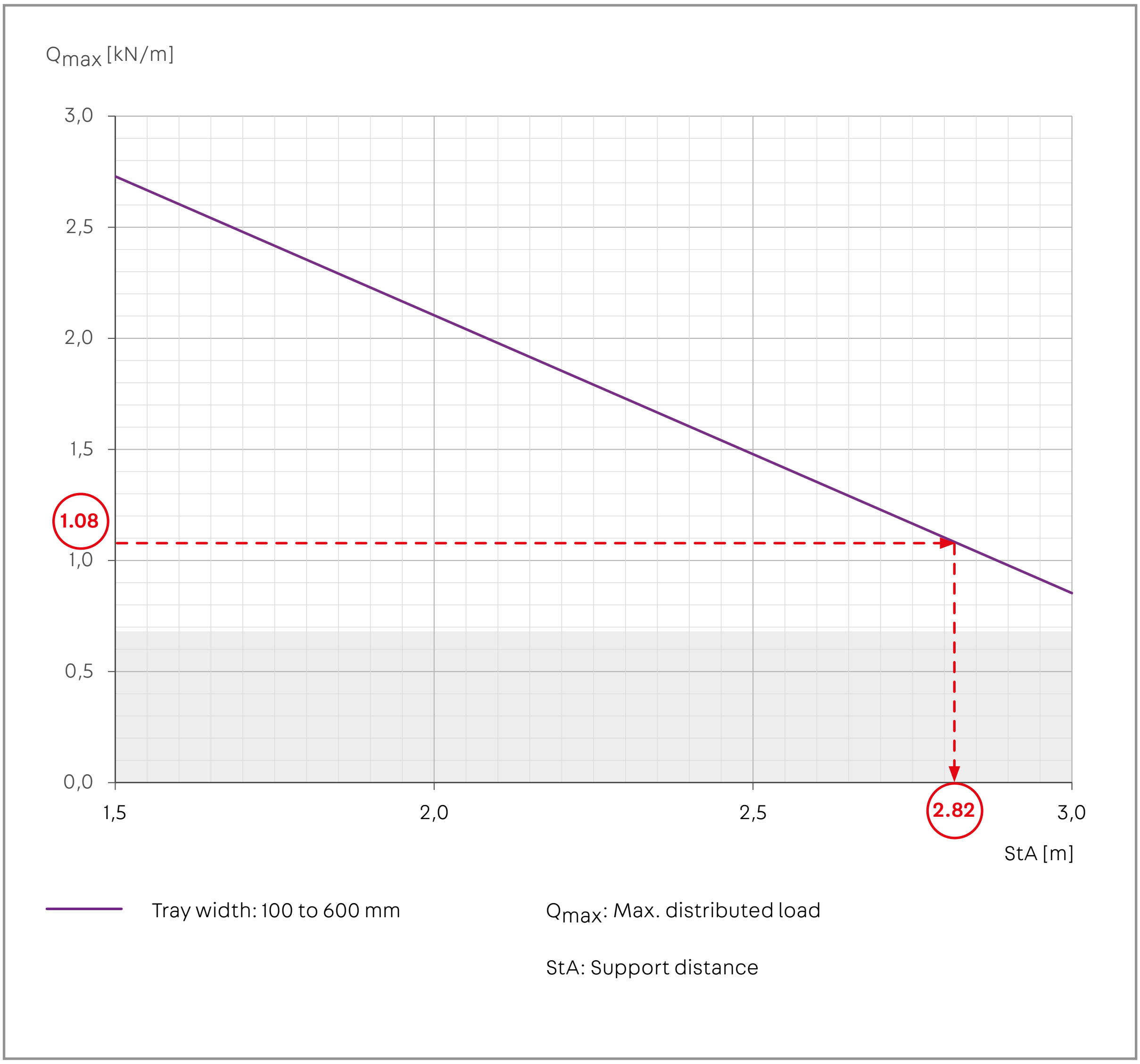


Figure 2: LGG 60 load diagram with the maximum load Q_{max} marked for the purpose of determining the maximum support distance StA

The maximum support distance being sought can now be determined from the load diagram with the aid of Q_{max}.
Thus, the maximum support distance is StA = 2.82 m.

The load diagrams include a safety reserve of at least 70% before the possible point of failure is reached (in accordance with DIN EN 61537). Nevertheless, nobody is allowed to stand on cable trays!
If the maximum load (Q_{max}) or the maximum support distance (StA) of the respective cable tray are not sufficient, check whether you can use versions with a higher load-bearing capacity instead.

Alternative cable tray types

A higher load with the same support distance

As an alternative, other cable management systems can be used for a defined support spacing. This technique enables the use of alternative systems that are capable of transmitting higher loads because of their rigidity.

The load-bearing capacities must be observed for the cable management systems selected, along with the permissible support spacings!

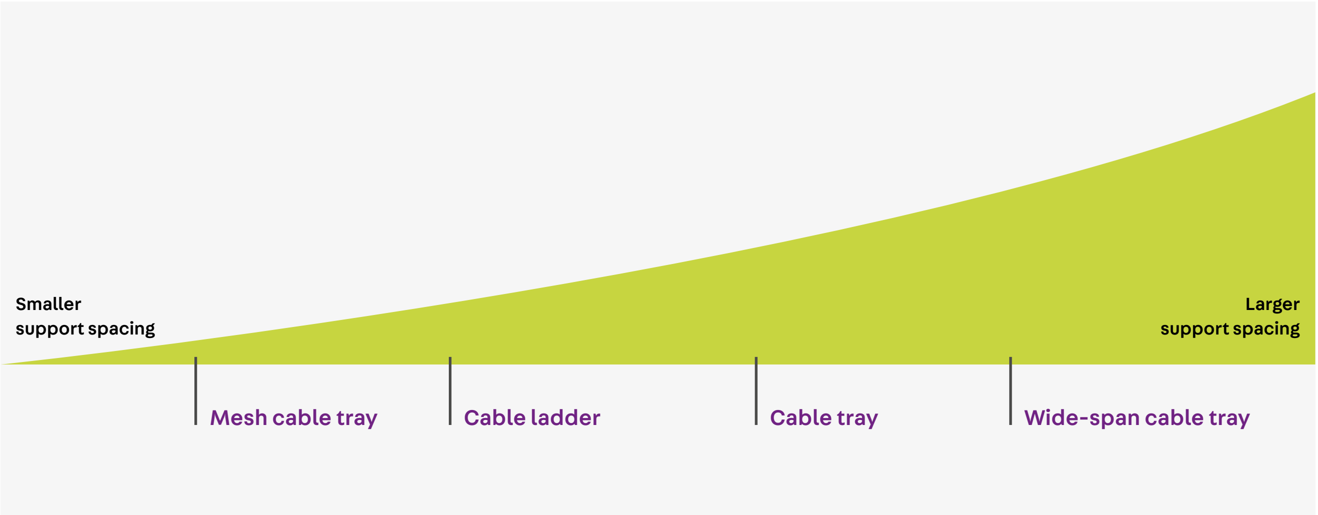


Figure 3: Alternative cable management systems according to permissible support spacings

Selecting the right support system

When routing cable trays on ceilings, the support systems usually consist of a stem supports and ceiling supports. When attaching cable trays to walls, wall brackets, profile rails and stem supports are used. To enable the selection of systems with sufficient load-bearing capacity, the first step is to calculate the load of each cable tray at the support point.

For detailed information, use the online expert chat service at www.pohlcon.com (only available in German) or speak to a PohlCon consulting engineer.

The load diagrams already have a safety concept built in. This is because the load-bearing capacities – which have been determined in accordance with test standard DIN 61537 – have appropriate safety factors applied to them. If the load levels or support distances are not sufficient for proper dimensioning of the cable management systems, the next version up (i.e. one with higher load levels) must be selected or the support distances must be reduced.

Useful information

Application of loads to the building structure

All stated load-bearing capacities relate to the product concerned. The load-bearing capacity of the installed system depends on the dimensions and materials used in each case and, in particular, on how the load is applied to the building structure. Substantial additional loads can occur when installing cables. Care must be taken to prevent these additional loads from being permanently applied to the cable management system.

Substrate

The condition and properties of the substrate and the type of wall or ceiling have a major impact on the fastening of support systems. To enable a better assessment of concealed, plastered or painted substrates, it is helpful to carry out sample drilling.

This will enable you to attach the cable trays to any of the following using the appropriate support systems: timber, mortar, sandstone, limestone, concrete, solid brick, perforated brick, aerated concrete, wallboard, gypsum board, gypsum fibreboard and insulating board. Within this context, special attention must be paid to the dowels because they transmit the loads further into the substrate.

Permissible dowel load F_{ZUl}

The dowel load is a superposition of vectors that represent various force components acting on the fastening point (e.g. shear force and vertical pull-out force). This must be less than or equal to the permissible dowel load specified in the approval. This generally applies to all diagonal pull directions. The permissible dowel load depends on the anchorage (concrete grade, type of masonry brick, etc.) and stress exerted on it:

- Cracked concrete tensile zone
- Verified concrete compression zone (e.g. concrete wall, concrete supports, upper half of concrete girder).

In cases of doubt, advice must be sought from the responsible structural engineer.

Reduction

The permissible dowel load F_{ZUl} must be reduced if:

- Several dowels are closer to each other than dimension a of the centre-to-centre distance.
- The distance between the dowel and an edge/corner of the building structure is less than edge distance dimension ar.

Whenever you are planning cable management systems, it is important to remember that the filling capacity of cable trays may exceed their load-bearing capacity. You must allow sufficient reserves and, where applicable, plan using a multi-layered approach.

For detailed information, use the online expert chat service at www.pohlcon.com (only available in German) or speak to a PohlCon consulting engineer.

Testing according to DIN EN 61537

Cable management systems

Among other things, DIN EN 61537 determines which test procedure is to be followed when testing the mechanical properties of the cable support elements.

The following undergo testing:

1. Cable trays including connectors with an appropriate design

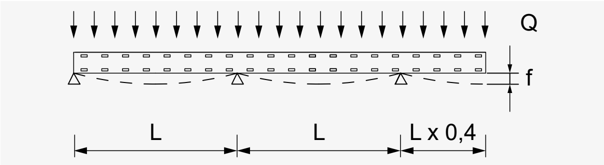


Figure 4: Load diagram for the testing of a cable tray
Q: Distributed load | L: Support distance

2. Brackets as an individual component, i.e. without the reinforcing effect provided by assembled cable trays. The stated load-bearing capacities are based on the loads measured with a level of deformation that is still permissible (f_{zul}) for the cable support elements in the respective standard version (e.g. Sendzimir/hot-dip galvanised).

Cable trays

The cable trays undergo testing on a specially developed test stand. This ensures even surface loading of the components that bend elastically under load.

f_{zul} (in longitudinal direction) = 0.01 x support distance StA

f_{zul} (in transverse direction) = 0.05 x cable tray width B

Arms/brackets

Under a vertical load, the tips of the arms are allowed to drop by:

f_{zul} = 0.05 x arm length (but ≤ 30 mm)

Stems (bracket supports)

The stems undergo various tests. Careful attention is paid to the following points when testing the stems:

- Bending from to lateral application of force; the permissible deflection within this context is f_{zul} = 0.05 x stem length
- Application of force in connection with arms
- Pull under centric load

Safety

A safety factor of 1.7 must be incorporated into the tested structures, as per the safety concept required under the test standard. The failure scenario possible as a result is not tantamount to the respective structure breaking. Rather, it involves the structure becoming so heavily deformed that no further increase in load can be registered. For this reason, the elastic-plastic deformability of metal cable support systems makes them preferable to brittle plastic systems that break easily.

Whenever you are planning cable management systems, it is important to consider that the filling capacity of cable trays may exceed their load-bearing capacity. Therefore, you must factor in sufficient reserves and, where applicable, plan using a multi-layered approach.

Equipotential bonding

Equipotential bonding is implemented between electrically conductive components with different levels of electrical potential. The primary purpose of this is to provide protection against electric shock but, at the same time, it protects the electrical equipment in the event of excess voltage. Over time, the effect of equipotential bonding has become ever more important in relation to electromagnetic compatibility (EMC). When electricity flows through conductors, it generates magnetic fields. Due to the large number of wiring systems installed in buildings, these can then have a negative effect on electromagnetic compatibility. Low potential differences are extremely important for ensuring that an electrical installation is electromagnetically compatible.

In the case of PUK cable management systems that are assembled using bolted connections, the equipotential bonding has been verified in accordance with DIN EN 61537. In all other cases, the equipotential bonding must be ensured by further mechanical means.

Our synergy concept for your benefit

With us, you can take advantage of the collective experience of three established manufacturers that combine products and expertise in one comprehensive offer. That is the PohlCon synergy concept.

Full service consulting
Our extensive network of consultants is available to answer all of your questions about our products on site. From planning to deployments, enjoy personal support from our qualified professionals.

Digital solutions
Our digital offerings offer targeted support in planning with our products. From tender texts through CAD details and BIM data to modern software solutions, we offer you tailored support for your planning.

7 areas of application
We think in holistic solutions, which is why we have grouped our products into seven areas of application for you where you can benefit from the synergy of the PohlCon product portfolio.

10 product categories
To help you find the right product in our extensive range even faster, the products are grouped into ten product categories so you can navigate clearly between our products.

Individual special solutions
There's no mass produced-product on the market that is suitable for your project? We master extraordinary challenges with the many years of expertise of our three manufacturing brands in the sector of individual solutions, allowing us to realize your unique construction projects together.

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