

Spring loaded cable reels

Series AV

Technical information





Our solutions move you further...

Since 1953 Wabtec Netherlands has been the specialist in developing and creating flexible power supply for movable equipment. We advise and design solutions for a wide variety of applications such as cranes, AS/RS industry, assembling plants, blast-furnace applications, concrete factories, production machines and many more.

Wabtec Netherlands: the world-wide supplier.

The Wabtec Netherlands head office is situated in Ede, the Netherlands. World-wide Wabtec Netherlands is represented in more than 65 countries, which ensures you short delivery times, a world-wide availability of components and technical support. Naturally we communicate by means of the most modern equipment. Solutions can therefore be sent within seconds to almost every corner of the world. Speaking of efficiency.



Wabtec Netherlands: flexible all the way ...

For product improvement and development we use the most modern design technologies and testing facilities. This ensures the best possible solutions technically as well as economically for your projects. Flexibility in solutions for applications and tailor made installations make us your specialist. Quick and very accurate.

And of course, compliant to ISO 9001 and SCC/VCA accreditations.

Wabtec Netherlands: in good company!

We are part of the American Wabtec Corporation, a leading supplier of value-added, technology-based products and services for rail, transit and other global industries. We offer you continuity as your partner in business with affiliated companies in e.g. Germany, Great-Britain, USA, Australia, China and more.

Reel series AV

- Rigid spring driven cable reels for medium and mid-heavy duties
- Current capacities from 4mA up to 200A and higher
- Standard up to 52 sliprings possible
- Protection degree up to IP66
- Maximal adaption to the application and environment
- Also available in stainless steel and epoxy coated
- Suitable for transmission of data- and control signals
- Can be delivered with high-flexible cable on request



AKAPP spring driven cable reels are reliable and safe. In numerous applications in a wide variety of situations, these reel series offer the perfect link between the power source and the movable apparatus to be fed.

Our reels can be optimised for your application and environment, including the flexible cable to be reeled!

The top picture shows a greenhouse area, where an AKAPP AV-cable reel is used for feeding and controlling a transporter for flower containers.

The picture in the middle shows a shutter transporter on a cargo vessel. For the lifting of the shutters, an AKAPP AV-cable reel is in use.

Below, an application with the cable reel mounted on a fixed point, with unsupported cable.

All dimensions and performances in this brochure are under proviso and can be changed without prior notice.

Spring-driven cable reels series AV: general technical data

Spring-driven cable reels serve for the controlled reeling on and off of cables, hoses or ropes - mainly for cranes, stacking devices or in waste water technology. Driven by means of spiral leaf springs they present a well priced alternative with regard to the motor-driven cable reels - especially for movable devices without internal power supply!



Reel series
AV28 with cable

Reel body

The flanges of the spring-driven cable reel are made of sendzimir-galvanized sheet metal plates which are extremely crimped at the outer diameter. The winding core is made of sheet metal with a corrosion protection of polyester-powder coating.

The reel body flange is made of galvanized steel. Upon request the flanges and the reel body flange can be additionally polyester-powder coated.



Slipring assembly

The slipring assemblies are designed for an operational voltage of max. 400 / 500 V. Depending on the size and the application of the spring-driven cable reel both sliprings for the data transmission (mA-range / data bus systems) and sliprings for power transmission (up to max. 200 A) can be used. The individually admissible amperages of the slipring assemblies can be gathered from the selection list.

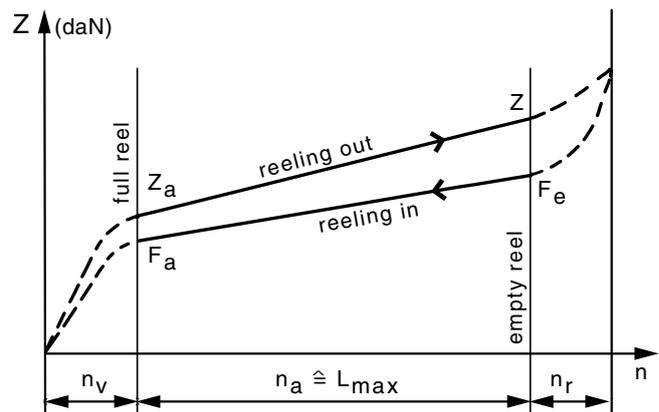
The material of the housings for slipring assemblies of up to 100 A is glass-fibre reinforced plastic. Additionally, these housings are equipped with a ventilation. The plastic housings correspond to protection class IP 66.

With amperages of more than 200 A and with special versions the housings are made of sheet metal with polyester-powder coating. The sheet metal housings correspond to protection class IP 55.

Springs

Springs of high-quality texture-roller spring steel with a long lifespan are used. The springs conduct as shown in the diagram.

The spring forces indicated in the selection list are the max. achievable forces Z (referred to the corresponding reel body core). The pre-tensioning-, working- and reserve-turns to be observed during commissioning are indicated on the type plate of the reel.



- L_{max} : maximum operationally reelable cable length
- n_a : operationally admissible working-turns
- n_v : required pre-tensioning turns
- n_r : reserve-turns
- F_a : rest tensile force with fully reeled cable
- F_e : return tensile force with fully reeled off cable
- Z : required tensile force while pulling the cable off

Cable selection

regulations to be observed

On page 7 you will find a selection of cables for which our spring-driven cable reels are suitable.

When selecting the cable to be reeled the information of the cable supplier and the corresponding regulations have to be observed.

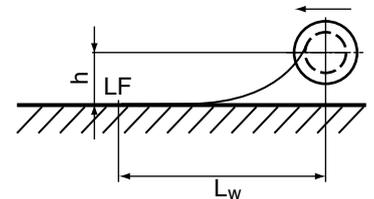
The spring-driven cable reels in this list are cylindrically uncontrolled-winding reels.

Thus, especially with long winding lengths the number of layers on the reel body has to be observed when the core-cross section is determined.

General basic principles for determination of cable length

When determining the complete cable length to be reeled the following has to be observed:

- only put as much cable on the reel body as is required for the winding (L_w) + 2 additional windings as tension relief which have to stay on the reel body when the cable is completely pulled off
- connection length for the connection to the brush holders
- connection length for the connection within the feeding point LF
- length for the mounting height h (horizontal cable pay-off)
- length for L_0 (vertical cable pay-off, see picture below)



General basic principles for designing the reel

In the tables of this selection list spring-driven cable reels for the application "horizontal cable pay-off" or "vertical cable pay-off" are indicated.



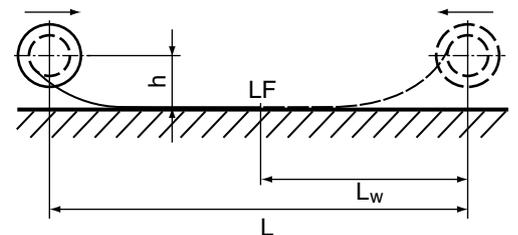
Horizontal cable pay-off



Vertical cable pay-off downwards

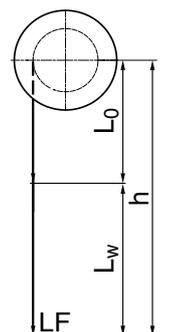
Preconditions for horizontal cable pay-off

- cable pay-off to 1 or 2 directions
- cable deposit on a continuous surface or on supports in distances of less than 1 m
- mounting height from cable deposit to reel centre max. 1 m
- a cable diversion is not taken into consideration
- travel speed 10 m/min up to max. 60 m/min
- acceleration max. 0,3 m/s²



Preconditions for vertical cable pay-off downwards

- reel arrangement on top
- cable pay-off vertically downwards
- travel speed 10 m/min up to max. 40 m/min
- acceleration max. 0,3 m/s²
- a freely suspending cable length L_0 was not taken into consideration



Should your application deviate from one of the a.m. items or should one of the following criteria not apply we will be pleased to make an individual quotation for you (cf. questionnaire).

Cable reel applications

the most common cases

AKAPP cable reels can be mounted on various ways, in a number of applications.

Cables can be winded horizontal or vertical. Cable reels can be mounted on the movable apparatus or on a fixed point (stationnary). Cables can be supported or unsupported. All cases need to be considered when selecting the proper cable reel.

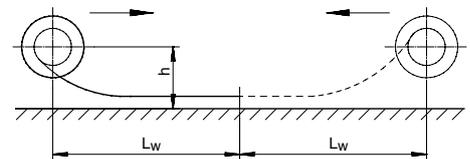
The selection tables in this catalog however, only consider application cases 1 and 8, which are the most common situations.

If you need a cable reel for all other cases, of which the most common examples are shown here, please contact our sales office.

Most common cases (referring to selection tables for each reel type, from page 11)

Case 1 (case 2 with diverting rollers)

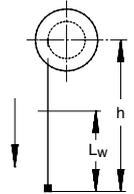
Horizontal retrieval to one or both sides.
Cable laying on a flat continuous surface.



Case 8

Vertical lift
 h = suspended cable length
 L_w = winding length

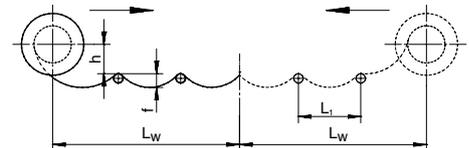
If an additional weight is suspended at the end this must be added to the cable weight.



Other cases

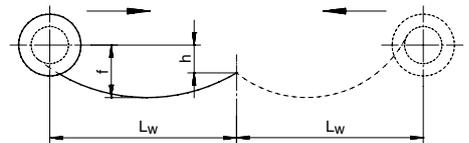
Case 3 (case 4 with diverting rollers)

Horizontal retrieval on support rollers ($L_1 < 1$ m) or on rounded smooth supports (support spacing of rollers, $L_1 = 1-3$ m, depending on the cable size).



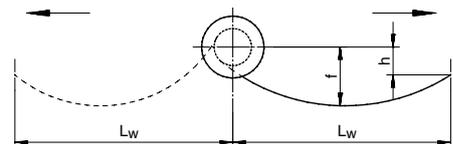
Case 6

Retrieval to one side without cable support. Only suitable for relatively short span distances.
The value f must be calculated (approx. 10% of L).



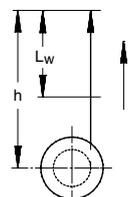
Case 7 (case 5 with support rollers)

Stationary application. Retrieval to both sides without cable support.
Only suitable for relatively short span distances.
The value f must be calculated (approx. 10% of L).



Case 9

Vertical retrieval to the top
Cable reel moves up and down, power feed on fixed point.
 h = suspended cable length
 L_w = winding length
This arrangement allows longer winding lengths, since the cable weights do not have any effect on the dimensioning of the spring tension.



Reel and cable selection: more considerations

With the following extreme ambient influences it is strongly recommended that you contact us:

- crawling speeds (< 10 m/min)
- strong vibrations
- application at sea or salty / aggressive air
- temperatures below -15 °C
- strong diversions
- compulsory guide (see next column)

If a compulsory guide (e.g. diverting rollers, roller guide) is existing a distance of 6 x drum width of the reel body has to be kept between compulsory guide and reel body.

The spring-driven cable reel has to be arranged in such a way that the cable can be reeled on and off freely and without obstructions. Compulsory guides and too small diverting rollers have to be avoided in any case.

You will find the suitable spring-driven cable reel for your special requirements as follows:

- The cable for your electrical machine has to be known. A further precondition is the application type: "horizontal cable pay-off" or "vertical cable pay-off downwards". See the capacity tables for each cable reel.
- By means of the cable that you are using and the table on this page you will be referred to one of the selection tables for spring-driven cable reels following later in this catalogue. In these selection tables you will find detailed information regarding the required spring-driven cable reel.

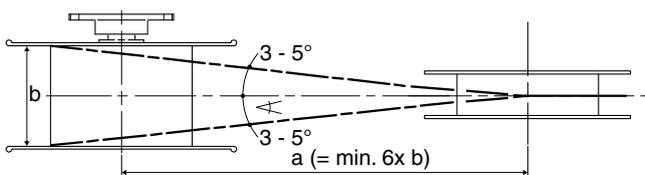
Reeling cable on drum

It is absolutely necessary to reel the cable onto the drum without twists or bends. To this end, lay out the complete cable straight along the travel length. When reeling the cable on the drum be sure to maintain the same reeling direction used on the wooden drum delivered by the manufacture.

Using roller guides

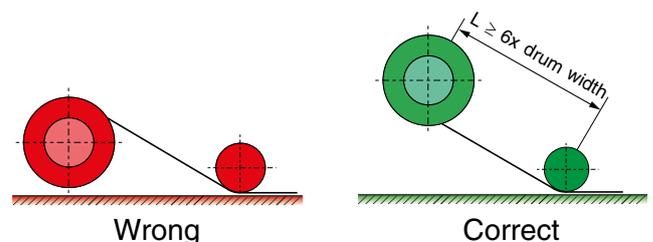
When roller guides are used, it is important to avoid reverse bending of the cable. See examples next.

The distance between the centre of the cable drum and the centre of the roller guide should be **at least 6x** the drum width, as shown in the figures below and next.



The angle of the cable from the centre of the roller guide to one side of the drum should be between 3° - 5°.

Cable data - Type PUR-HF *)		
Cross section (mm ²)	Ø (mm)	Weight (kg/m)
4x1,5	11,2	0,155
5x1,5	11,8	0,178
7x1,5	13,5	0,218
12x1,5	17,0	0,363
18x1,5	18,1	0,459
24x1,5	20,9	0,590
30x1,5	23,0	0,720
4x2,5	12,3	0,208
5 x 2,5	13,0	0,230
7 x 2,5	14,7	0,315
12 x 2,5	20,4	0,485
18 x 2,5	20,5	0,679
24 x 2,5	23,6	0,860
30 x 2,5	26,8	1,080
4 x 4	13,6	0,281
5 x 4	14,5	0,318
4 x 6	14,9	0,372
5 x 6	17,4	0,435
4 x 10	18,9	0,615
5 x 10	20,5	0,704
4 x 16	22,1	0,924
5 x 16	24,2	1,067
4 x 25	25,5	1,270
Hybrid cable with Profibus - cores		
6x(2x2,5)+2x(2x0,5(ST)C)	29,0	0,920
5x(4x2,5)+2x(2x0,34)C	29,0	1,160



Also note that the application of roller guides will require about **20% increase of spring force** to wind the cable properly. Please consult our sales office for further advise on this.

*) Please note that the min. bending radius 'R' of the cable PUR-HF is 6 x cable diameter (Ø); e.g. if cable diameter Ø = 17 mm, the min. bending radius 'R' = 102 mm. The drum of the cable reel should be min. Ø 204 mm.

Springs and sliprings: the power of flexibility

Cable reels of the AV series have a modular structure. This means that each cable reel can be fitted out according to the specific demands of your application. You can choose

- springs (number, strength and lay out)
- sliping assembly
- finish of the reel body and sliping cover
- winding cable and connection cable

On this page, you can find detailed information on the springs and sliprings. This helps you in determining the proper configuration of the cable reels that fit to your application.

Please contact our sales office for any advise you might need. You'll find the references on the front cover of this brochure.

Overview of the springs:

The table below shows all available types of springs with their attributes, Please note that you can switch up to 4 springs in parallel to increase the tensile power, or serial

to increase winding length (e.g. code '12' means 2 springs parallel switched, code '20' means 2 springs serial switched).

Spring type	Preload turns min. n	Operational turns max. n	Spare turns n	Total turns n	Tensile force (see next for explanation)			
					Za (daN)	Fa (daN)	Fe (daN)	Z (daN)
A1	2	28	1	31	1,6	1,4	4,3	5,2
A	3	13,5	1	17,5	3,4	2,9	6,8	7,8
B	1,5	10,5	1	13	5	3,7	11	12
C	3	21	1	25	3	2,5	7	9
D	3	17	1,5	21,5	4,5	4	10	12
E	3	13	1,5	17,5	7,1	6,8	17,5	19
F	3,5	20	1,5	25	6	5	13	15
G	2,5	17	1,5	21	7	6	20	24
H	2,5	13	1	16,5	16	13	39	46
I	2,5	16	1,5	20	10	8,5	29	35

Za = Required tensile force for pulling cable off (daN)
 Fa = Rest tensile force with fully reeled cable (daN)
 Fe = Return tensile force with fully reeled off cable (daN)
 Z = Required tensile force while pulling cable off (daN)

Overview of sliping assemblies:

The table shows all available sliping assemblies with the corresponding current and voltage capacities, number of poles and terminal connections.

Sliping assembly series 10 has gold plated sliprings with hard silver contacts, especially developed for data transmission (always add even number of rings).

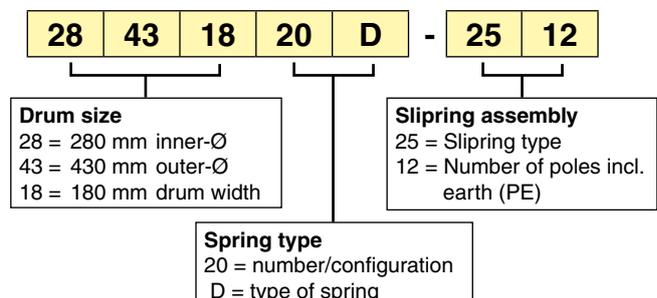
Sliping assembly		Current/Voltage max.*	# Poles standard excl. earth	# Poles max. incl. earth	Cross section terminal	Sliping cover								
						# Poles / Dimension 'a'								G Ø
Series *	Type					#	mm	#	mm	#	mm	#	mm	mm
10	1004	10 A / 415 V	4	52	1,5 mm ²	18	175	24	235	30	295	50	385	200
16	1603	16 A / 500 V	4	12	2,5 mm ²	5	175	10	235	12	295			160
01	0104	20 A / 500 V	4	42	2,5 mm ²	18	250	32	350	42	500			266
25	2503	25 A / 500 V	3	18	2,5 mm ²	4	175	7	235	12	295	18	385	200
50	5003	50 A / 500 V	3	8	10 mm ²	3	175	4	235	8	295			200
02	2003	100 A / 500 V	3	8	16 mm ²	5	250	8	350					266
03	0303	100 A / 600 V	3	8	16 mm ²	4	250	8	350					266
04	0403	150 A / 660 V	3	5	35 mm ²	3	350	5	385					266
05	0503	200 A / 660 V	3	8	50 mm ²	4	340							266
09	0903	300 A / 660 V	3	4	50 mm ²	4	350							266

* If current < 2A and/or voltage < 24V, we strongly recommend to apply sliping series 10. Lowest value is 4mA at 6V minimum.

Code key of the reel types:

Reel types are formulated based upon the configuration of the reel as shown next.

For ordering, you can use the code like this example.



Electrical parameters:

Current capacity of the reeled cables

When selecting the cable cross-section it is important to take in consideration the maximum current allowed (thermal heating), the voltage drop limits as well as the maximum tension allowed.

- duty cycle (DC) of the apparatus to be fed
- ambient temperature
- number of layers on the reel drum
- reduction factor for multicore cables

Most important factors are:

- max. current load allowed

Please see the tables below or contact us for further advise.

Selection chart for determining the cross section of reel cables

Way of cable reeling	stretched, on surface	spiral and cyl. 1 layer	cylindric 2 layers	cylindric 3 layers	cylindric 4 layers	cylindric 5 layers	cylindric 6 layers	cylindric 7 layers	Calculating factors due to duty cycle		
									Factor	60%	40%
Factor	1	0,8	0,61	0,49	0,42	0,34	0,27	0,22	D.C.	D.C.	D.C.
Cross section	I max (A)	I max (A)	I max (A)	I max (A)	I max (A)	I max (A)	I max (A)	I max (A)	1,00	1,00	1,00
1	18	14	11	9	8	6	5	4	1,00	1,00	1,00
1,5	23	18	14	11	10	8	6	5	1,00	1,00	1,00
2,5	30	24	18	15	13	10	8	7	1,00	1,00	1,02
4	41	33	25	20	17	14	11	9	1,00	1,03	1,05
6	53	42	32	26	22	18	14	12	1,00	1,04	1,13
10	74	59	45	36	31	25	20	16	1,03	1,09	1,21
16	99	79	60	49	42	34	27	22	1,07	1,16	1,34
25	131	105	80	64	55	45	35	29	1,10	1,23	1,45
35	162	130	99	79	68	55	44	36	1,13	1,28	1,53
50	202	162	123	99	85	69	55	44	1,16	1,34	1,62
70	250	200	153	123	105	85	68	55	1,18	1,38	1,69
95	301	241	184	147	125	102	81	66	1,20	1,42	1,74
120	352	282	215	172	148	120	97	77	1,21	1,44	1,78
150	404	323	246	198	170	137	109	89	1,22	1,46	1,81
185	461	369	281	226	194	157	124	101	1,23	1,48	1,82

Following parameters are considered:

Nominal voltage 380 V, $\cos \varphi = 0,8$

3 loaded cores

Max. voltage drop over entire cable length $\Delta U = 2,5\%$

Permissible temperature of cable = 80 °C

Ambient temperature = 30 °C

Conversion factor for the current capacity of multicore cables with 1 to 10 mm² cross section

acc. to VDE 0298 Part 4

Number of loaded cores	5	7	10	14	19	24	40	61
Conversion factor	0,75	0,65	0,55	0,50	0,45	0,40	0,35	0,30

Reduction of power transmission at ambient temperatures from 25 °C up to 75 °C

acc. to VDE 0298 Part 4 (for 80 °C cable temperature)

Ambient temp. (°C)	25	30	35	40	45	50	55	60	65	70	75
Reduction factor	1,05	1	0,95	0,89	0,84	0,77	0,71	0,63	0,55	0,45	0,32

Cable reels series AV12: compact and solid

Series 12 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

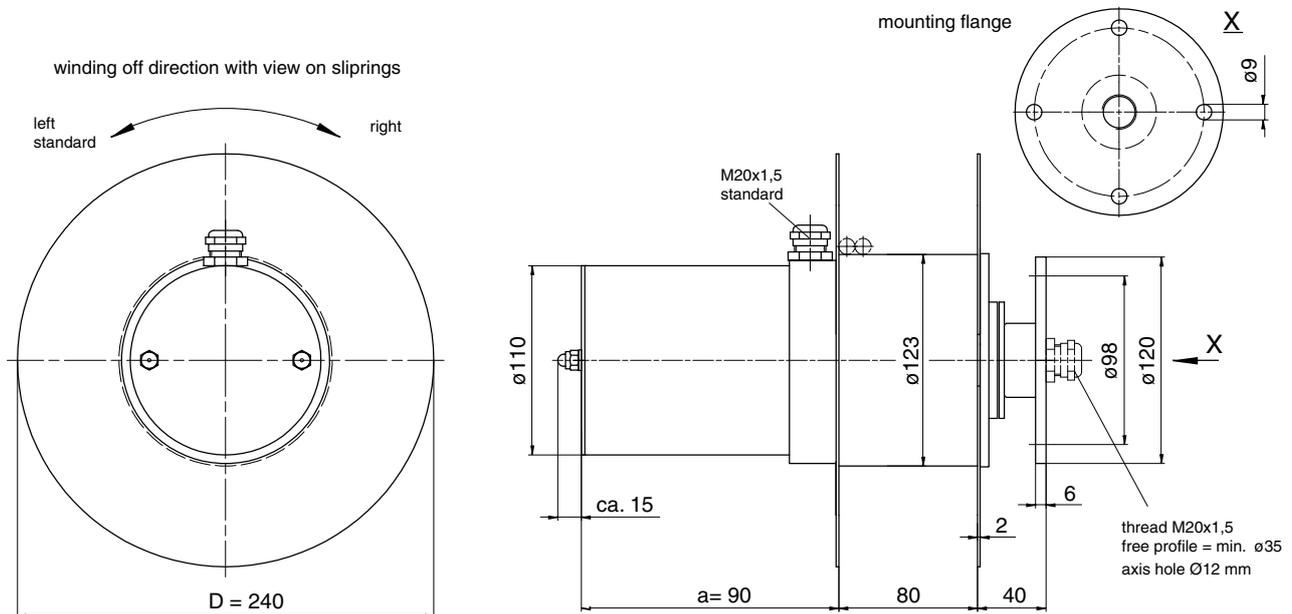
- axis hole $\varnothing 12$ mm
- spring types A1 (see ref. table on page 8)
- slipping type 10 and 16 (see ref. table on page 8)
- standard current range 4 mA up to 16 A
- standard voltage range 24 V up to 415 V



Series AV12

Standard Reels

Ref. No.	Reel type	d \varnothing	D \varnothing	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight
1	12180410A1	123	180	36	0,8	0,7	2,2	2,6	2,0	1,0	31,0	3,9
2	12240812A1	123	240	80	1,6	1,4	4,3	5,2	2,0	1,0	31,0	5,5



Cable reels series AV12: compact and solid



Slipring view

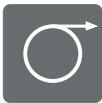


Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 10 m; vertical 10 m
- max. travel speed:
horizontal 63 m/min.; vertical 40 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 0,25 kg/m
- max. cable diameter Ø12 mm

Winding length Lw (m), Case 1 h ≤ 1 m



Cable		Winding length Lw (m), Case 1 h ≤ 1 m											
Ø mm	Weight from ... up to ... kg/m _{max.}	5				10				15			
< 3		1											
4		1											
5	0,05	1											
6	0,08	1											
7	0,10	1											
8	0,12	1											
9	0,14	1											
10	0,20	2											
11	0,23	2											
12	0,25	2											

Winding length Lw (m), Case 8 h ≤ 1 m



Cable		Winding length Lw (m), Case 8 h ≤ 1 m											
Ø mm	Weight from ... up to ... kg/m _{max.}	5				10				15			
< 3		1											
4		1											
5	0,05	1											
6	0,08	1											
7	0,10	1											
8	0,12	1											
9	0,14	1											
10	0,20	2											
11	0,23	2											
12	0,25	2											

Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 2 m for tension relief and connection on slipring

Cable reels series AV19: compact and versatile

Series 19 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

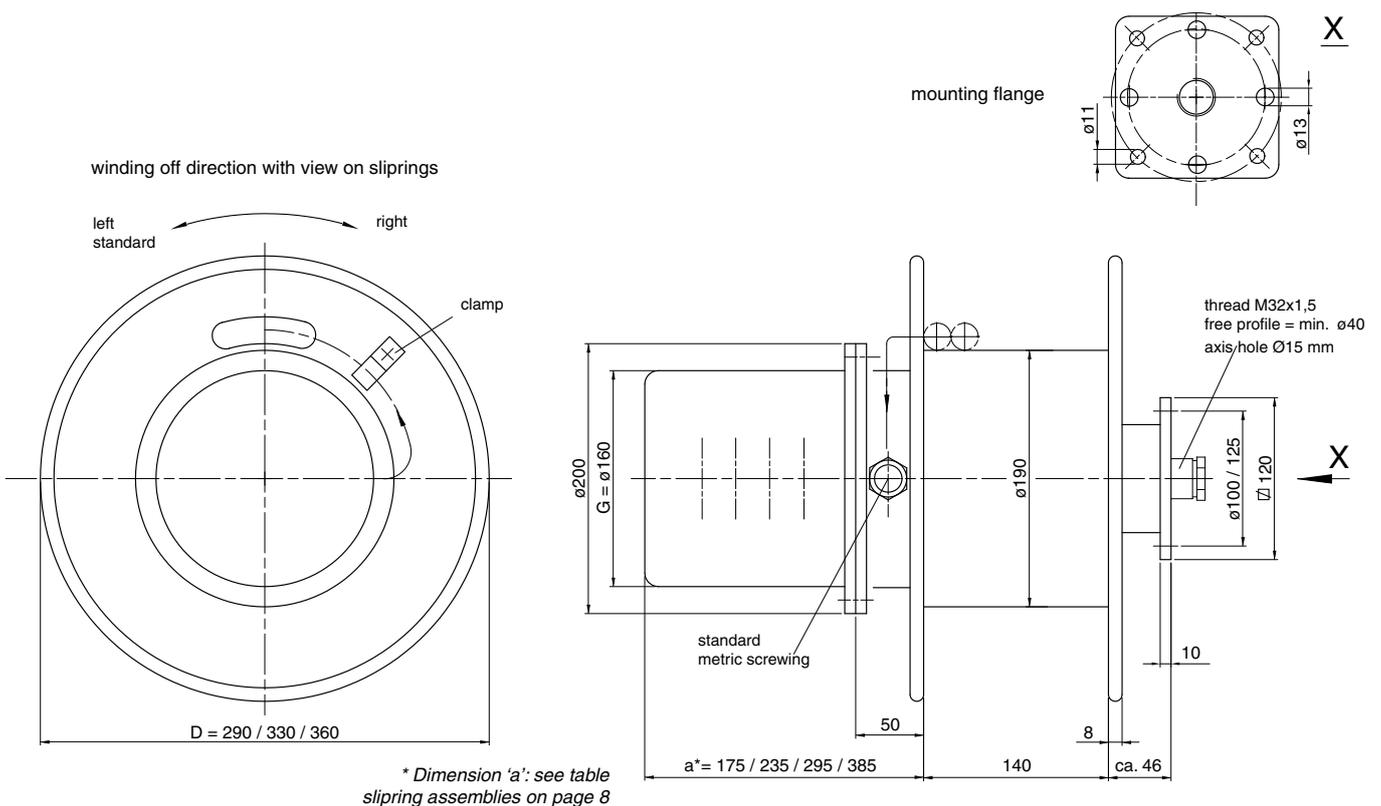
- axis hole Ø15 mm
- spring types A and B (see ref. table on page 8)
- slipping types 10, 25, 30 and 50 (see ref. table on page 8)
- standard current range 4 mA up to 50 A
- standard voltage range 24 V up to 500 V



Series AV19

Standard Reels

Ref. No.	Reel type	dØ	DØ	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight
1	19291410A	190	290	140	3,4	2,9	6,8	7,8	3,0	1,0	17,5	11,0
2	19331410A	190	330	140	3,4	2,9	6,8	7,8	3,0	2,0	17,5	13,5
3	19361410A	190	360	140	3,4	2,9	6,8	7,8	3,0	2,0	17,5	14,5
4	19291420A	190	290	140	3,4	2,9	6,8	7,8	6,0	2,0	35,0	16,0
5	19331420A	190	330	140	3,4	2,9	6,8	7,8	6,0	2,0	35,0	16,5
6	19361420A	190	360	140	3,4	2,9	6,8	7,8	6,0	3,0	35,0	20,0
7	19361420B	190	360	140	5,0	3,7	11,0	13,0	4,0	2,0	27,0	18,0
8	19361430A	190	360	140	3,4	2,9	6,8	7,8	9,0	3,0	53,0	16,8
9	19361430B	190	360	140	5,0	3,7	11,0	12,0	6,0	3,0	41,5	19,0



Cable reels series AV19: compact and versatile



Slipping view

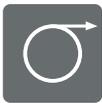


Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 25 m; vertical 18 m
- max. travel speed:
horizontal 63 m/min.; vertical 40 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 0,55 kg/m
- max. cable diameter Ø20 mm

Winding length L_w (m), Case 1 h ≤ 1 m



Cable		Winding length L _w (m), Case 1 h ≤ 1 m									
Ø mm	Weight										
from ... up to ...	kg/m _{max.}	5	10	15	20	25	30				
< 8	0,09										
8 – 10	0,15										
10 – 12	0,25										
12 – 14	0,30	1									
14 – 16	0,40										
16 – 18	0,45										
18 – 20	0,55										



Cable		Winding length L _w (m), Case 8 L _w = H									
Ø mm	Weight										
from ... up to ...	kg/m _{max.}	5	10	15	20	25	30				
< 8	0,09										
8 – 10	0,15										
10 – 12	0,25										
12 – 14	0,30	1									
14 – 16	0,40										
16 – 18	0,45										
18 – 20	0,55										

Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 2 m for tension relief and connection on slipping.

Cable reels series AV28: the ideal medium duty reels

Series 28 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

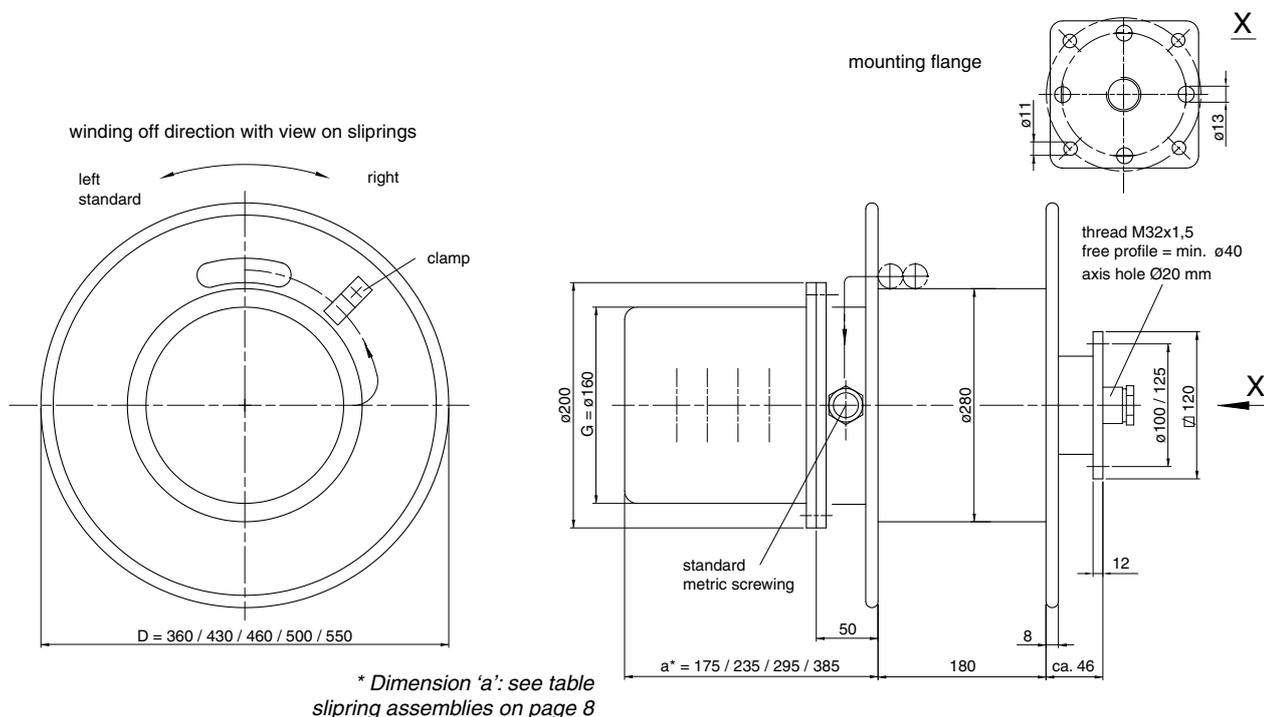
- axis hole $\varnothing 20$ mm
- spring types C, D and E (see ref. table on page 8)
- slipping types 10, 25 and 50 (see ref. table on page 8)
- standard current range 4 mA up to 50 A
- standard voltage range 24 V up to 500 V



Series AV28

Standard Reels

Ref. No.	Reel type	d \varnothing	D \varnothing	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight (kg)
1	28431810C	280	430	180	3,0	2,5	7,0	9,0	3,0	1,0	25,0	22,5
2	28501810C	280	500	180	3,0	2,5	7,0	9,0	3,0	1,0	25,0	23,5
3	28361810D	280	360	180	4,5	4,0	10,0	12,0	3,0	1,5	21,5	22,5
4	28431810D	280	430	180	4,5	4,0	10,0	12,0	3,0	1,5	21,5	22,5
5	28431812D	280	430	180	9,0	8,0	20,0	24,0	3,0	1,5	21,5	27,5
6	28501812D	280	500	180	9,0	8,0	20,0	24,0	3,0	1,5	21,5	28,5
7	28431820D	280	430	180	4,5	4,0	10,0	12,0	6,0	3,0	43,0	27,5
8	28501820D	280	500	180	4,5	4,0	10,0	12,0	6,0	3,0	43,0	28,5
9	28431820C	280	430	180	3,0	2,5	7,0	9,0	6,0	2,0	50,0	30,0
10	28501820C	280	500	180	3,0	2,5	7,0	9,0	6,0	2,0	50,0	30,0
11	28551820D	280	550	180	4,5	4,0	10,0	12,0	6,0	3,0	43,0	30,0
12	28431830C	280	430	180	3,0	2,5	7,0	9,0	9,0	3,0	75,0	32,5
13	28551830D	280	550	180	4,5	4,0	10,0	12,0	9,0	4,5	64,5	33,5
14	28431830D	280	430	180	4,5	4,0	10,0	12,0	9,0	4,5	64,5	33,5
15	28431840C	280	430	180	3,0	2,5	7,0	9,0	12,0	4,0	100,0	36,0
16	28501840D	280	500	180	4,5	4,0	10,0	12,0	12,0	6,0	86,0	38,0
17	28551840D	280	550	180	4,5	4,0	10,0	12,0	12,0	6,0	86,0	38,5



Cable reels series AV28: the ideal medium duty reels



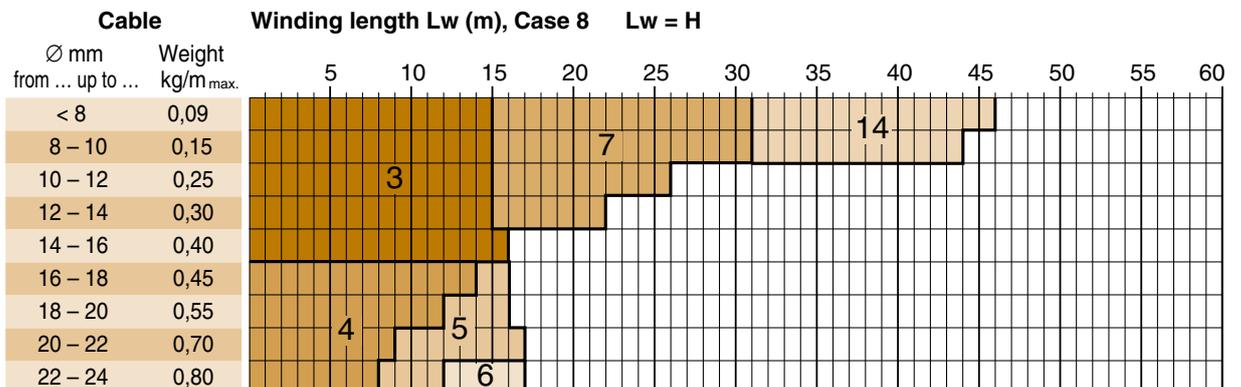
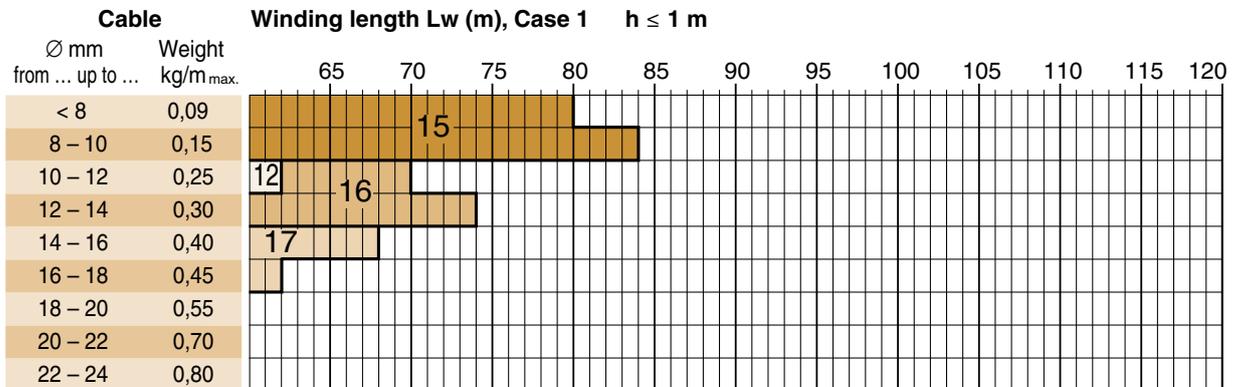
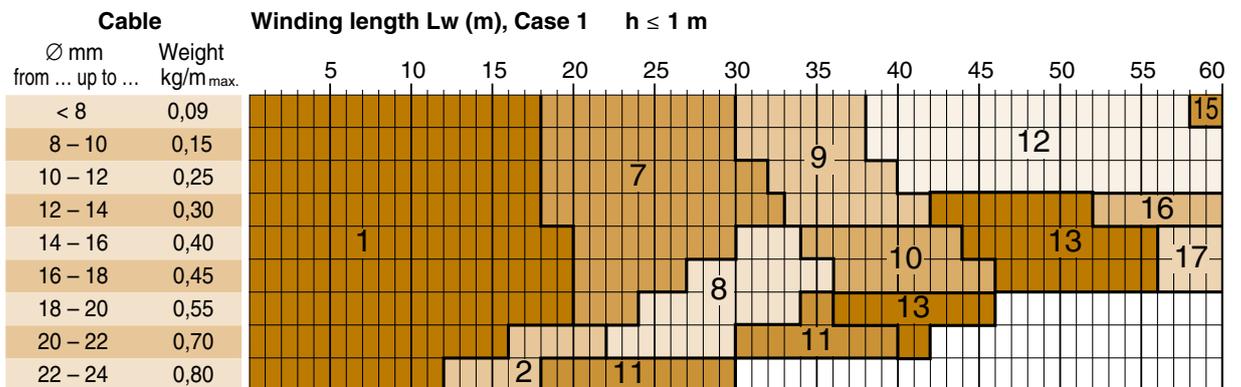
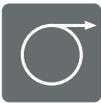
Slipping view



Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 60 m; vertical 27 m
- max. travel speed:
horizontal 63 m/min.; vertical 40 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 0,80 kg/m
- max. cable diameter Ø24 mm



Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 3 m for tension relief and connection on slipping.

Cable reels series AV28 with 'E'-springs: medium duty reels with higher spring force

Series 28 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

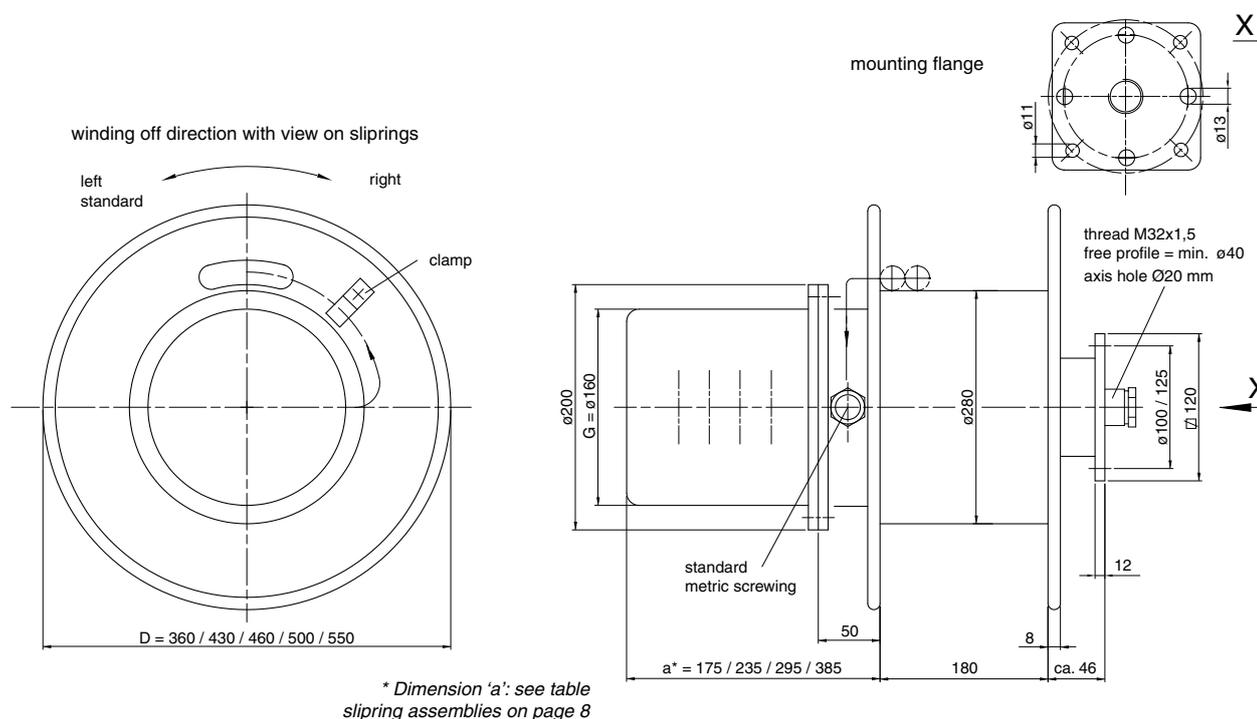
- axis hole $\varnothing 20$ mm
- spring type E (see ref. table on page 8)
- slipping types 10, 25 and 50 (see ref. table on page 8)
- standard current range 4 mA up to 50 A
- standard voltage range 24 V up to 500 V



Series AV28

Standard Reels

Ref. No.	Reel type	d \varnothing	D \varnothing	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight (kg)
1	28361810E	280	360	180	7,1	6,8	17,5	19,0	3,0	1,5	17,5	22,5
2	28431810E	280	430	180	7,1	6,8	17,5	19,0	3,0	1,5	17,5	23,5
3	28431820E	280	430	180	7,1	6,8	17,5	19,0	6,0	3,0	35,0	30,0
4	28551820E	280	550	180	7,1	6,8	17,5	19,0	6,0	3,0	35,0	31,0
5	28431830E	280	430	180	7,1	6,8	17,5	19,0	9,0	4,5	52,5	33,5
6	28501830E	280	500	180	7,1	6,8	17,5	19,0	9,0	4,5	52,5	34,0
7	28551830E	280	550	180	7,1	6,8	17,5	19,0	9,0	4,5	52,5	34,5
8	28431840E	280	430	180	7,1	6,8	17,5	19,0	12,0	6,0	70,0	39,5
9	28552140E	280	550	215	7,1	6,8	17,5	19,0	12,0	6,0	70,0	40,5
10	28551822E	280	550	180	14,0	13,5	35,0	38,0	6,0	3,0	35,0	40,5



Cable reels series AV28 with 'E'-springs: medium duty reels with higher spring force



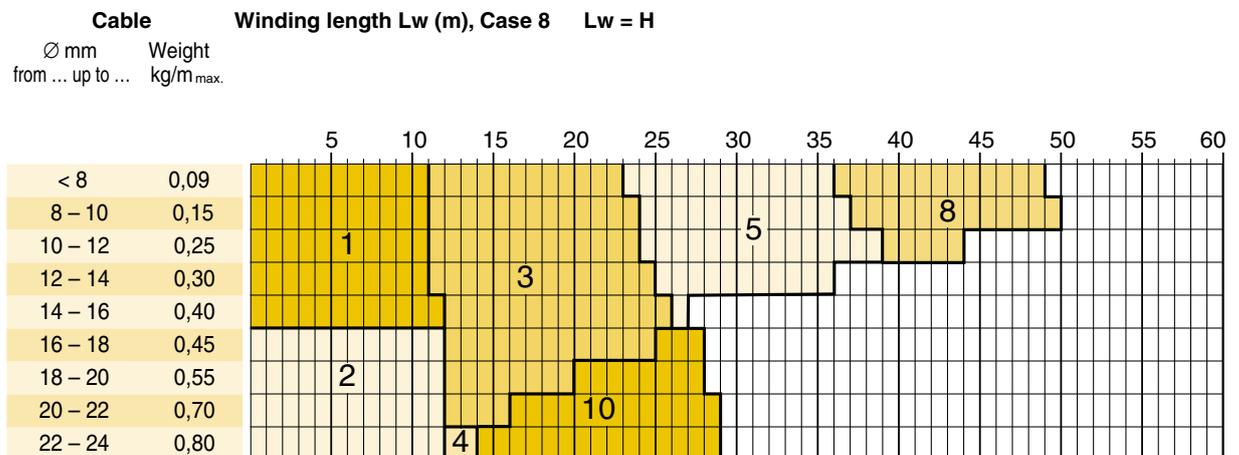
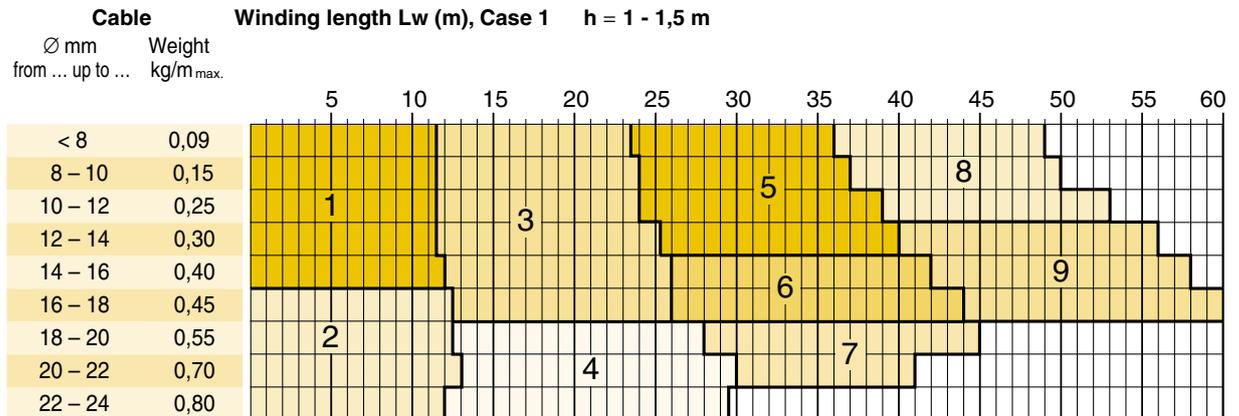
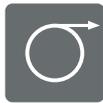
Slipping view



Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 60 m; vertical 27 m
- max. travel speed:
horizontal 63 m/min.; vertical 46 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 0,80 kg/m
- max. cable diameter Ø24 mm



Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 3 m for tension relief and connection on slipping.

Cable reels series AV30: the ideal medium duty reels

Series 30 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

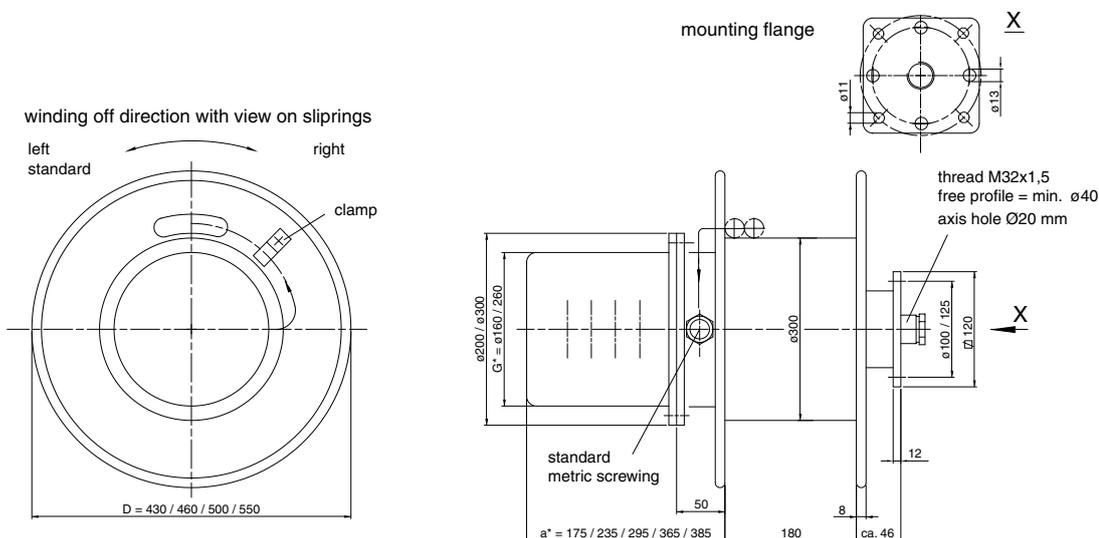
- axis hole $\varnothing 20$ mm
- spring type C, D, and E (see ref. table on page 8)
- slipping types 01, 03, 04, 10, 25 and 50 (see ref. table on page 8)
- standard current range 4 mA up to 150 A
- standard voltage range 24 V up to 500 V



Series AV30

Standard Reels

Ref. No.	Reel type	d \varnothing	D \varnothing	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight (kg)
1	30431810C	300	430	180	2,8	2,3	6,5	8,4	3,0	1,0	25,0	21,0
2	30431810D	300	430	180	4,2	3,7	9,3	11,2	3,0	1,5	21,5	21,5
3	30501810D	300	500	180	4,2	3,7	9,3	11,2	3,0	1,5	21,5	22,0
4	30501820D	300	500	180	4,2	3,7	9,3	11,2	6,0	3,0	43,0	27,0
5	30501820C	300	500	180	2,8	2,3	6,5	8,4	6,0	2,0	50,0	28,0
6	30551820E	300	550	180	6,6	6,3	16,3	17,7	6,0	3,0	35,0	31,0
7	30461830C	300	460	180	2,8	2,3	6,5	8,4	9,0	3,0	75,0	30,0
8	30551830D	300	550	180	4,2	3,7	9,3	11,2	9,0	4,5	64,5	32,5
9	30551830E	300	550	180	6,6	6,3	16,3	17,7	9,0	4,5	52,5	34,0
10	30501840D	300	500	180	2,8	2,3	6,5	8,4	12,0	4,0	100,0	34,5
11	30551840D	300	550	180	4,2	3,7	9,3	11,2	12,0	6,0	86,0	36,5
12	30431810E	300	430	180	6,6	6,3	16,3	17,7	3,0	1,5	17,5	21,8
13	30461820E	300	460	180	6,6	6,3	16,3	17,7	6,0	3,0	35,0	28,0
14	30501810E	300	500	180	6,6	6,3	16,3	17,7	3,0	1,5	17,5	23,0
15	30501840E	300	500	180	6,6	6,3	16,3	17,7	12,0	6,0	70,0	39,0
16	30551822E	300	550	180	13,0	12,6	32,6	35,5	6,0	3,0	35,0	39,0



* Dimensions 'a' and 'G': see table slipping assemblies on page 8

Cable reels series AV30: the ideal medium duty reels



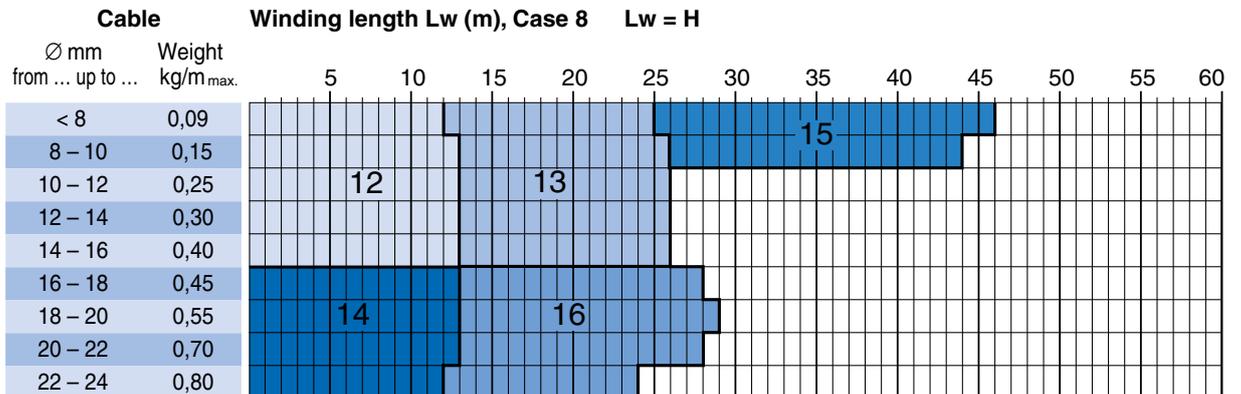
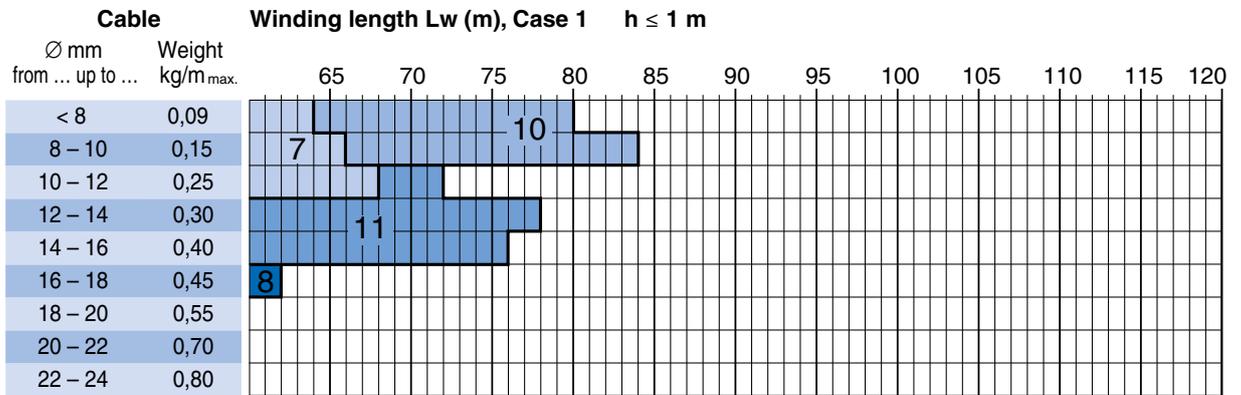
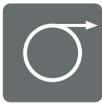
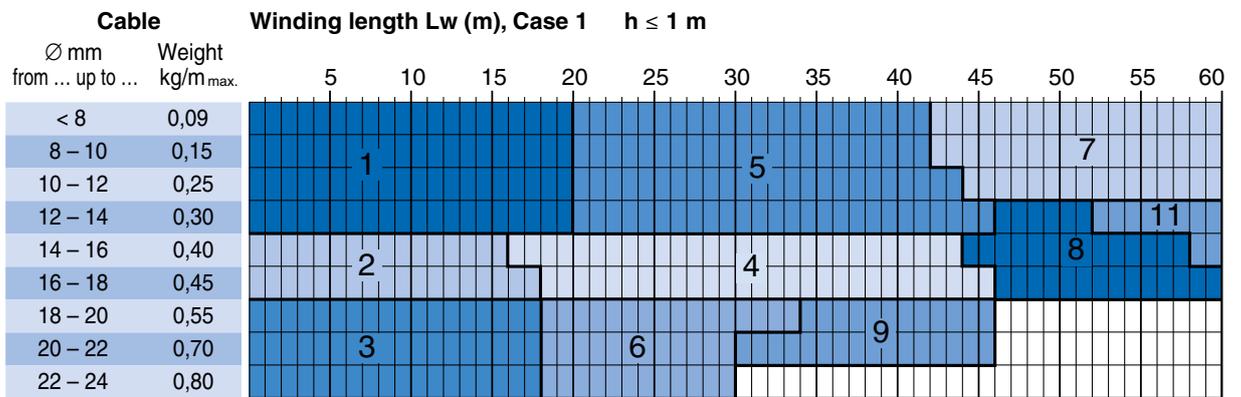
Slipping view



Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 84 m; vertical 45 m
- max. travel speed:
horizontal 63 m/min.; vertical 40 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 1,80 kg/m
- max. cable diameter Ø40 mm



Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 3 m for tension relief and connection on slipping.

Cable reels series AV40: the solid heavy duty reels

Series 40 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

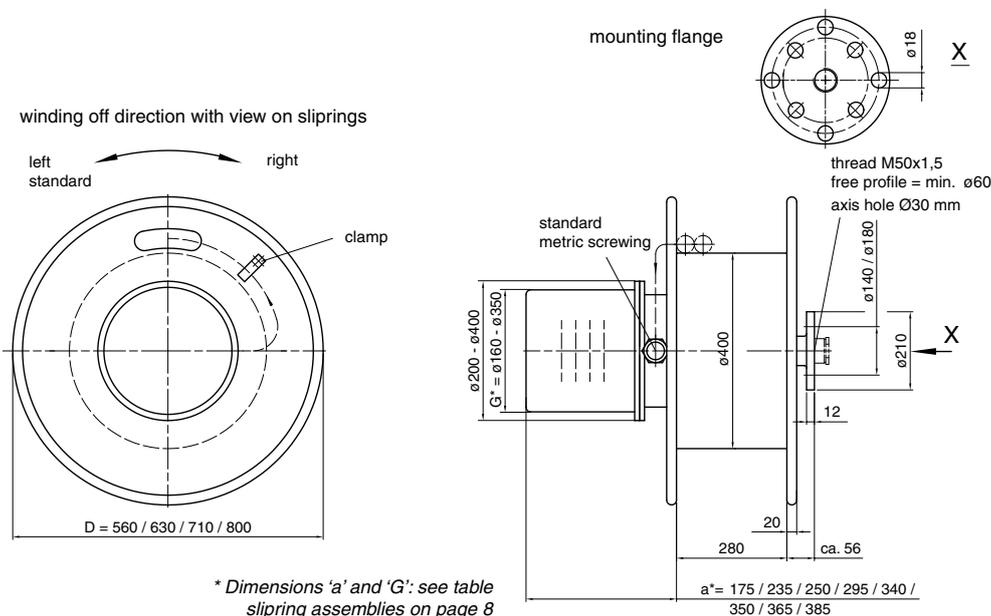
- axis hole $\varnothing 30$ mm
- spring types F, G and H (see ref. table on page 8)
- slipping type 01, 03, 04, 05, 10, 25 and 50 (see ref. table on page 8)
- standard current range 4 mA up to 200 A
- standard voltage range 24 V up to 500 V



Series AV40

Standard Reels

Ref. No.	Reel type	d \varnothing	D \varnothing	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight (kg)
1	40562810G	400	560	280	7,0	6,0	20,0	24,0	2,5	1,5	21,0	56,0
2	40562810F	400	560	280	6,0	5,0	13,0	15,0	3,5	1,5	25,0	54,0
3	40632810G	400	630	280	7,0	6,0	20,0	24,0	2,5	1,5	21,0	58,0
4	40712810G	400	710	280	7,0	6,0	20,0	24,0	2,5	1,5	21,0	60,0
5	40632810H	400	630	280	16,0	13,0	39,0	46,0	2,5	1,0	16,5	61,0
6	40562812G	400	560	280	14,0	12,0	40,0	48,0	2,5	1,5	21,0	70,0
7	40632812G	400	630	280	14,0	12,0	40,0	48,0	2,5	1,5	21,0	72,0
8	40632813G	400	630	280	21,0	18,0	60,0	72,0	2,5	1,5	21,0	85,0
9	40712813G	400	710	280	21,0	18,0	60,0	72,0	2,5	1,5	21,0	86,0
10	40562820G	400	560	280	7,0	6,0	20,0	24,0	5,0	3,0	42,0	70,0
11	40632820F	400	630	280	6,0	5,0	13,0	15,0	7,0	3,0	50,0	67,0
12	40712820G	400	710	280	7,0	6,0	20,0	24,0	5,0	3,0	42,0	74,0
13	40802820G	400	800	280	7,0	6,0	20,0	24,0	5,0	3,0	42,0	77,0
14	40562820H	400	560	280	16,0	13,0	39,0	46,0	5,0	2,0	33,0	76,0
15	40632830F	400	630	280	6,0	5,0	13,0	15,0	10,5	4,5	75,0	77,0
16	40712830F	400	710	280	6,0	5,0	13,0	15,0	10,5	4,5	75,0	80,0
17	40632830G	400	630	280	7,0	6,0	20,0	24,0	7,5	4,5	63,0	85,0
18	40712830G	400	710	280	7,0	6,0	20,0	24,0	7,5	4,5	63,0	86,0
19	40802830G	400	800	280	7,0	6,0	20,0	24,0	7,5	4,5	63,0	88,0
20	40632830H	400	630	280	16,0	13,0	39,0	46,0	7,0	3,5	49,5	94,0



Cable reels series AV40: the solid heavy duty reels



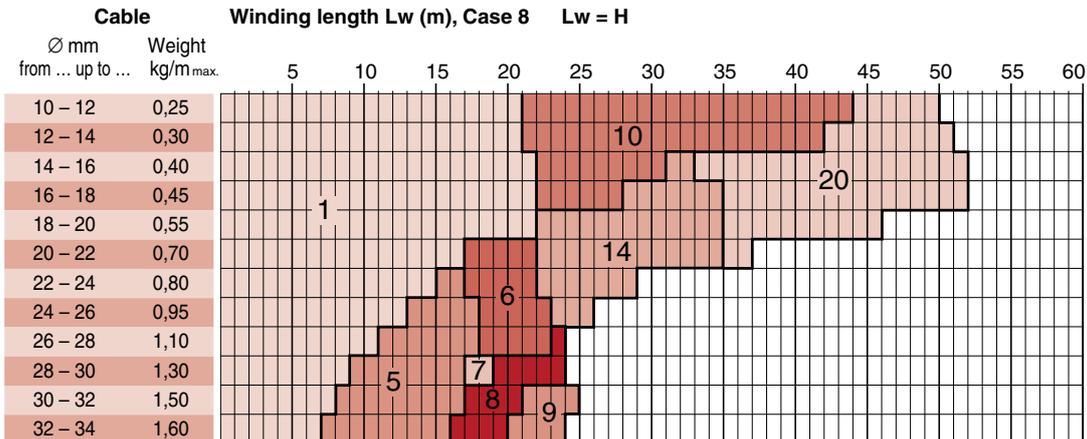
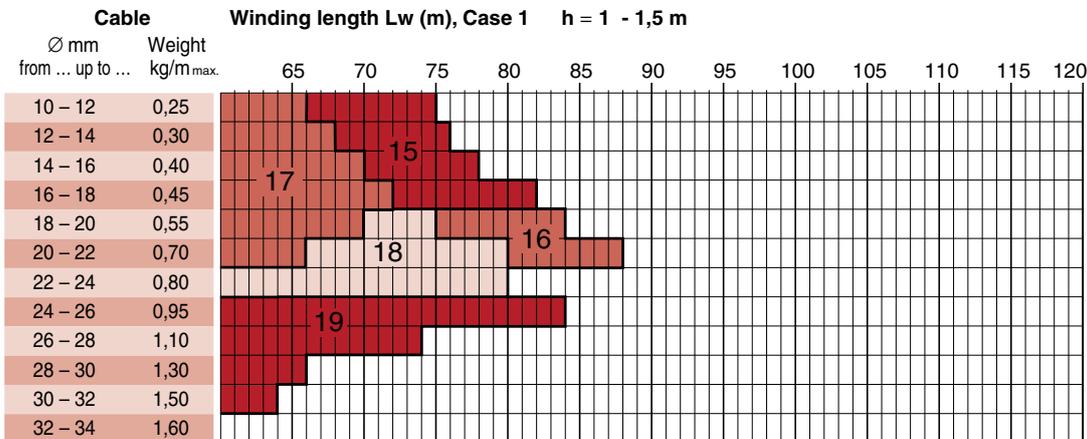
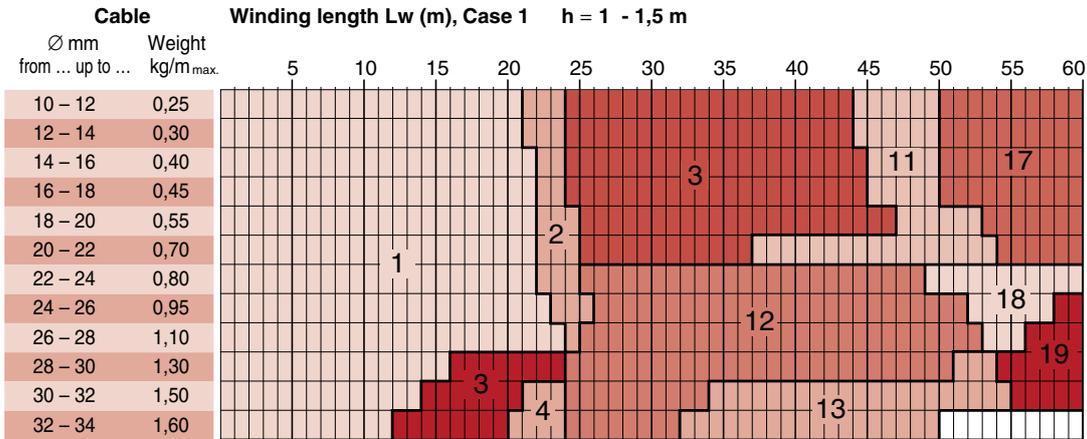
Slipping view



Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 70 m; vertical 30 m
- max. travel speed:
horizontal 63 m/min.; vertical 40 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 1,60 kg/m
- max. cable diameter Ø34 mm



Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 4 m for tension relief and connection on slipping.

Cable reels series AV50: the solid heavy duty reels

Series 50 cable reels can be used indoors and outdoors, with respect to the following general characteristics:

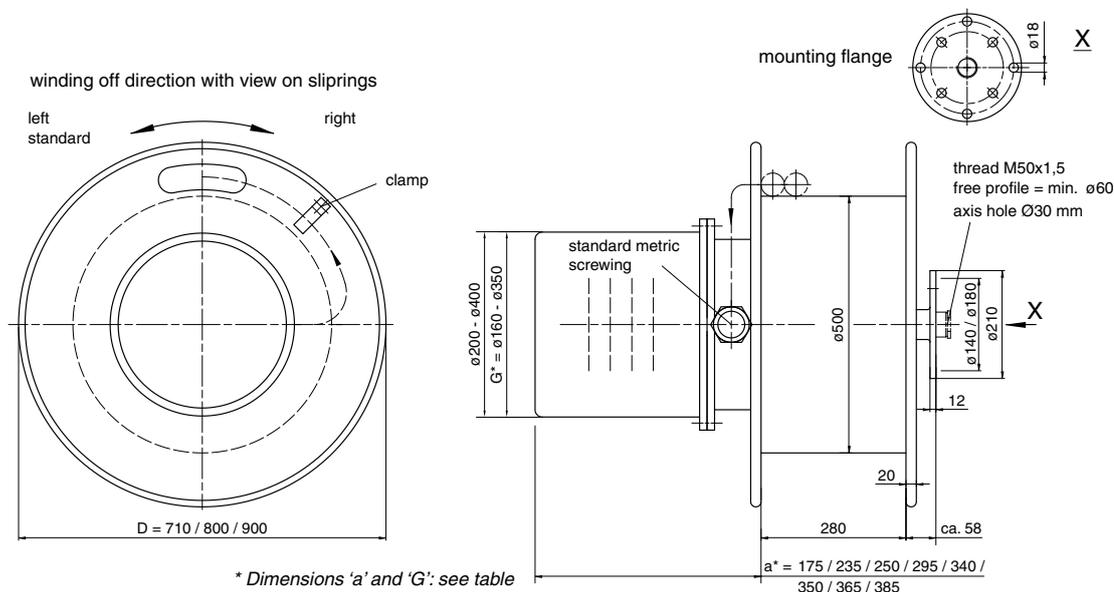
- axis hole Ø30 mm
- spring types G, H and I (see ref. table on page 8)
- slipping type 01, 03, 04, 05, 10, 25 and 50 (see ref. table on page 8)
- standard current range 4 mA up to 200 A
- standard voltage range 24 V up to 500 V



Series AV50

Standard Reels

Ref. No.	Reel type	dØ	DØ	b	Za	Fa	Fe	Z	n pre	n spare	n total	Weight (kg)
1	50712810G	500	710	280	6,0	5,0	17,0	20,0	2,5	1,5	21,0	80,0
2	50802810G	500	800	280	6,0	5,0	17,0	20,0	2,5	1,5	21,0	82,0
3	50712810H	500	710	280	14,0	11,0	31,0	38,0	2,5	1,0	16,5	84,0
4	50802810H	500	800	280	14,0	11,0	31,0	38,0	2,5	1,0	16,5	86,0
5	50902810I	500	900	280	10,0	8,5	29,0	35,0	2,5	1,5	20,0	90,0
6	50802812G	500	800	280	12,0	10,0	34,0	40,0	2,5	1,5	21,0	86,0
7	50802812H	500	800	280	28,0	22,0	62,0	76,0	2,5	1,0	16,5	92,0
8	50802813G	500	800	280	18,0	15,0	51,0	60,0	2,5	1,5	21,0	90,0
9	50802813H	500	800	280	42,0	33,0	93,0	114,0	2,5	1,0	16,5	112,0
10	50802820G	500	800	280	6,0	5,0	17,0	20,0	5,0	3,0	42,0	86,0
11	50902820G	500	900	280	6,0	5,0	17,0	20,0	5,0	3,0	42,0	92,0
12	50802820H	500	800	280	14,0	11,0	31,0	38,0	5,0	2,0	33,0	92,0
13	50802820I	500	800	280	10,0	8,5	29,0	35,0	5,0	3,0	40,0	97,0
14	50902820I	500	900	280	10,0	8,5	29,0	35,0	5,0	3,0	40,0	104,0
15	50802830G	500	800	280	6,0	5,0	17,0	20,0	7,5	4,5	63,0	90,0
16	50802830H	500	800	280	14,0	11,0	31,0	38,0	7,5	3,0	49,5	112,0
17	50902830H	500	900	280	14,0	11,0	31,0	38,0	7,5	3,0	49,5	117,0
18	50902830I	500	900	280	10,0	8,5	29,0	35,0	7,5	4,5	60,0	120,0
19	50903430I	500	900	340	10,0	8,5	29,0	35,0	7,5	4,5	60,0	127,0
20	50803440G	500	800	340	6,0	5,0	17,0	20,0	10,0	6,0	84,0	117,0
21	50903440I	500	900	340	10,0	8,5	29,0	35,0	10,0	6,0	80,0	150,0



Cable reels series AV50: the solid heavy duty reels



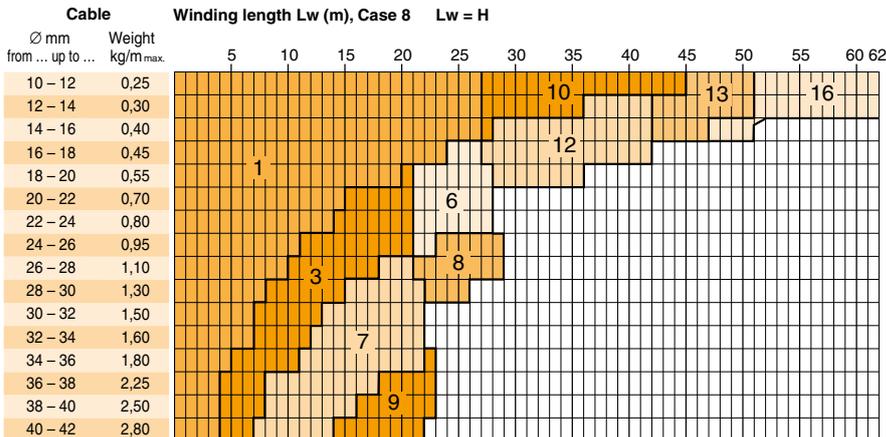
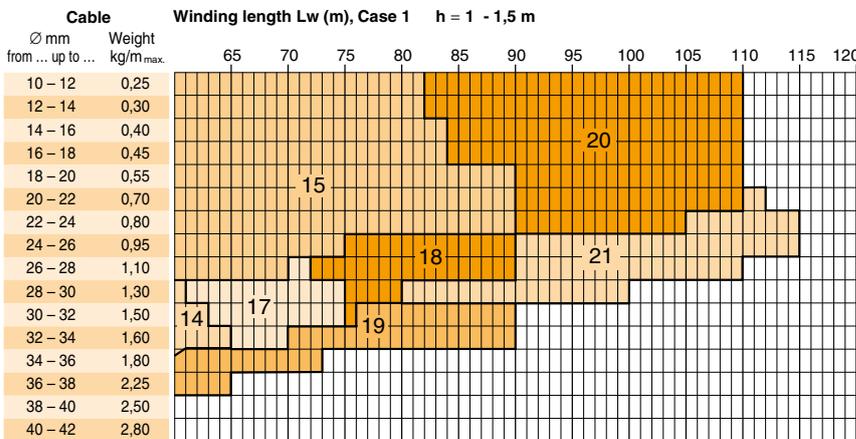
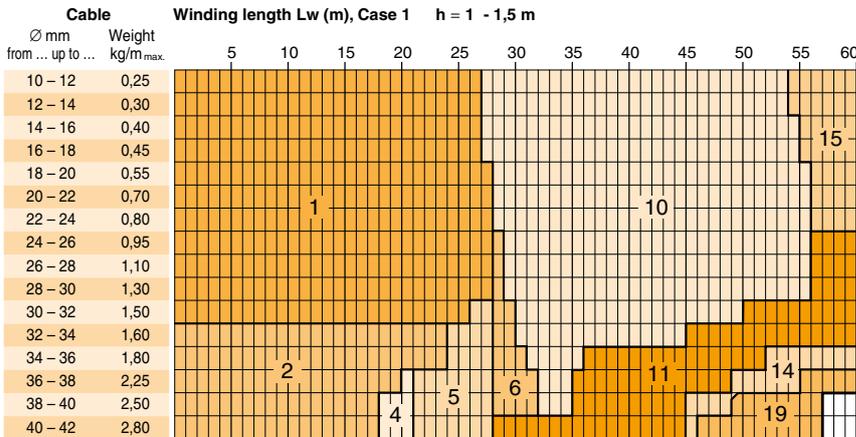
Slipping view



Mounting flange view

General characteristics (continued):

- max. recommended reeling lengths:
horizontal 110 m; vertical 30 m
- max. travel speed:
horizontal 63 m/min.; vertical 40 m/min.
- max. acceleration 0,3 m/s²
- max. cable weight 2,80 kg/m
- max. cable diameter Ø42 mm



Remarks:

- the diagrams show the maximum winding lengths. For recommended winding lengths, see information above;
- for cable length add 5 m for tension relief and connection on slipping.

Accessories for cable reels

guide arms for perfect cable guidance

It is of great importance that cables, winded on and off the reel, are handled with care. Therefore, we supply a number of accessories to ensure proper winding with respect to the cable attributes. It will help to increase the life time of your cables!

Application of any accessories can influence the working of the cable reel. Therefore it is very important to contact our sales office when considering the use hereof.

To avoid transversal tensions towards the reel for mobile machines, a guide arm with roller guide is needed.

There are rigid and rotatable performances.

The roller guides are also available as a separate part. Please see page 29.

Guide arm with roller guide, short version

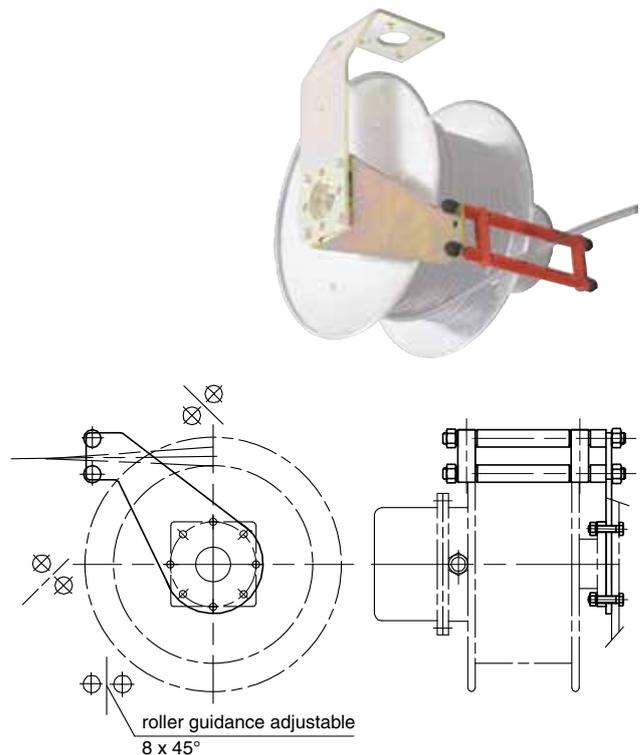
For spring-driven cable reels of sizes AV 19, 28, 30, 40 and 50.

The guide arm should be used for manual cable pay-off. It prevents the cable from falling over the flange if the lateral angle from which the cable is fed is too big.

Material: steel (galvanized, polyester coated or stainless); rollers made of plastic.



special guide arms (for reels AV19 and AV28)

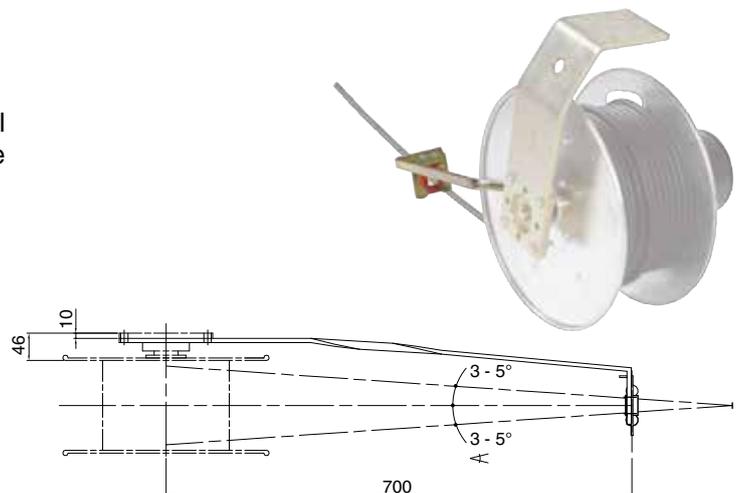


Guide arm with roller guide, rigid

For spring-driven cable reels of sizes AV 19 and 28.

The guide arm mostly is used where transversal tensions towards the reel shall be avoided for mobile machines.

Material: steel, galvanized, rollers made of plastic



Accessories for cable reels

guide arms for perfect cable guidance

It is of great importance that cables, winded on and off the reel, are handled with care. Therefore, we supply a number of accessories to ensure proper winding with respect to the cable attributes. It will help to increase the life time of your cables!

Application of any accessories can influence the working of the cable reel. Therefore it is very important to contact our sales office when considering the use hereof.

Roller guides can be applied for secure winding of the cable on the reel drum, while manual and automatic operation. Suitable for mounting on a guide arm or on a construction part.

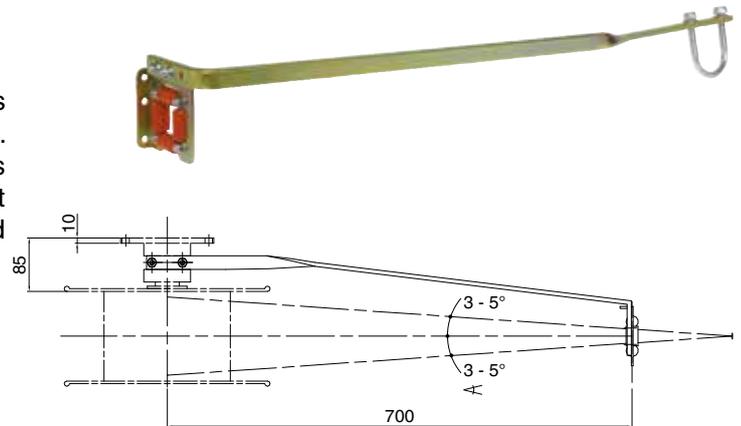
Roller guides should not be applied for diversion of cables. In these cases you can use a diverting roller (see page 32).

Guide arm with roller guide, rotatable

For spring-driven cable reels of sizes AV 19 and 28.

The guide arm mostly is used where transversal tensions towards the reel shall be avoided for mobile machines. The design of the arm is effected in such a way that as a rigid guide arm it can be adjusted to every tangent or as a freely rotatable guide arm it can rotate around the reel.

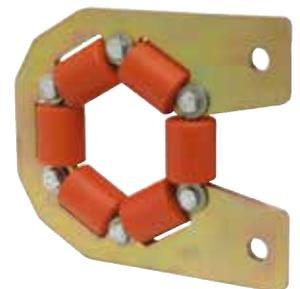
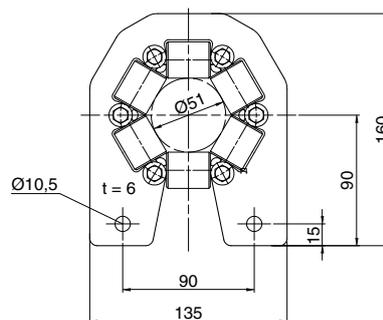
Material: steel, galvanized, rollers made of plastic



Roller guide, 6 rolls

Opening $\varnothing 51$ mm. By means of 6 guide rollers, optimal cable guidance is guaranteed. The lowest roller can be disassembled. Due to this, cables up to ca. $\varnothing 32$ mm can be installed without disassembling the cable while the roller guide is installed.

Material: steel, galvanized, rollers made of plastic

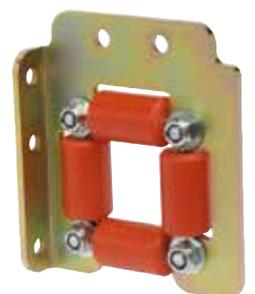
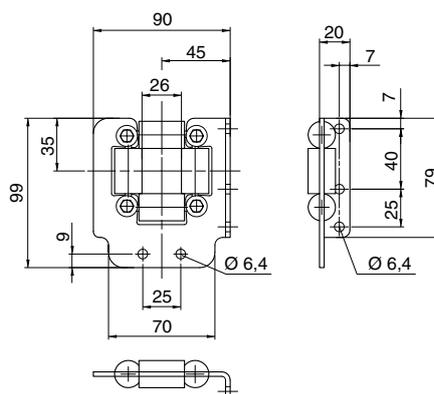


Roller guide, 6 rolls

Roller guide, 4 rolls

Opening 26x30 mm. The upper-most roller can be disassembled. Due to this, cables up to ca. $\varnothing 26$ mm can be installed easily and quick without disassembling the cable while the roller guide is installed.

Material: steel, galvanized, rollers made of plastic



Roller guide, 4 rolls

Accessories for cable reels

attachments for cable reels

It is of great importance that cables, winded on and off the reel, are handled with care. Therefore, we supply a number of accessories to ensure proper winding with respect to the cable attributes. It will help to increase the life time of your cables!

Application of any accessories can influence the working of the cable reel. Therefore it is very important to contact our sales office when considering the use hereof.

Cable reels of the series AV can be perfectly mounted to the ceiling, wall or floor by means of rigid and rotatable attachments.

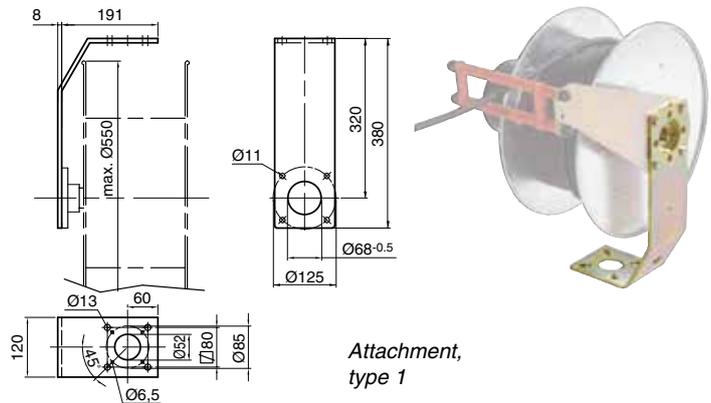
Please note that some applications require a guide arm in addition.

Please contact us for further advise.

Rigid bearing for ceiling-, floor- and wall-attachment, type 1

Suitable for the spring-driven cable reels of sizes AV 19, 28 and 30.

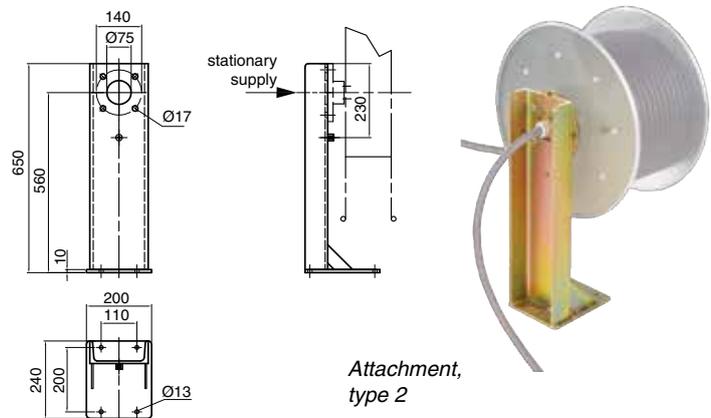
Material: steel, galvanized



Rigid bearing for ceiling-, floor- and wall-attachment, type 2

Suitable for the spring-driven cable reels of sizes AV 40 and 50.

Material: steel, galvanized

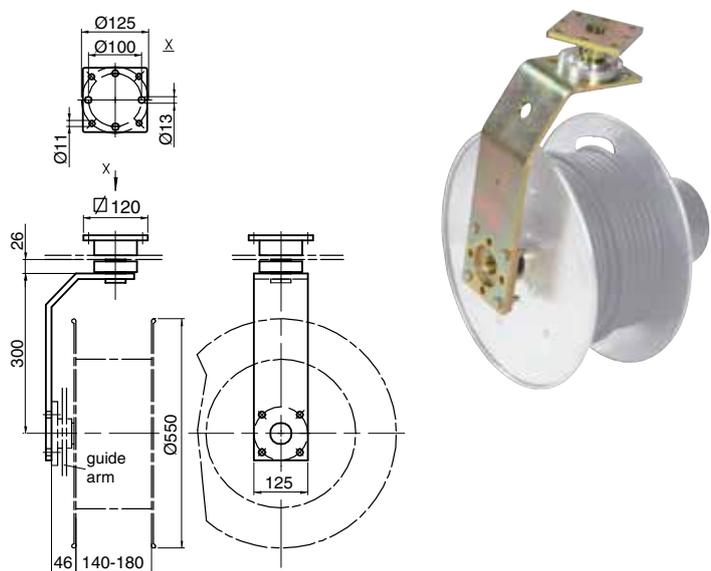


Rotary attachment console for ceiling- and floor-attachment

Suitable for spring-driven cable reels of sizes AV19, 28 and 30.

Range of rotation: 360°, bidirectional. If possible the rotary attachment console should always be installed with a long guide arm with roller guide. The stationary cable connection has to be laid in a loose loop.

Material: steel, galvanized



Accessories for cable reels

take care of your expensive cables

It is of great importance that cables, winded on and off the reel, are handled with care. Therefore, we supply a number of accessories to ensure proper winding with respect to the cable attributes. It will help to increase the life time of your cables!

Application of any accessories can influence the working of the cable reel. Therefore it is very important to contact our sales office when considering the use hereof.

Diversion of the reeling cable can be necessary e.g. in line feed applications. A diverting funnel with tension relief is needed.

At all times, there is a relationship between the diameter of the cable and the diameter of the diversion roller. We will be glad to advise you.

Also, for diverting the direction of the cable, a diverting roller can be used. See page 32.

Cable mesh grip

By means of a cable mesh grip the tensile forces regarding spring-driven cable reels for horizontal pay-off with end feeding and for hoisting reels can be absorbed.

Material: steel-mesh wire, galvanized, on request also available in stainless steel

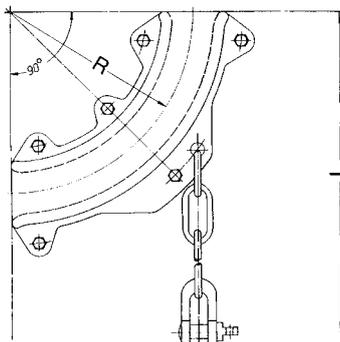


Cable holding sleeve

Type	Cable Ø (mm)	Length of meshwork (mm)	Total length (mm)	Art.-No.
TPMU8	8 - 10	130	295	8510060
TPMU12	10 - 13	130	295	8510020.B0000
TPMU15	12 - 16	130	295	8510070
TPMU17	15 - 18	140	340	8510150
TPMU20	18 - 22	140	340	8510230
TPMU25	22 - 28	195	395	8510280.B0000
TPMU30	27 - 33	195	395	8510285.B0000
TPMU40	37 - 44	195	395	8510300.B0000

Cable collar with chain and shackle

The cable collar serves as tension relief at the feeding point. It consists of two shells that will be laid around the cable and then will be bolted together. Chain and shackle lock the cable clamp in the fixed point and avoid that tensile forces are acting on the terminal box.



Size	Cable Ø (mm)	Weight (kg)	R (mm)	L (mm)	Art.-No.
I	...- 24	1,5	100	250	8501980.B0000
II	25 - 30	1,7	120	300	8501980.B2333
III	31 - 36	3,2	150	300	8501980.B3140
IV	37 - 43	4,2	200	350	8501980.B3743

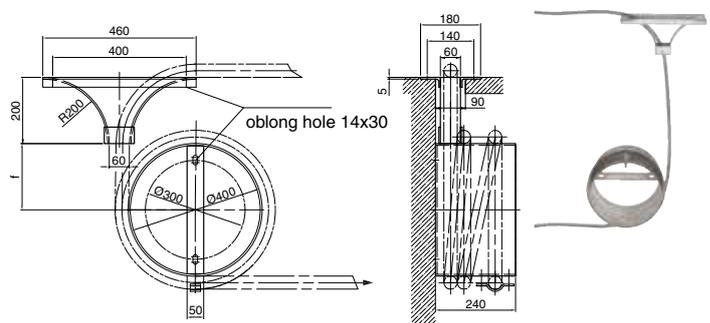


Cable collar with chain and shackle

Diverting funnel with tension relief reel

By means of the diverting funnel a perfect diversion of the cable in the feeding point is granted. The tension relief reel absorbs the existing tensile forces for that these will not act on the terminal box.

Material: steel, galvanized



Accessories for cable reels

return motion locking and diverting roller

It is of great importance that cables, winded on and off the reel, are handled with care. Therefore, we supply a number of accessories to ensure proper winding with respect to the cable attributes. It will help to increase the life time of your cables!

Application of any accessories can influence the working of the cable reel. Therefore it is very important to contact our sales office when considering the use hereof.

By means of the ratchet lock the respectively required length of cable can be held outside the spring-driven cable reel. This is only suitable for manual winding of the cable.

For correct diversion of cables, we recommend to use our diverting roller, perfectly adapted to your reeling cable.

Ratchet lock

For spring-driven cable reels of sizes AV 19, 28, 30, 40 and 50.

The ratchet lock is intended for applications where the cable is manually reeled on resp. off.

By means of the ratchet lock the respectively required length of cable can be held outside the spring-driven cable reel in a tension-relieved way. The ratchet lock can be engaged 6 times per each rotation, By shortly pulling at the cable the ratchet lock can be unlatched and the cable can be manually fed to the spring-driven cable reel.

The ratchet lock should always be installed in connection with a guide arm with roller guide, to ensure proper winding of the cable on the reel drum.

Material: steel, galvanized

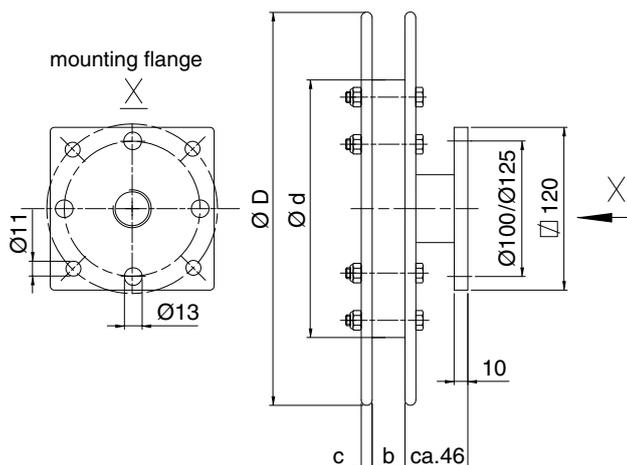


Diverting roller

For the diversion of cables. Version with attachment flange and ball bearing.

Material: steel, galvanized

Special performances on request.



Type	Cable-Ø (mm)	Dimensions (mm)			Weight (kg)
	d Ø	D	b	c	
UR-190	190	290	35	10	3,0
UR-280	280	330	35	10	4,0
UR-300	300	360	35	10	5,5
UR-400	400	500	35	12	15,0



AV28 cable reel for the feeding of a portal crane, used in concrete industry



AV50 cable reel (stainless steel), feeding a portal crane on a freight ship



AV28 cable reel for feeding and controlling of a hatch crane on a freight ship



AV40 cable reels for feeding and controlling of a transfer cart and machines

Company : _____ City : _____

Country : _____ Contact : Mr. / Mrs. _____

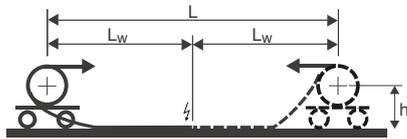
Phone : _____ E-mail : _____

Fax : _____ Date : _____

Your ref. : _____

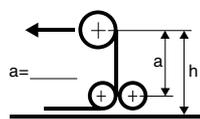
Reel cases

The cases shown below are in principal the standard arrangements. Further applications on request.
For cases not listed here, please supply us a drawing of your configuration below or on a separate sheet.



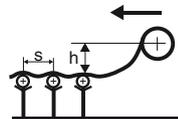
Case 1

Horizontal retrieval to one or both sides.
Cable laying on a flat continuous surface.



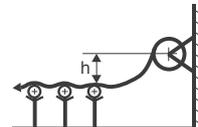
Case 2

Like case 1, with diverting rollers.



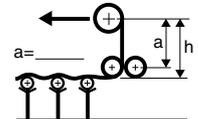
Case 3

Like case 1, with support rollers.



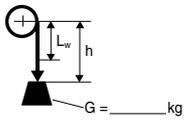
Case 4

Horizontal drag, with support rollers.

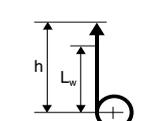


Case 5

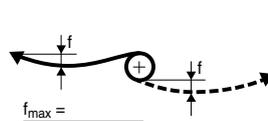
Like case 1, with diverting rollers and support rollers.
Not recommended!



Case 6A
Vertical lift

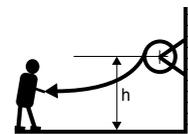


Case 6B
Vertical retrieval



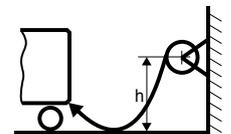
Case 7/8

Horizontal stretch. Retrieval to one or both sides without cable support.



Case 9

Retrieval to one side without cable support.
Manual operation.



Case 10

Horizontal drag, with automatic operation. This application has possible damaging effects on the cable.

I attached a drawing with an alternative configuration

Please continue on the next page

Your drawing here

Number of the required cable reels: _____ pc.

Information of the machine

Type of machine _____

Number of movements _____ /h/8h

Travel speed _____ m/min

Acceleration _____ m/s²

Mounting height (h) _____ m

Track length (L) _____ m
 If centre feed: $L = 2 \times L_w$

Cable winding length (L_w) _____ m

Additional cable length required for connection _____ m

Feeding of the reel End Centre
 at _____ / _____ m

Conditions

Type of industry _____

Outdoors Indoors

Normal Humid, _____ %

Chemical aggressive

Ambient temperature _____ °C_{min.} / _____ °C_{max.}

Electrical details

Supply _____ V

A.C. 3 Phase A.C. 1 Phase D.C.

Max. current _____ A

Duty cycle (D.C.) _____ %

Control / Data signal _____ V _____ A

Slipping body

Number of slibrings for _____ + Earth
 power

Number of slibrings for _____
 control/data signal

Bus system _____

Heating of slipping unit required

Cable details

Cores / cross section _____ x _____ mm²

Control wires Shielded
 Twisted pairs

Cable to be supplied by Wabtec Netherlands
If cable not to be supplied by Wabtec Netherlands:

Cable type _____

Outer diameter \varnothing _____ mm

Min. bending radius _____ mm

Weight _____ kg/m

Operation

Automatic Manual

Accessories

Cable grip

Cable anchor

Diverting funnel

Diverting rollers

Swivel base

Roller guide

Guide arm

Ratchet lock (*only if manual operation*)

Further remarks:

Wabtec Netherlands: Flexible with energy!



Wabtec Netherlands is a market leader with our made to order conductor bar systems. We offer you the best possible solution for almost any application in whatever the circumstances. We welcome your inquiries!



Our festoon systems offer the most flexible solutions for transporting flat or round cables and hoses. A wide variety of profiles and components guarantees reliable installations, adapted to the environment.



The AKAPP products are designed by the highest standards and are certified by UL, CCC and CE.

More information on our products can be found in our brochures, which we are happy to send you on request. Or visit our website www.akapp.com, where you can find more relevant information, download brochures and make online inquiries; fast and easy!

