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Circuit integrity maintenance of electrical cable systems - Cable systems with integrated circuit integrity DIN 4102 Part 2

The DIN VDE 0100-718 deals with the erection and operation of high voltage equipments in structural assets for group gatherings and with the emergency lightning in places of work.

Structural assets are primarily: Auditoriums, department stores, office buildings, multi-story buildings, hotels, hospitals, closed car parks.

The Fachkommission Bauaufsicht der Bauministerkonferenz (Specialist Agency Construction Supervision of Construction Secretaries) has issued the Muster-Leitungsanlagen-Richtlinie (Sample Wire Construction Guideline) version in March 2000.

Point 5 regulates the circuit integrity maintenance of electrical cable systems in case of a fire.

5. Circuit integrity maintenance of electrical cable systems in case of a fire

5.1 Integrity Maintenance

Because of § 17 paragraph 1 MBO electrical cable systems for security constructions according to the regulation law for construction have to be of a certain making or separated in a manner that allows continued function for a sufficient time span in case of exposure to fire from the outside (Maintenance of function).

5.1.1 The maintenance of cable systems is warranted if the cable systems comply with DIN 4102 Part 12, edition November 1998.

5.2. Time span of maintenance of function

5.2.1 The time span for maintenance of function has to amount to at least 90 minutes in

- constructions for increasing distribution pressure in devices providing water for fire fighting
- mechanical fume outlet devices and fume protection pressure devices
- fire brigade lifts and bed lifts in hospitals

5.2.2 The time span for maintenance of function has to amount to at least 30 minutes in

- emergency lighting devices
- passenger hoists with fire control
- fire detection systems including their transmission devices
- alarm systems and systems issuing instructions to visitors and employees insofar as these systems have to function in case of fire
- natural fume outlets (fume outlet by thermal buoyancy)
- mechanical fume outlet devices and fume protection pressure devices in cases not covered by paragraph 5.2.1

Requirements and testing of circuit integrity maintenance of electrical cable systems are determined in DIN 4102 part 12, edition of November 1998.

The application range is limited to cables with a nominal voltage of up to 1 kV. Cable systems are high voltage cables, isolated high voltage cables, installation cables and wires for telecommunication and data processing, as well as for rail traffic including related channels, coatings and sidings, connection pieces, carrying devices and fittings.

Circuit integrity maintenance is given, if the fire test does not result in short-circuits and if there is no interruption of current conduction in the cable system.

According to the measured time span of circuit integrity maintenance there is a distinction:

Class of circuit integrity maintenance	Time span of circuit integrity maintenance
E 30	≥ 30 min.
E 60	≥ 60 min.
E 90	≥ 90 min.

As implemented action regarding circuit integrity maintenance, mainly cable systems with integrated circuit integrity maintenance are acknowledged.

These are special non-halogen lines that are passed on a special carrier construction. Cable plus carrier construction make a cable system.

Cable systems with integrated circuit integrity maintenance are being tested as follows:

The cable system with a testing length of at least 3 meters is embedded into a test bench according to DIN 4102-2 horizontally inside a fire room of at least 3 x 2 x 2.5 meters.

The test takes place according to the uniform temperature time graph (ETK). After 30 minutes a temperature of 822 K and after 90 minutes 989 K is reached.

The testing of high voltage cables, for example NHXH or NHXCH, is done with a cable containing four electrical conductors. According to the construction of the cable and the way of passing two test samples, each of the smallest electrical conductor cross-section of the construction layout and two test samples, each usually with a cross sectional area of 50 mm² or bigger have to be tested.

For testing of cables and conductors for telecommunication and data processing devices two test samples of each, the smallest conductor and number of pairs for each construction layout, have to be tested.

The circuit integrity maintenance of cable systems with integrated circuit integrity maintenance can be proved with the following three ways of passing:

- Passing of cables on cable ladders
- Passing of cables in cable trays
- Individual passing of cables under the ceiling

The standard construction according to DIN 4102-12 (norm carrier construction) for testing circuit integrity maintenance in case of passing cables on ladders or trays consists of a carrying construction with a support distance of 1.2 meters. The suspension is made of hanging rods with screwed on or wedged on brackets and the additional suspension at the tip of the bracket by means of threaded bolts.

The hanging rods and threaded bolts are to be dimensioned in a manner that their calculated tensile stress according to table 109 DIN 4102 part 4 related to circuit integrity maintenance E 30 is no bigger than 9 N/mm², related to circuit integrity maintenance E 90 no bigger than 6 N/mm².

The cable ladder's width is 400 mm, the maximum load 20 kg/m.

The cable tray's width is 300 mm, the maximum load 10 kg/m.

The ladder stringer's height is 60 mm; the sheet thickness is defined as 1.5 mm.

The distance between the rods is 150 mm.

The joints of cable trays and cable ladders have to be arranged in the center of the testing field.

For individual passing under the ceiling there are two determined variations:

Individual passing with profile rails and clips with extended counter bed as well as individual passing with single cable clamps.

The passing with single cable clamps is done with intervals of 300 mm. The passing with profile rails and bracket clamps is done with intervals of 600 mm; the length of the extended counter bed is 200 mm.



Differing from this, the distance between the profile rails in PUK-norm-support constructions is 400 mm with extended counter beds of 70 mm length.

Only the horizontal arrangement of cable systems is tested, that means that test results for horizontal cable systems are valid for inclined or vertical systems (for example ascending traces) as well. Cables have to be supported efficiently at the horizontal-vertical junction in order to prevent deviation or sliding. For continuous ascending traces, an effective cable support has to be installed within at least every 3.5 meters.

A test certificate will be issued for execution and results of the test. It carries the notation: "For the application for a test certificate of approval of the building authorities according to building regulation list A".

The support systems of the PUK-WERKE KG are qualified with the drafting of an expert's report on support systems no. 3374/2096 of the material testing institute for the building industry (MPA) in Braunschweig as norm constructions according to DIN 4102-12: 1998-11. It is divided into four parts:

- Part 1: Passing on cable ladders
- Part 2: Passing on cable trays
- Part 3: Passing with cable clamps
- Part 4: Ascending traces

These documents with explanations have been combined into a documentation. It is available in print and as PDF-file on request.

Cables which have been tested on a norm support construction may also be passed on norm support constructions of other manufacturers without additional testing.

In case of testing that varies from the norm support construction the test result is only valid for the tested combination of cable and support construction.

The PUK-WERKE KG has carried out tests of 400 mm and 500 mm wide cable trays and wire mesh cable trays with a distance between supports of up to 1.5 meters and a load of up to 20 kg that diverge from the norm support construction together with several cable manufacturers.

Test results are also available for profile rails and cable clamps with up to 800 mm distance between rails without extended counter beds.

Cable systems have to be erected in a manner which prevents negative impact from surrounding component parts during the classification period.

Cable systems may only be fixed to building component parts that have at least the period of circuit integrity maintenance required for the cable system.

Support constructions have to be fastened to massive ceilings or walls with steel plugs that have been certified for their fire performance by a fire test or by drafting of an expert's report on their fire performance through an acknowledged testing institute.

When passing cables on cable trays or cable ladders, the clearance between cable and side rail of the ladder or tray has to be at least 30 mm. Formed components have to be quenched separately.

When passing cables on an ascending trace there has to be an effective cable support at least every 3.5 meters as it is described in part 4 of the drafting of an expert's report no. 3374/2096.

The contractor implementing the action of circuit integrity maintenance of electrical cable systems is to issue a consistence certificate for each building project. In it he certifies that his implementing of the action was according to the site inspection's (AbP) test certificates.

The cable system has to be marked permanently through the contractor with

- Name of the company that manufactured the cable support system
- Identification of the cable support system according to the site inspection's test certificate
- Class of circuit integrity maintenance
- Number of the general site inspection's test certificate
- Year of manufacture.

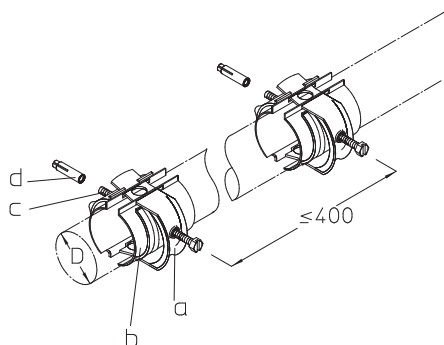
In case of certification of a cable system by an official expert, the conformity of the execution with the general construction supervision test certificate (AbP) shall be confirmed.

Standardised support systems according to DIN 4102-12 (11/98)

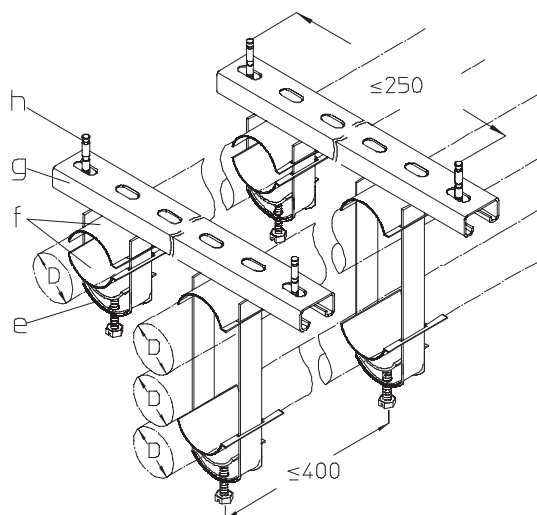
Passing of single cables

1. a) Cable clamps and extended counter beds

For fastening cables to ceilings and walls in horizontal and vertical direction with a distance between mounting parts of at least 400 mm.



a	cable clamp	...W ¹⁾	H13
b	extended counter bed	LW... ²⁾ (2 x)	H14
c	screw	SSV 6x10	KS-D4
d	plug	SAZ 6 ⁴⁾	H26



e	cable clamp	...AC oder ...H ³⁾	H13
f	extended counter bed	LW... ²⁾	H14
g	bracket support	KHA oder KHB	H14
h	plug washer	SD-BS 6/5 ⁴⁾ US 6x18	H26 G11

D = Diameter of cable⁵⁾

1) Cable clamp size = counter bed size + 4 mm

2) Counter bed size ≥ cable diameter (D)

3) Cable clamp size = counter bed size

4) or other permitted plugs

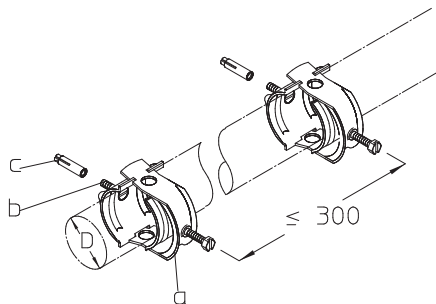
5) Max. three cables up to a diameter of 25 mm each may be aligned under one cable clamp

Standardised support systems according to DIN 4102-12 (11/98)

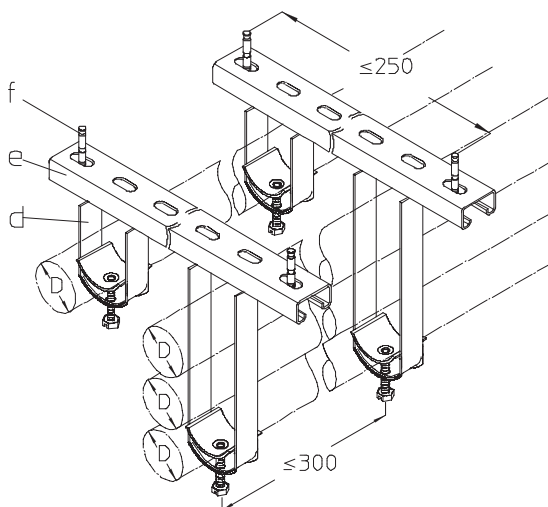
Passing of single cables

1. b) Single cable clamps

For fastening cables to ceilings and walls in horizontal and vertical direction as well as on ascending traces with a distance between mounting parts of at least 400 mm.



a	cable clamp	...W ¹⁾	 H13
b	screw	SSV 6x10	KS-D4
c	plug	SAZ 6 ²⁾	H26



d	cable clamp	...AC oder ...H ¹⁾	H13
e	bracket support	KHA oder KHB	H14
f	plug washer	SD-BS 6/5 ²⁾ US 6x18	H26 G11

D = Diameter of cable³⁾

1) Cable clamp size = cable diameter (D)

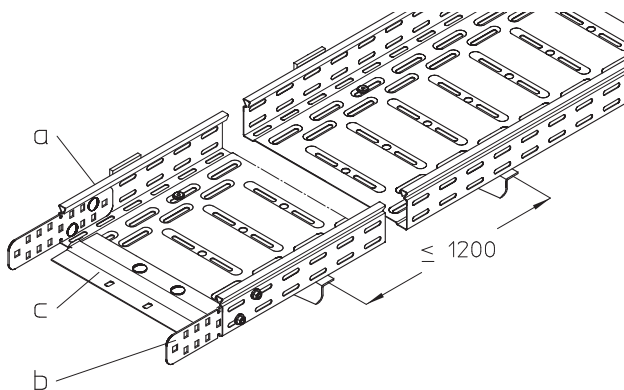
2) or other permitted plugs

3) At most three cables up to a diameter of 25 mm each may be aligned under one cable clamp

Standardised support systems according to DIN 4102-12 (11/98)

Passing of several cables

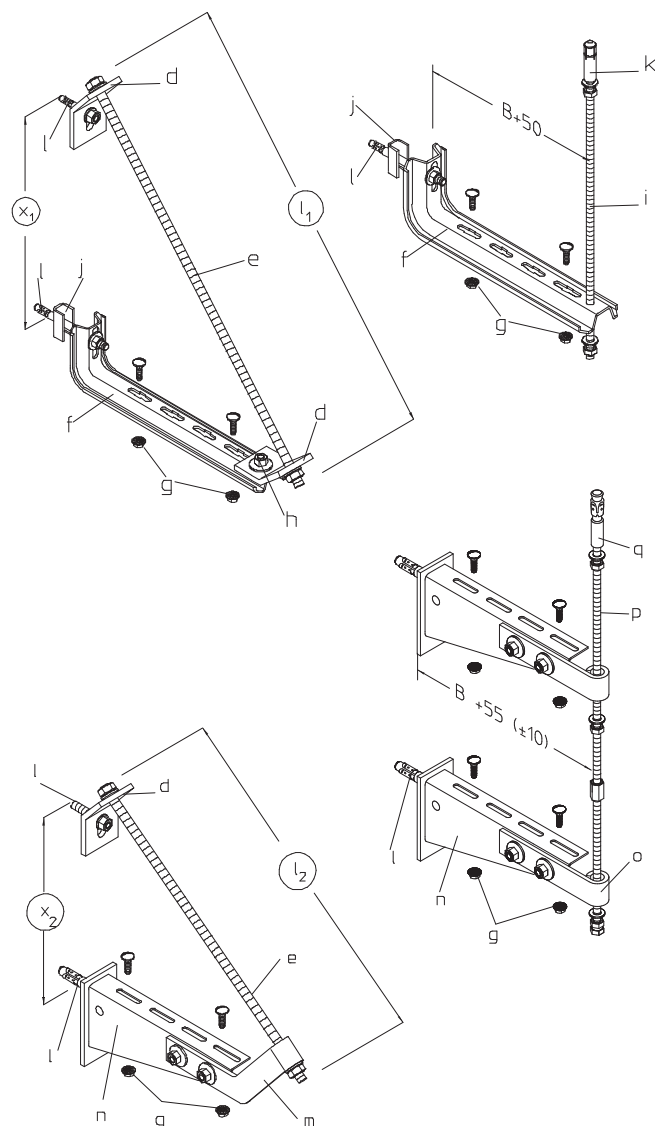
2. a) Cable trays



For passing of security cables along massive ceilings and massive walls in horizontal direction including leaps in height with a distance between supports of maximal 1.2 meters.

Carrying capacity: 10 kg/m

Width of tray ≤ 300 mm



a	cable tray	RGS 60	H15
b	connector	RGV-BS	H15
c	coupler	VB-BS	H15
d	wall angle	W-BS	H24
e	threaded rod	GB M10	G7
	washer (2 x)	US 10x21	G10
	nut (2 x)	SEM 10	G11
f	bracket	KSLW	H21
g	tray clamping screw	KLRL	G3
h	hexagon head bolt	SES 8x20	G9
	hexagon nut self locking	SEMS M8	G11
i	threaded rod	GB M8	G7
j	bracket	KSL-SP	F9
k	plug	SAZ 8 ¹⁾	H26
l	plug	SD 8 ¹⁾	H26
m	bracket adapter	KAW-BS	H24
n	bracket	KW-BS	H23
o	bracket adapter	KAD-BS	H24
p	threaded rod	GB ²⁾	G7
	rod coupling	VM ^{2), 3)}	G7
	nut	SEM ²⁾	G11
	washer (2 x)	US ²⁾	G10
q	plug	SD ^{1), 2)}	H26
	rod coupling	VM ^{2), 3)}	G7
r	tray clamping screw	KLR	G3

Width mm	X ₁ mm	l ₁ mm	X ₂ mm	l ₂ mm
100	138	318	165	260
200	258	473	250	390
300	376	628	330	515
400	-	-	420	655

1) or other permitted plugs

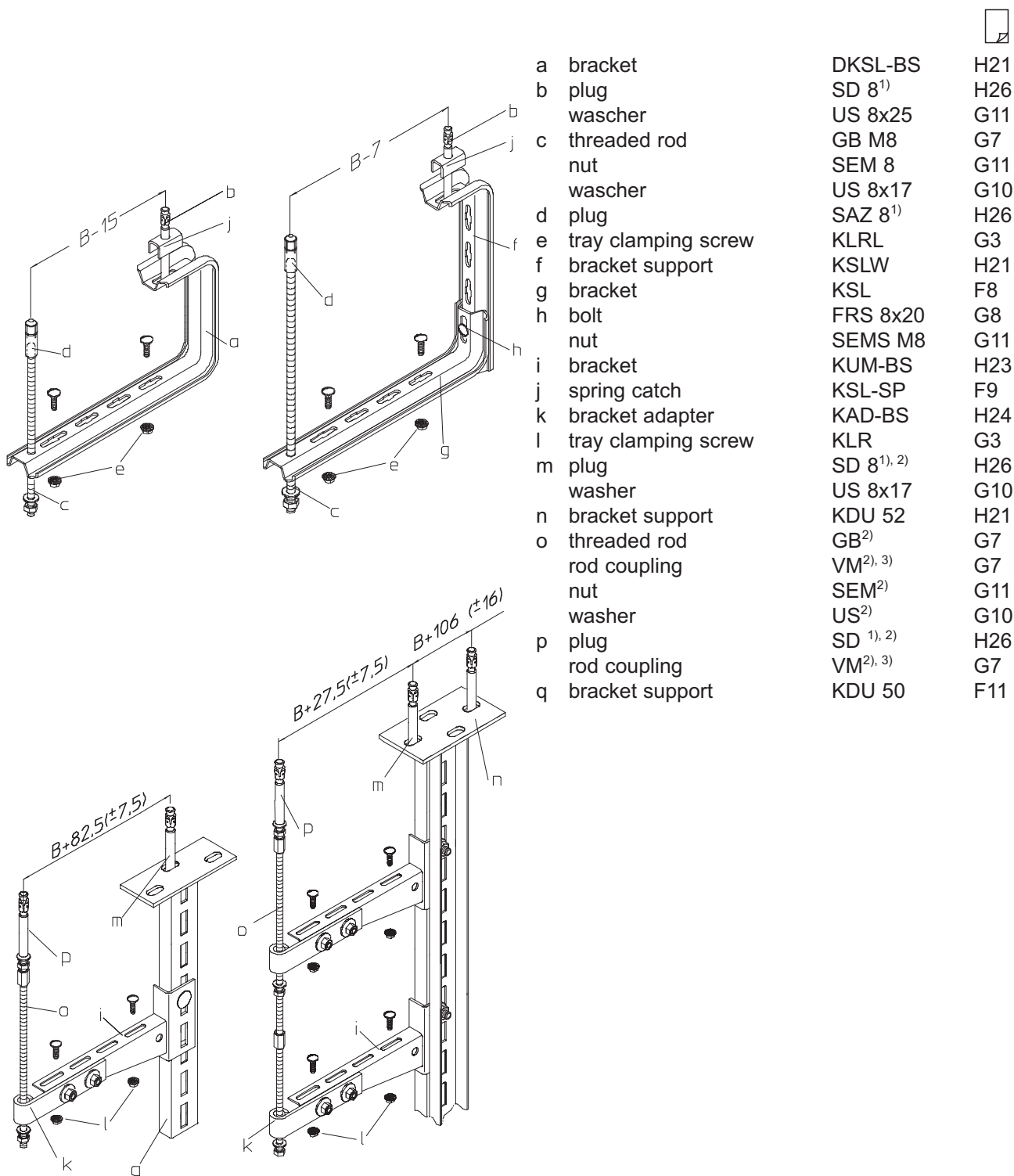
2) for 1 cable tray: M 8

for 2 cable trays: M 10

for 3/4 cable trays: M 12

3) screw in depth into rod coupling $\leq$ diameter of threaded rod

Standardised support systems according to DIN 4102-12 (11/98) Passing of several cables



1) or other permitted plugs

2) for 1 cable tray: size M 8
for 2 cable trays: size M 10
for 3/4 cable trays: size M 12

3) screw in depth into rod coupling $\leq$ diameter of threaded rod

Standardised support systems according to DIN 4102-12 (11/98)

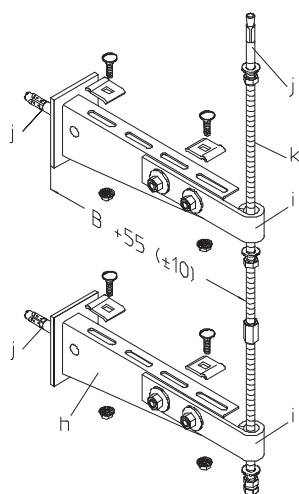
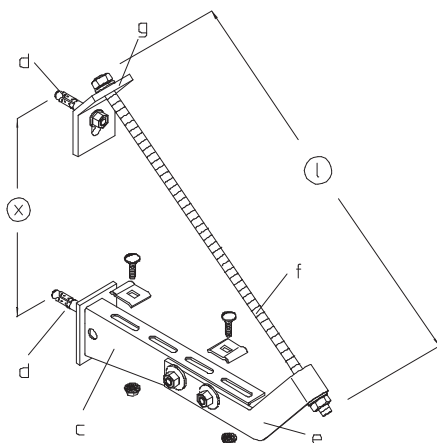
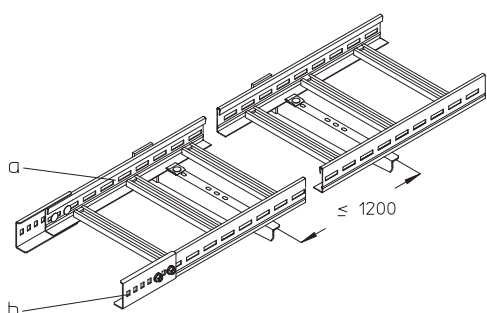
Passing of several cables

2. b) Cable ladders

For passing of security cables along massive ceilings and massive walls in horizontal direction including leaps in height with a distance between supports of maximal 1.2 meters.

Carrying capacity: 20 kg/m

Width of tray: ≤ 400 mm



a	cable ladder	L-BS 60 ³⁾	H17
b	coupler	LGV-BS (2 x)	H18

accessory:	cable clamp	...H	H13
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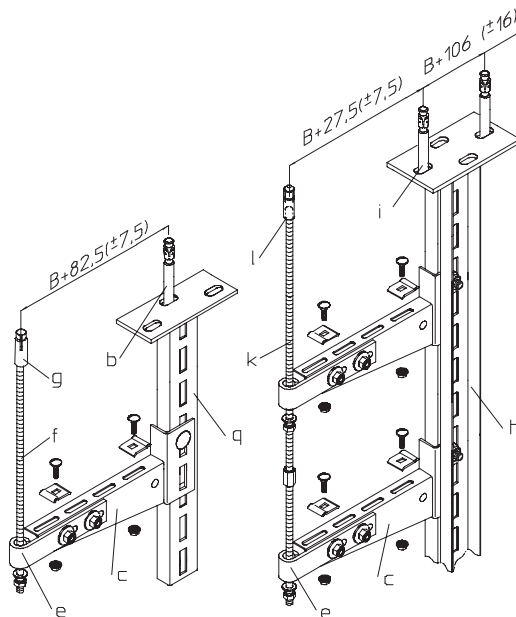
c	bracket	KW-BS	H23
	tray clamping fixing	KLU	G3
d	plug	SD 10 ¹⁾ (2 x)	H26
e	bracket adapter	KAW-BS	H24
f	threaded rod	GB M10	G7
	nut	SEM 10 (2 x)	G11
	washer	US 10x21 (2 x)	G10
g	wall angle	W-BS	H24
h	bracket	KW-BS	H23
	tray clamping fixing	KLU	G3
i	bracket adapter	KAD-BS	H24
j	plug	SD 10 ¹⁾	H26
k	threaded rod	GB M ²⁾	G7
	rod coupling	VM M ²⁾ , 4)	G7
	nut	SEM ²⁾	G11
	washer	US ²⁾	G10
	armature	SAZ ²⁾	H26
	or		
	plug and additional	SD ¹⁾ , 2)	H26
	rod coupling	VM M ²⁾ , 4)	G7

width mm	X mm	l mm
100	165	260
200	250	390
300	330	515
400	420	655

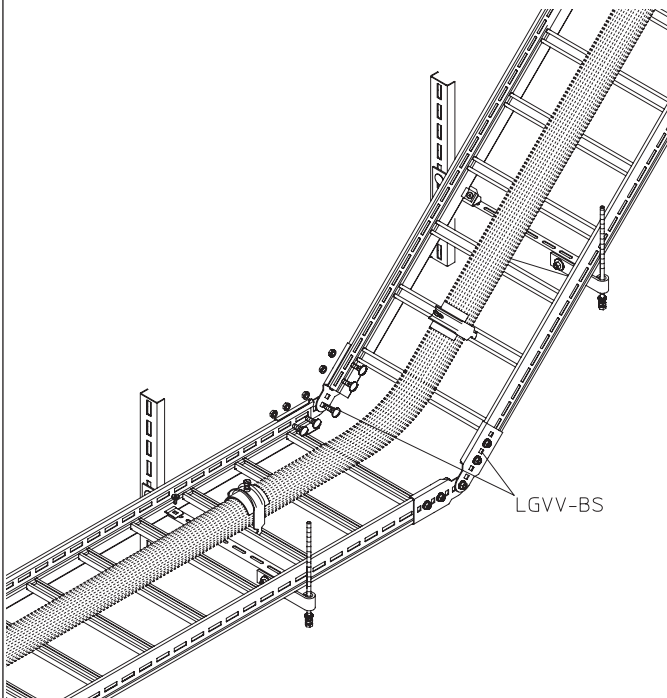
- 1) or other permitted plugs
- 2) for 1 cable tray: thread M 8
for 2 cable trays: thread M 10
for 3/4 cable trays: thread M 12
- 3) one support construction on each end of the fitting as well as in the middle
- 4) Screw in depth into rod coupling $\leq$ diameter of threaded rod

Standardised support systems according to DIN 4102-12 (11/98)

Passing of several cables



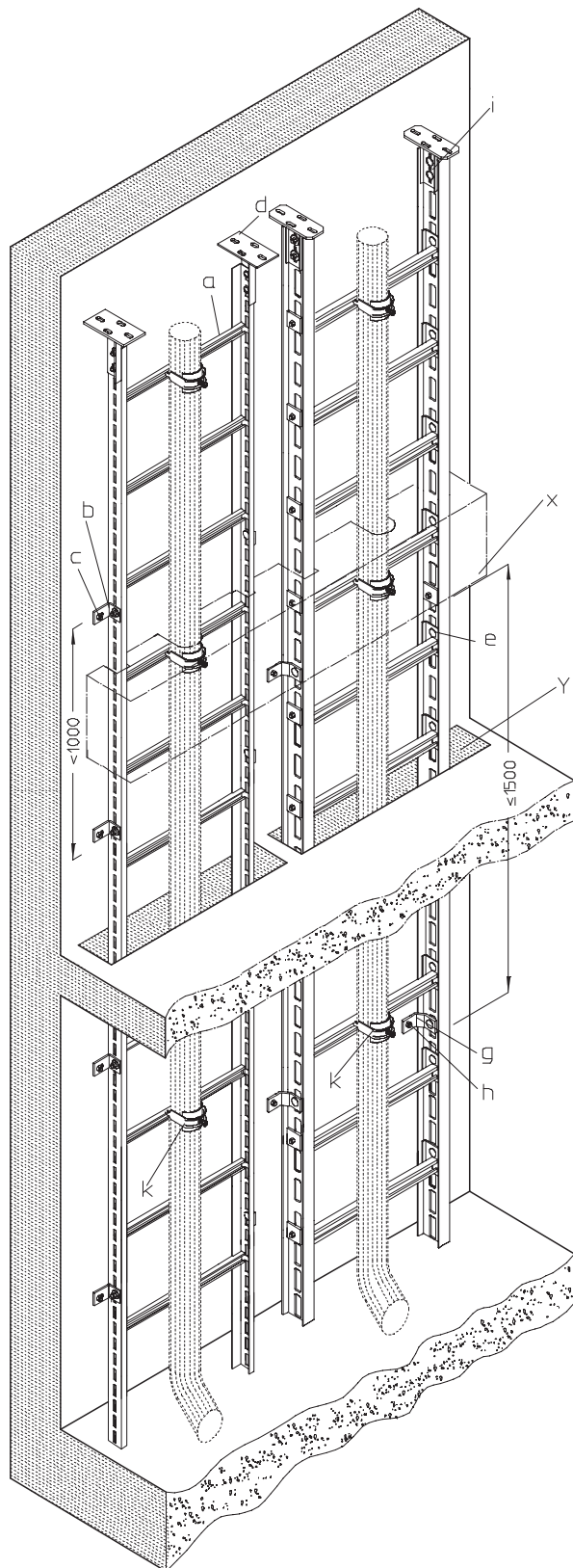
a	bracket support	KDU 50	H25
b	plug	SD 8 ¹⁾	H26
	washer	US 8x25	G11
c	bracket	KUM-BS ⁴⁾	H23
d	ladder anchorage	KLU	G3
e	bracket adapter	KAD-BS	H24
f	threaded rod	GB M 8	G7
	nut	SEMS 8	G11
	washer	US 8x17	G10
g	plug	SAZ 8 ¹⁾	H26
h	bracket support	KDU 52	H25
i	plug	SD 10 ¹⁾	H26
	washer	US 10x21	G10
k	threaded rod	GB ²⁾	G7
	rod coupling	VM ³⁾	G7
	nut	SEM ²⁾	G11
	washer	US ²⁾	G10
l	plug	SAZ ^{1), 2)}	H26
m	cable clamp	...H	H13



- 1) or other permitted plugs
- 2) for 1 cable tray: thread M 8
for 2 cable trays: thread M 10
for 3/4 cable trays: thread M 12
- 3) Screw in depth into rod coupling $\leq$ diameter of threaded rod
- 4) Console drag down to the stop

Standardised support systems according to DIN 4102-12 (11/98) Passing of several cables

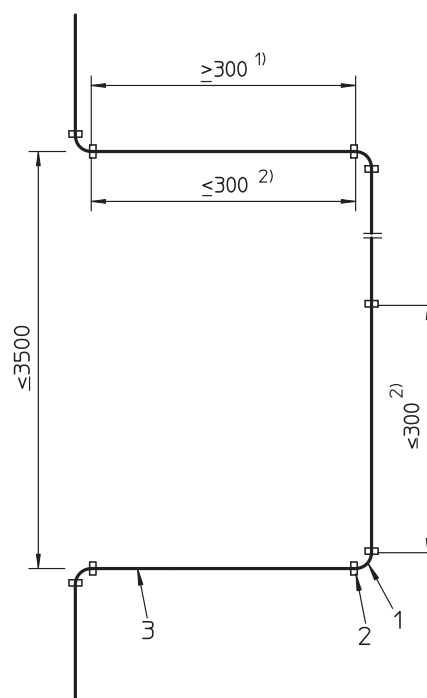
3.) Vertical ladders / ascending traces



For passing of security cables along massive walls in vertical direction.

carrying capacity: 20 kg/m
width of trace: ≤ 600 mm

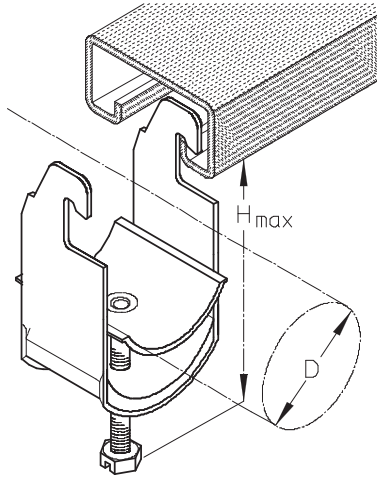
a	vertical ladder	STU-BS	H19
b	angled plate	BL 4	F16
c	screw	KLS 10x20	G8
d	plug	SD 10 ¹⁾	H26
e	washer	US 10x21	G10
f	head plate	BGU 50	H19
g	vertical ladder	ST-BS 81	H20
h	angled plate	BL 7	H20
i	plug	SD 10	H26
j	washer	US 10x21	G10
k	head plate	BGI	F24
l	cable clamp	...AC	H13
m	cable support	(for example coated cable clamp)	H3
n	Ceiling penetration closed with fireproof bulkhead		H3



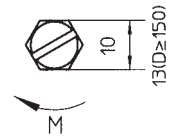
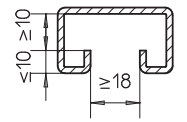
1) or other permitted plugs

Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

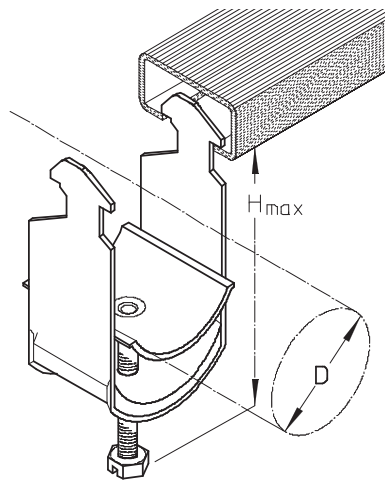
AC



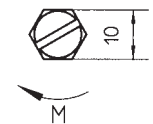
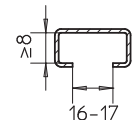
	D	H _{max}	M	
	mm	mm	Nm	kg/100
12 AC	8-12	40	2,0	2,7
16 AC	12-16	44	2,0	3,1
20 AC	16-20	48	2,0	3,5
24 AC	20-24	52	2,0	3,7
28 AC	24-28	56	2,0	4,2
32 AC	28-32	61	2,0	6,4
36 AC	32-36	65	2,0	6,7
40 AC	36-40	69	2,0	7,5
44 AC	40-44	80	4,0	9,6
48 AC	44-48	84	4,0	9,8
52 AC	48-52	88	4,0	10,7
56 AC	52-56	92	4,0	11,5
60 AC	56-60	96	4,0	15,1
64 AC	60-64	100	4,0	15,9
70 AC	64-70	106	4,0	16,9
76 AC	70-76	112	4,0	23,3



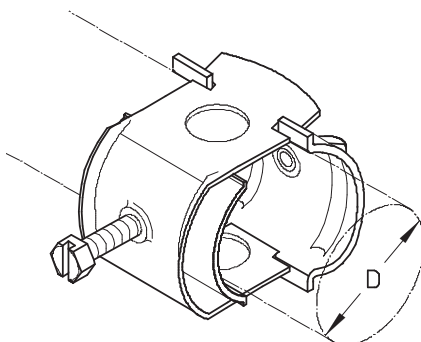
H



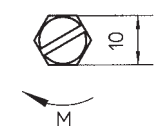
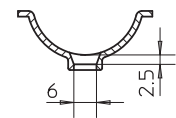
12 H	8-12	40	2,0	2,7
16 H	12-16	44	2,0	3,2
20 H	16-20	48	2,0	3,6
24 H	20-24	42	2,0	3,9
28 H	24-28	56	2,0	4,4
32 H	28-32	61	2,0	6,3
36 H	32-36	65	2,0	7,0
40 H	36-40	69	2,0	7,5
44 H	40-44	80	4,0	9,8
48 H	44-48	84	4,0	10,2
52 H	48-52	88	4,0	10,6
56 H	52-56	92	4,0	11,3
60 H	56-60	96	4,0	15,8
64 H	60-64	100	4,0	16,5
70 H	64-70	106	4,0	17,1



W

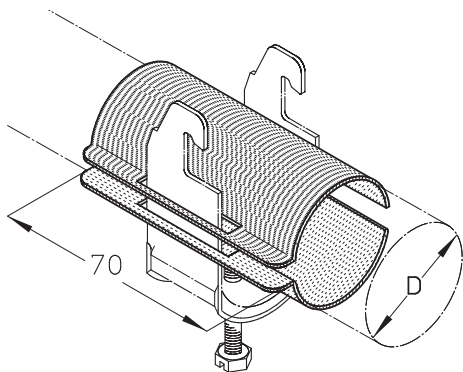


16 W	12-16	2,0	4,4
20 W	16-20	2,0	5,4
24 W	20-24	2,0	5,8
28 W	24-28	2,0	6,3
32 W	28-32	4,0	8,5
36 W	32-36	4,0	9,1
44 W	36-44	4,0	13,5
52 W	44-52	4,0	16,5
60 W	52-60	4,0	19,5



Befestigungszubehör
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Accesorios de fijación

LW



S

	D	
	mm	kg/100
LW 12	9-12	0,88
LW 16	13-16	1,16
LW 20	17-20	1,43
LW 24	21-24	1,71
LW 28	25-28	2,04
LW 32	29-32	2,31
LW 36	33-36	2,57
LW 40	37-40	2,88
LW 44	41-44	3,14
LW 48	45-48	3,32
LW 52	49-52	3,66
LW 56	53-56	3,90
LW 60	57-60	9,23
LW 64	61-64	9,84
LW 70	65-70	10,76
LW 76	71-76	11,69

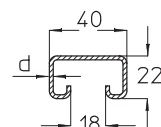


S

	kg
KHA 7-02S	0,2
KHA 7-03S	0,3
KHA 7-04S	0,4
KHA 7-05S	0,5
KHA 7-06S	0,6
KHA 7-07S	0,7
KHA 7-08S	0,8
KHA 7-09S	1,0
KHA 7-10S	1,1
KHA 7-11S	1,2
KHA 7-12S	1,3
KHA 7-13S	1,4
KHA 7-14S	1,5
KHA 7-15S	1,6
KHA 7-20S	2,1
KHA 7-30S	3,2
KHA 7-60S	6,3

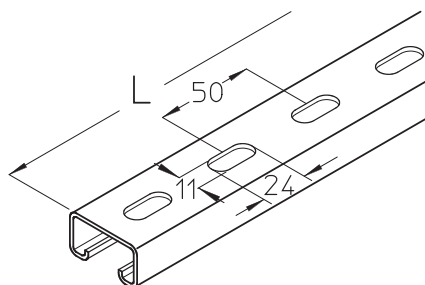
F

	kg	L
	kg	m
KHA 8-02F	0,3	0,2
KHA 8-03F	0,5	0,3
KHA 8-04F	0,6	0,4
KHA 8-05F	0,8	0,5
KHA 8-06F	0,9	0,6
KHA 8-07F	1,1	0,7
KHA 8-08F	1,3	0,8
KHA 8-09F	1,4	0,9
KHA 8-10F	1,6	1,0
KHA 8-11F	1,7	1,1
KHA 8-12F	1,9	1,2
KHA 8-13F	2,0	1,3
KHA 8-14F	2,2	1,4
KHA 8-15F	2,4	1,5
KHA 8-20F	3,1	2,0
KHA 8-30F	4,7	3,0
KHA 8-60F	9,4	6,0

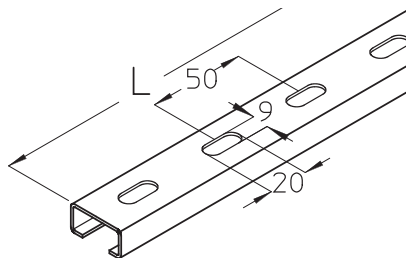


	d
KHA 7	1,5
KHA 8	2,0

KHA 7 / KHA 8



KHB 7

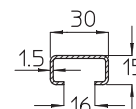


S

KHB 7-60S

F

KHB 7-60F 6,0 4,6

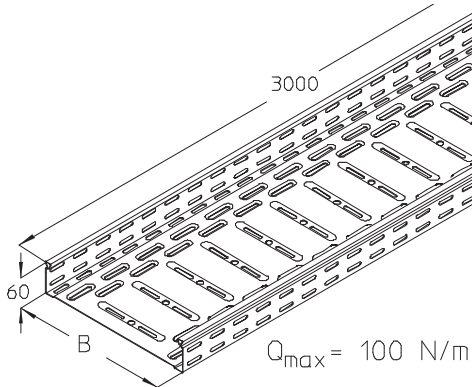


Systeme zum Funktionserhalt im Brandfall
Fire resistive cable installations
Installations resistente au feu
Instalaciones resistentes al fuego



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

RGS 60



S F

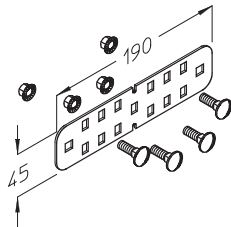
RGS 60-10S	100	56	8,8
RGS 60-20S	200	113	11,4
RGS 60-30S	300	171	14,7
RGS 60-10F	100	56	9,4
RGS 60-20F	200	113	12,2
RGS 60-30F	300	171	15,7



RGV-BS
VB-BS



RGV-BS



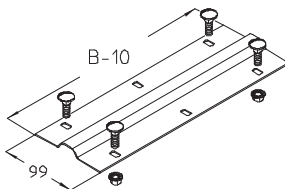
S F

RGV-BS 60S		0,09
RGV-BS 60F		0,09

inkl. 2 x KLR



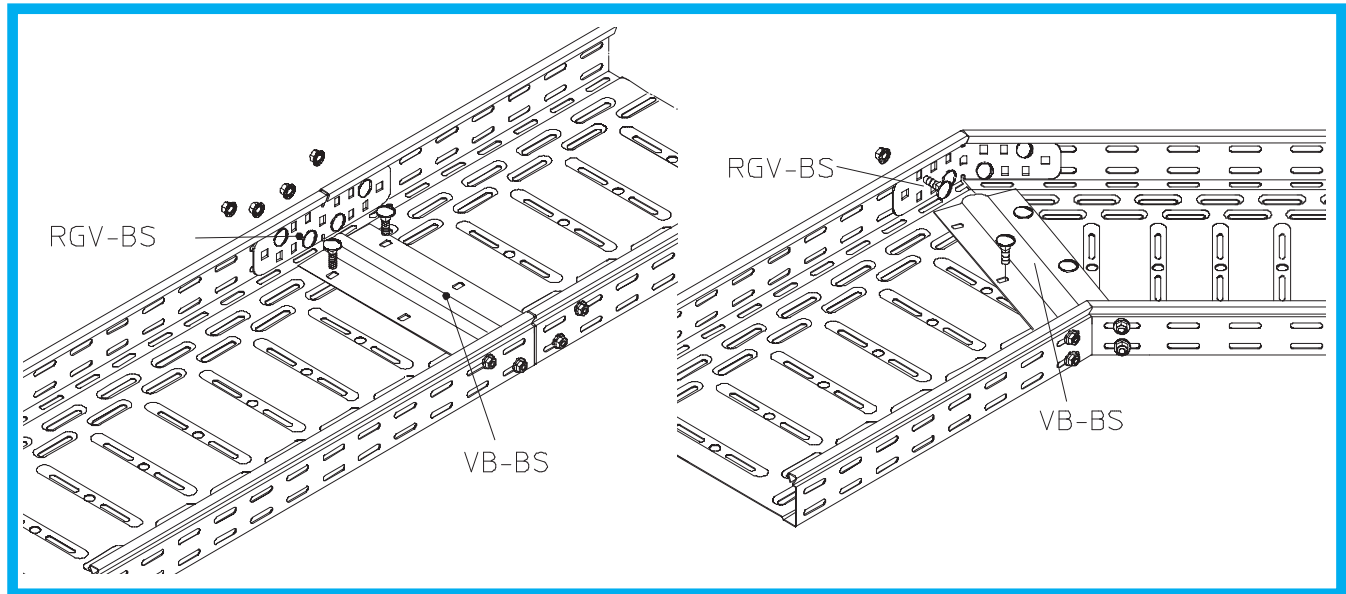
VB-BS



S F

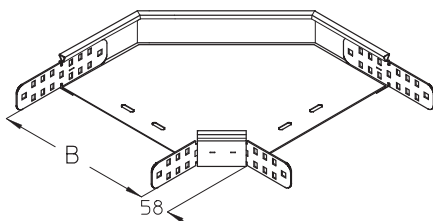
VB-BS 10S	100	0,04
VB-BS 20S	200	0,11
VB-BS 30S	300	0,18
VB-BS 10F	100	0,04
VB-BS 20F	200	0,11
VB-BS 30F	300	0,18

inkl. 1 x / 2 x KLR



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

RB-BS



S F

RB-BS 60-10S
RB-BS 60-20S
RB-BS 60-30S

B
mm kg

100 0,6
200 1,0
300 1,6

RB-BS 60-10F
RB-BS 60-20F
RB-BS 60-30F

100 0,7
200 1,4
300 1,8

inkl. 4 x KLR



G3



VB-BS

H15

S F

RB-BS45 60-10S
RB-BS45 60-20S
RB-BS45 60-30S

100 0,5
200 0,8
300 1,2

RB-BS45 60-10F
RB-BS45 60-20F
RB-BS45 60-30F

100 0,6
200 0,9
300 1,3

inkl. 4 x KLR



G3



VB-BS

H15

S F

RAA-BS 60-10S
RAA-BS 60-20S
RAA-BS 60-30S

100 0,5
200 0,6
300 0,7

RAA-BS 60-10F
RAA-BS 60-20F
RAA-BS 60-30F

100 0,8
200 1,0
300 1,1

inkl. 4 x KLR



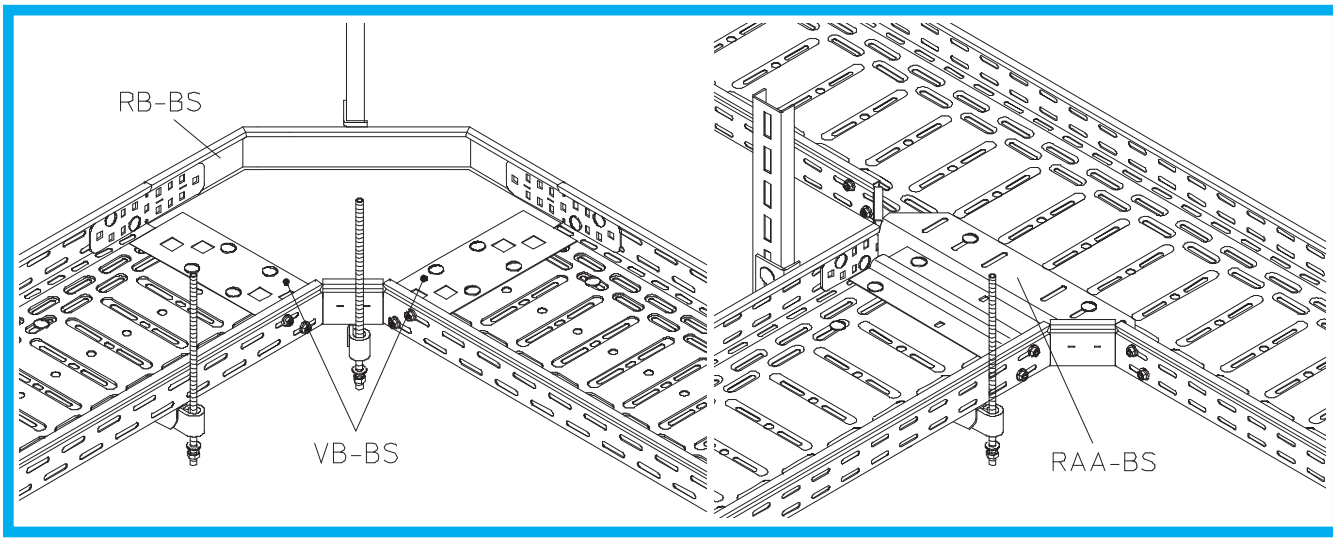
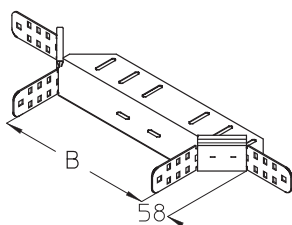
G3



VB-BS

H15

RAA-BS

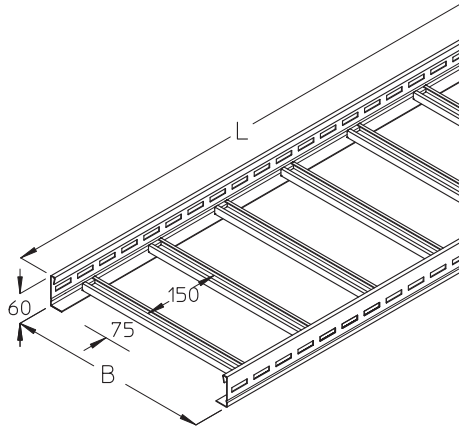


Systeme zum Funktionserhalt im Brandfall
Fire resistive cable installations
Installations resistente au feu
Instalaciones resistentes al fuego



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

L-BS 60

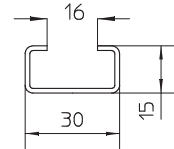


S F

L-BS 60-20-3S	200	3	9,9
L-BS 60-30-3S	300	3	11,4
L-BS 60-40-3S	400	3	12,9
L-BS 60-20-6S	200	6	19,8
L-BS 60-30-6S	300	6	22,7
L-BS 60-40-6S	400	6	25,7

L-BS 60-20-3F	200	3	10,7
L-BS 60-30-3F	300	3	12,3
L-BS 60-40-3F	400	3	13,9

L-BS 60-20-6F	200	6	21,4
L-BS 60-30-6F	300	6	25,5
L-BS 60-40-6F	400	6	27,7

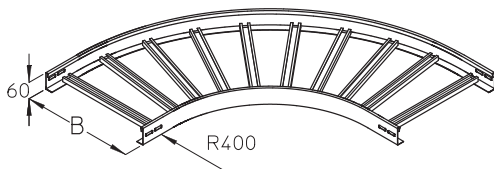


KLU
LGV-BS 60



G3
H18

LIB-BS



F

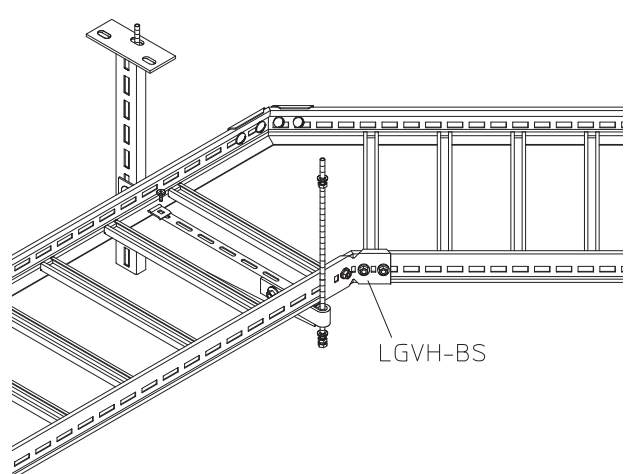
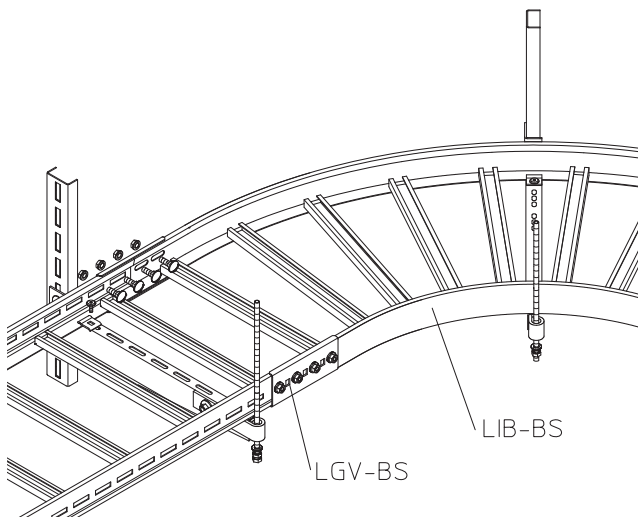
LIB-BS 60-20F	200	3,5
LIB-BS 60-30F	300	4,5
LIB-BS 60-40F	400	5,4



KLU
LGV-BS 60

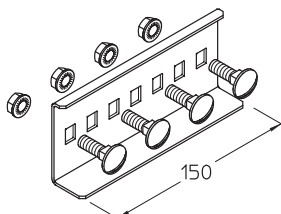


G3
H18

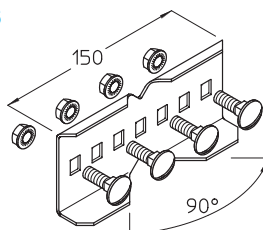


Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

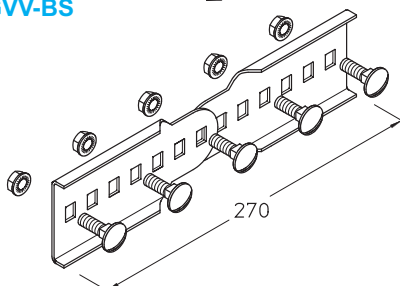
LGV-BS



LGVH-BS



LGVV-BS



kg

S F

LGV-BS 60S

0,28

LGV-BS 60F

0,30

inkl. 4 x KLS 8x16

G8

S F

LGVH-BS 60S

0,28

LGVH-BS 60F

0,30

inkl. 4 x KLS 8x16

G8

S F

LGVV-BS 60S

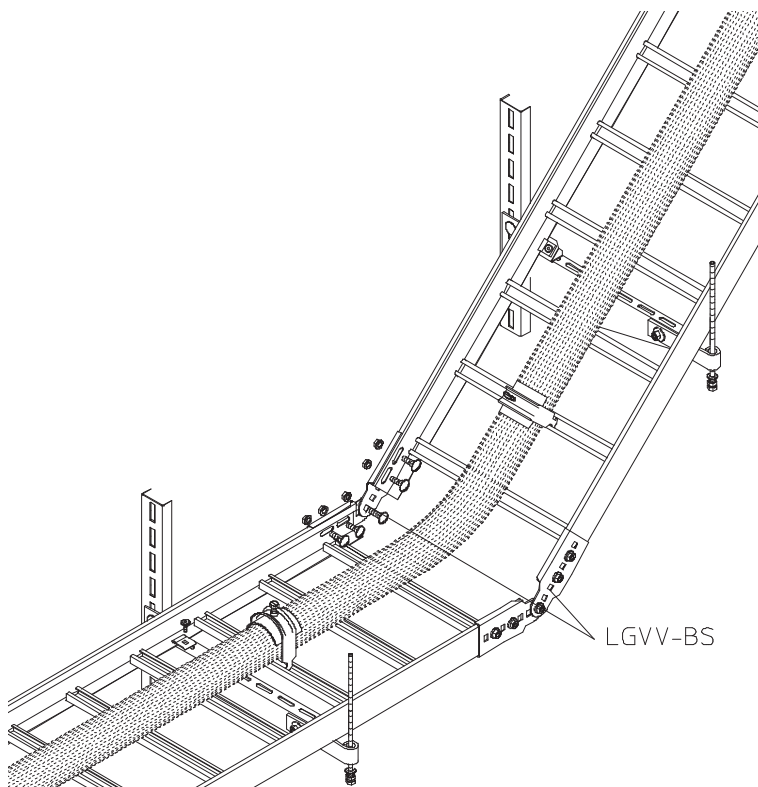
0,43

LGVV-BS 60F

0,43

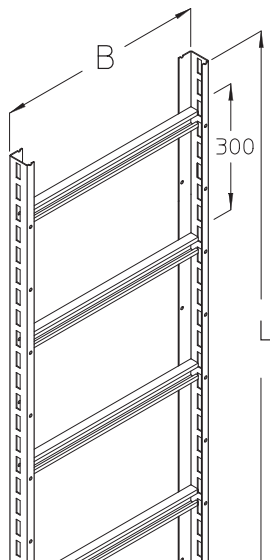
inkl. 5 x KLS 8x16

G8



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

STU-BS

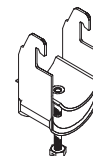


L	B	
mm	mm	kg

S F

STU-BS 50-02-3S	3000	210	10,3
STU-BS 50-03-3S	3000	300	10,8
STU-BS 50-04-3S	3000	400	11,4
STU-BS 50-05-3S	3000	500	11,9
STU-BS 50-06-3S	3000	600	12,4

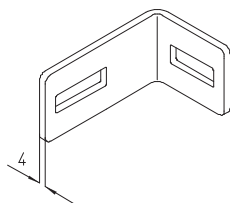
STU-BS 50-02-3F	3000	210	10,3
STU-BS 50-03-3F	3000	300	10,8
STU-BS 50-04-3F	3000	400	11,4
STU-BS 50-05-3F	3000	500	11,9
STU-BS 50-06-3F	3000	600	12,4



BL 4F
BL 5F

H19
H19

BL 4



F E

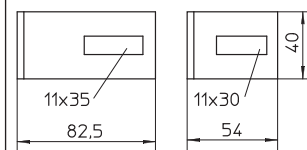
BL 4F
BL 4E

0,15
0,15

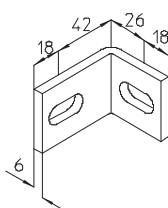


KLS 10x20
SD

G8
G5



BL 5



F

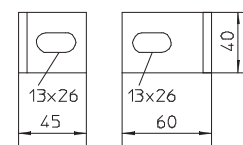
BL 5F

0,20

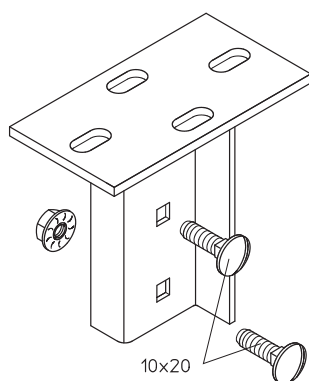


SEMS
KLS 10x20
SD 10

G11
G8
H26



BGU 50



F

BGU 50F

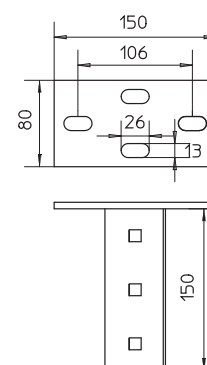
0,85

inkl. 2 x KLS 10x20



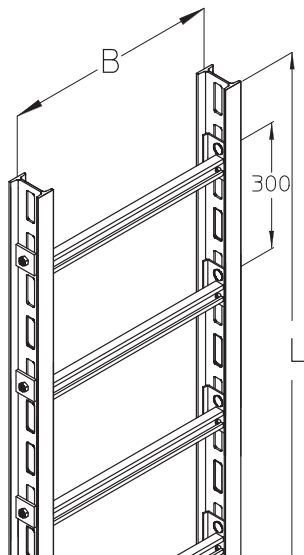
SD

G8
H26

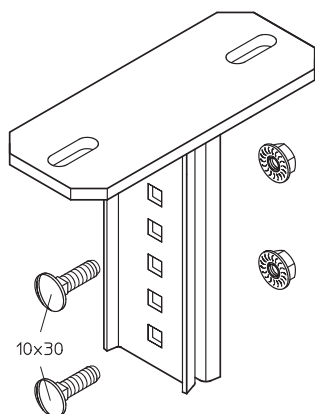


Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

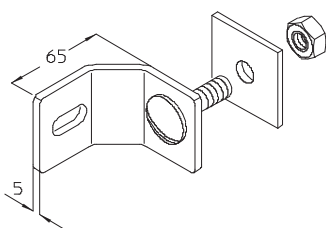
ST-BS 81



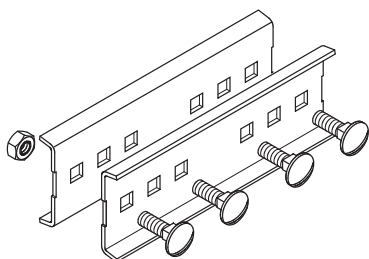
BGIQ



BL 7



HKI



L	B	
mm	mm	kg

F

ST-BS 81-02F
ST-BS 81-03F
ST-BS 81-04F
ST-BS 81-05F
ST-BS 81-06F

6000	200	87,0
6000	300	88,5
6000	400	90,0
6000	500	91,5
6000	600	93,0

inkl. 20 x STIS
2 x KHI 60



BGIQ F
BL 7F



E10
F23

H20
H20



Arbores and rungs will be delivered unmounted including nuts and bolts.

F

BGIQ F

1,4

inkl. 2 x FRS 10x30F
2 x SEM 10F

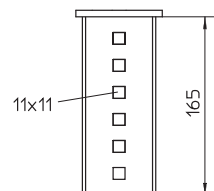
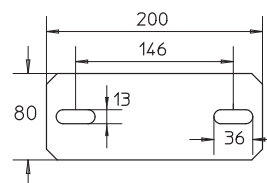


SD



G8
G11

H26



F

BL 7F

0,3

inkl. 1 x FRS 12x30F
1 x RUS 50-L 13F
1 x SEM 12F

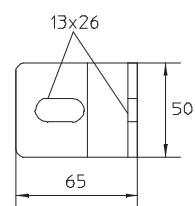


SD



G8
G11
G11

H26



F

HKI F

1,0

inkl. 4 x FRS 10x30F
4 x SEM 10F

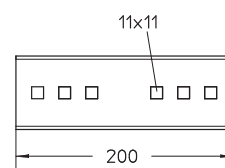


SD



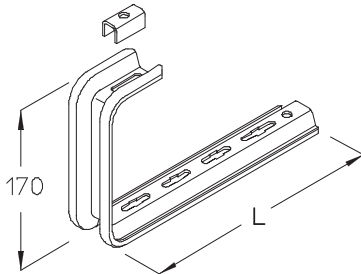
G8
G11

H26



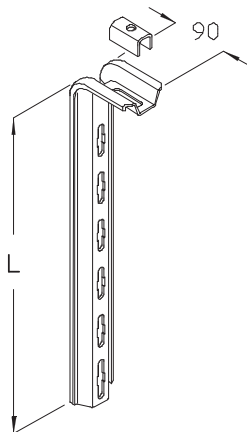
Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

DKSL-BS



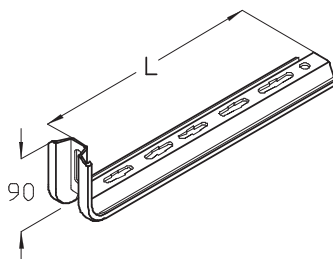
	L	
	mm	kg
S F		
DKSL-BS 010S	150	0,66
DKSL-BS 020S	250	0,75
DKSL-BS 030S	350	0,93
DKSL-BS 010F	150	0,71
DKSL-BS 020F	250	0,80
DKSL-BS 030F	350	0,99
inkl. KSL-SP		F9
→ GB		G7
SEM		G11
US		G10
KLRL		G3
SD, SAZ		H26

KSLW



S F		
KSLW 020S	220	0,53
KSLW 030S	320	0,69
KSLW 040S	420	0,86
KSLW 050S	520	1,03
KSLW 060S	620	1,18
KSLW 020F	220	0,56
KSLW 030F	320	0,73
KSLW 040F	420	0,92
KSLW 050F	520	1,10
KSLW 060F	620	1,26
inkl. KSL-SP		F9
→ KSL-BS		H21
SD 8		G5

KSL-BS



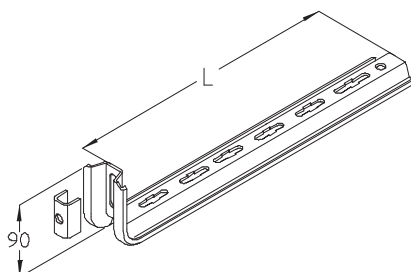
S F		
KSL-BS 010S	170	0,44
KSL-BS 020S	270	0,61
KSL-BS 030S	370	0,78
KSL-BS 010F	170	0,47
KSL-BS 020F	270	0,65
KSL-BS 030F	370	0,82
inkl. FRS 8x20		G8
SEMS M8		G11
→ GB		G7
US		G10
KLRL		G3
SD		H26
SAZ		H26
W-BS		H24



Systeme zum Funktionserhalt im Brandfall
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Instalaciones resistentes al fuego

Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

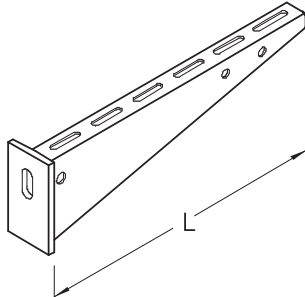
KSLW-BS



	L	
	mm	kg
S F		
KSLW-BS 010S	170	0,44
KSLW-BS 020S	270	0,61
KSLW-BS 030S	370	0,78
KSLW-BS 010F	170	0,47
KSLW-BS 020F	270	0,65
KSLW-BS 030F	370	0,82
inkl.	KSL-SP	 F9
➔	GB	G7
	US	G10
	KLRL	G3
	SD	H26
	SAZ	H26
	W-BS	H24

Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

KW-BS



F

KW-BS 010F	120	34	0,13
KW-BS 020F	220	56	0,35
KW-BS 030F	320	56	0,48
KW-BS 040F	420	75	0,81

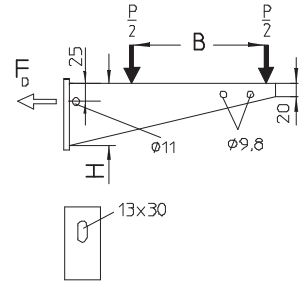
L mm H mm kg



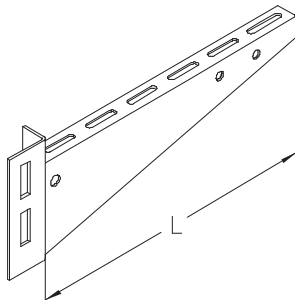
KLU, KLR
KAW-BS/W-BS
KAD-BS
SD



G3
H24
H24
H26



KUM-BS



F

KUM-BS 010F	120	35	0,20
KUM-BS 020F	220	56	0,38
KUM-BS 030F	320	56	0,50
KUM-BS 040F	420	75	0,85

L mm H mm kg

inkl. 1 x KLS 10x20

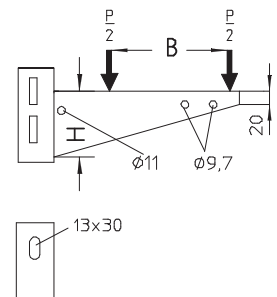


G8



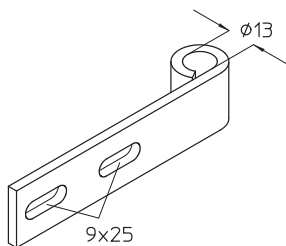
KLU, KLR
KDU 50, KDU 52
KAD-BS

G3
H25
H24



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

KAD-BS



S F

KAD-BS S
KAD-BS F


kg

0,22
0,23

inkl. 2 x IK 8x20
2 x SEMS 8

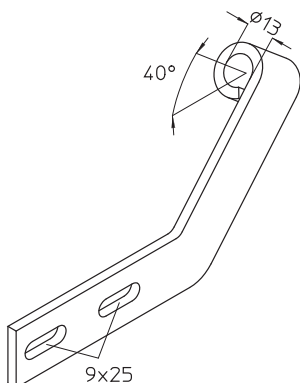

G9
G11



GB
SEM
US
SAZ

G7
G11
G10
H26

KAW-BS



S F

KAW-BS S
KAW-BS F

0,25
0,36

inkl. 2 x IK 8x20
2 x SEMS 8

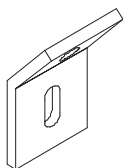

G9
G11



W-BS

H24

W-BS



F

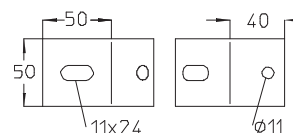
W-BS F

0,63



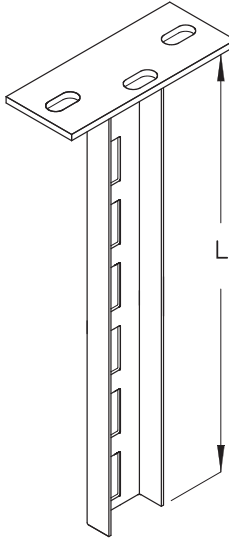
GB
SEM
US
SAZ


G7
G11
G10
H26



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

KDU 50



F

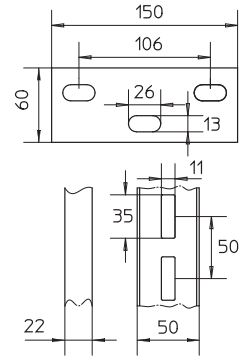
KDU 50-02F	200	0,62
KDU 50-03F	300	0,77
KDU 50-04F	400	0,91
KDU 50-05F	500	1,06
KDU 50-06F	600	1,20
KDU 50-07F	700	1,35
KDU 50-08F	800	1,49
KDU 50-09F	900	1,64
KDU 50-10F	1000	1,78

L
mm kg

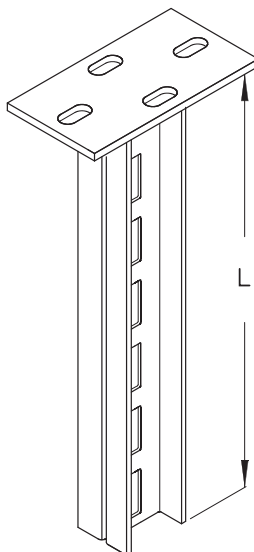


SD
KUM-BS
KAD-BS


H26
H23
H24



KDU 52



F

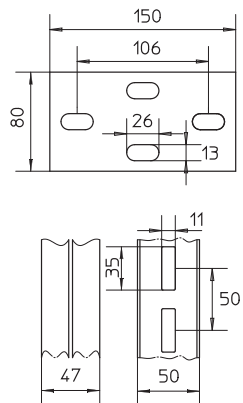
KDU 52-02F	200	1,12
KDU 52-03F	300	1,41
KDU 52-04F	400	1,70
KDU 52-05F	500	1,99
KDU 52-06F	600	2,28
KDU 52-07F	700	2,57
KDU 52-08F	800	2,86
KDU 52-09F	900	3,15
KDU 52-10F	1000	3,44
KDU 52-11F	1100	3,73
KDU 52-12F	1200	4,02
KDU 52-13F	1300	4,31
KDU 52-14F	1400	4,60
KDU 52-15F	1500	4,89

L
mm kg



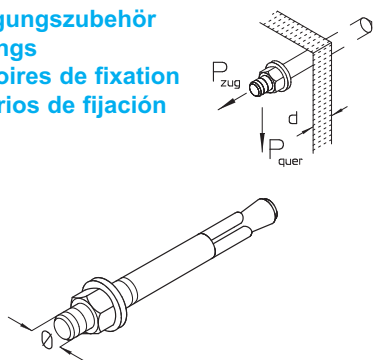
SD
KUM-BS
KAD-BS


H26
H23
H24



Befestigungszubehör
Fastenings
Accessoires de fixation
Accesorios de fijación

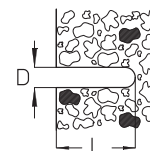
SD



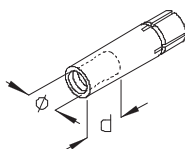
	Ø	d	P _{zul.}	E90*	L _{min}	D	
			P _{zug}	P _{quer}			
	mm	mm	kN	kN	mm	mm	kg/100
SD 8/10	8	0-10	0,9	1,3	55	8	3,5
SD 10/10	10	0-10	1,9	2,2	75	10	6,2
SD 12/10	12	0-10	3,2	3,5	90	12	11,0
SD 16/25	16	0-25	6,0	6,6	110	16	26,3

E4

SD 8/10E4	8	0-10	1,7		65	8	3,6
SD 10/10E4	10	0-10	2,5		80	10	6,2
SD 12/10E4	12	0-20	4,5		95	12	10,9



SAZ



SAZ 6	6	8-13	0,35		40	12	0,8
SAZ 8	8	11-17	0,8	0,7	43	10	0,8
SAZ 10	10	13-19	1,6	1,1	43	12	0,8
SAZ 12	12	15-21	1,8	1,4	43	14	1,0

E4

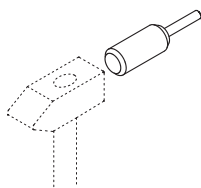
SAZ 8E4	8	11-17	0,8	0,7	43	10	0,8
SAZ 10E4	10	13-19	1,6	1,1	43	12	0,8
SAZ 12E4	12	15-21	1,8	1,4	43	14	1,0

SAZ-B



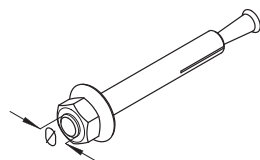
SAZ-B 8	8						0,1
SAZ-B 10	10						0,1
SAZ-B 12	12						0,2

SA-D



SA-D 8	8						25,0
SA-D 10	10						30,0
SA-D 12	12						35,0

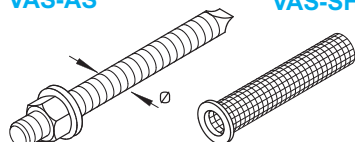
SD-B S



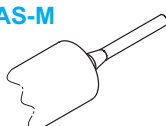
SD-B S 6/5	6	0-5	0,25		46	6	0,3
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VAS-AS

VAS-SH



VAS-M



VAS-AS 8/15*	8		0,5-1,0**				3,0
VAS-AS 10/25	10		0,5-1,0**				6,0

VAS-SH					150	16	1,0
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VAS-M							50,0
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*only in connection with cavity brickwork (cavity brick, cavity block stone, cavity lime bunter)

** Load designation dependant on sub grade.

The validated authorisation notification is valid at a time.