

**SANS 10142-1:2017** Edition 2

Single-core PVC insulated cables, unarmoured, with or without sheath.  
(SANS 1507-3) Current-carrying capacity copper conductors  
Installation method 3 (*clipped direct*).

Cable current ratings				
Conventional rated thermal current (A)	Copper conductor section			
	Cable		Busbars	
	No.	Section (mm <sup>2</sup> )	No.	Dim (mm)
15 A	1x	1.0	-	-
20 A	1x	1.5	-	-
27 A	1x	2.5	-	-
37 A	1x	4.0	-	-
47 A	1x	6.0	-	-
65 A	1x	10	-	-
87 A	1x	16	-	-
115 A	1x	25	-	-
140 A	1x	35	-	-
180 A	1x	50	1	15 x 5
235 A	1x	70	1	20 x 5
280 A	1x	95	-	-
330 A	1x	120	1	30 x 5
380 A	1x	150	-	-
433 A	1x	185	-	-
510 A	1x	240	-	-
590 A	2x	150	-	-
630 A	2x	185	1	30 x 10
740 A	2x	240	1	40 x 10
800 A	-	-	1	40 x 10
1000 A	-	-	1	50 x 10
1250 A	-	-	1	60 x 10
1600 A	-	-	1	80 x 10
2000 A	-	-	1	100 X 10

WÖHNER busbar support fault level chart						
icc kA pk	42	52.7	63	73.5	84	
icc kA eff. 1 s	20	25	30	35	40	
<b>01485/01495/01356</b> D = 60 (mm)						
E	20 X 5	400	250	-	-	-
	30 x 5	600	350	250	-	-
	20 x 10	470	300	-	-	-
	30 x 10	650	600	450	300	250
<b>01231("H" Profile)</b> D = 60 (mm)						
	"H" Profile	1100	1000	770	700	550
<b>01479</b> D = 100 (mm)						
E	30 X 10	600	400	-	-	-
	40 x 10	600	500	-	-	-
	50 x 10	600	500	-	-	-
	60 x 10	650	600	600	-	-
<b>01230</b> D = 185 (mm)						
E	60 X 10	600	600	500	-	-
	80 x 10	600	600	500	-	-
	100 x 10	600	600	500	-	-
	120 x 10	600	600	500	-	-
	"H" Profile	600	600	600	600	600

Current rating of non-insulated flat busbar												
A correction factor complying with DIN 43671 can be determined for <b>flat busbars</b> using the table below. The factor is dependant on the relevant ambient temperature. This correction factor should be taken into account when conditions change and loading is continuous.												
air temp	busbar temperature											
	50°C	55°C	60°C	65°C	70°C	75°C	80°C	85°C	90°C	100°C	110°C	120°C
correction factor $k_2$												
20°C	1.00	1.15	1.20	1.25	1.35	1.42	1.48	1.55	1.62	1.70	1.80	1.90
25°C	0.95	1.05	1.1	1.20	1.25	1.35	1.40	1.45	1.55	1.65	1.75	1.85
30°C	0.80	0.92	1.0	1.10	1.15	1.25	1.32	1.40	1.45	1.55	1.70	1.80
35°C	0.70	0.80	0.90	1.00	1.10	1.15	1.25	1.30	1.40	1.50	1.60	1.70
40°C	0.55	0.66	0.80	0.90	1.00	1.10	1.15	1.25	1.30	1.45	1.55	1.65
45°C	0.40	0.52	0.65	0.75	0.90	0.95	1.05	1.15	1.25	1.35	1.50	1.60
50°C	0.30	0.35	0.50	0.65	0.80	0.90	1.00	1.05	1.15	1.30	1.40	1.55
55°C	-	-	0.35	0.55	0.65	0.75	0.90	0.95	1.05	1.20	1.35	1.45
60°C	-	-	-	0.30	0.50	0.65	0.75	0.85	0.95	1.10	1.25	1.40

30 x 10 busbar can under normal operating conditions be loaded with 630A. A correction factor  $k_2$  of 1.30 for example is required if a load of 800A is applied. This diagram demonstrates that the busbar heats up to 85°C if this correction factor and an air temperature of 35°C apply.

**Δ T (°K) calculation**

eg.  
 $T_1$  ( internal panel temperature )      50°C  
 $T_2$  ( temperature of conductor )      100°C

temperature rise of conductor =  $T_2 - T_1 = \Delta T(^{\circ}K)$

eg.  $T_2$  (100°C) -  $T_1$  (50°C) = select from 50°K

**Rated motor current conversion table**

Rated power		3-phase 4-pole 50 - 60 hz					Single phase	
kW	Hp	400V A	415V A	440V A	500V A	660V A	220V A	240V A
0.37	0.5	0.9	0.9	0.9	0.8	0.6	3.9	3.6
0.55	0.75	1.4	1.4	1.3	1.1	0.9	5.2	4.8
0.75	1	1.9	1.8	1.7	1.5	1.1	6.6	6.1
1.1	1.5	2.5	2.4	2.3	2	1.5	9.6	8.8
1.5	2	3.5	3.3	3	2.7	2	12.7	11.7
2.2	3	4.8	4.7	4.4	3.8	3	18.6	17.1
4	5.5	8.1	8	7.5	6.5	5	32	29
5.5	7.5	11.1	11	10	9	6.7	42.2	38.7
7.5	10	14.7	14.3	13.5	12	9	54.4	50
10	13.5	19.5	19	18	15.6	12	–	–
11	15	20.9	20.5	19.5	17	13	75	–
15	20	28.5	28	26.5	23	17.5		
18.5	25	35.1	34	32	28	21.3		
22	30	42	40	38	33.5	25.4		
30	40	56	54	51	45	34		
37	50	68.4	66	62	55	42		
45	60	81	78	73	65	49		
55	75	99	95	90	79	60		
75	100	132	128	121	106	81		
90	125	162	157	148	130	99		
110	150	195	188	177	156	118		
132	180	233	225	212	187	142		
160	220	285	276	260	229	174		
200	270	353	341	321	283	214		
220	300	389	375	353	311	236		
250	340	442	426	402	353	268		
315	430	551	530	500	440	334		
355	480	617	595	560	490	374		
375	500	660	630	585	530	395		
425	580	742	715	675	594	450		

*Star-delta ratings calculated at full load current x 0.58*

**Contactor utilisation categories ( IEC 60947-4-1 )**

<b>Category AC-1</b>	Continuous current rating: All AC loads with a power factor $\geq 0.95$ – heating, distribution
<b>Category AC-2</b>	Starting, plugging and inching of slip ring motors – starting $\pm 2.5$ times rated motor current – stopping $\leq$ mains supply voltage
<b>Category AC-3</b>	Starting and stopping squirrel cage motors – closing and opening at 6 to 8 times rated motor current – stopping the voltage is at $\pm 20\%$ of mains supply voltage – light breaking
<b>Category AC-4</b>	Plugging and inching of squirrel cage – closing and opening 6 to 8 times rated motor current – severe breaking

**Type 2 co-ordination tables**

**80kA 400V (IEC/EN60947-4-1), Direct-on-line starters with fuses**

Motor		Fuse switch type	Fuse rating		Contactor	Thermal overload	Current range (A)
Rated output (KW)	Rated current (A)		gG	aM			
0.37	1.1	3631 3003	6	4	BF09A	RF380160	1-1.6
0.55	1.5	3631 3003	10	4	BF09A	RF380160	1-1.6
0.75	1.9	3631 3003	10	4	BF09A	RF380250	1.6-2.5
1.1	2.7	3631 3003	16	6	BF09A	RF380400	2.5-4
1.5	3.6	3631 3003	16	10	BF09A	RF380400	2.5-4
2.2	4.9	3631 3003	25	10	BF09A	RF380650	4-6.5
3.0	6.5	3631 3003	32	16	BF12A	RF381000	6.3-10
4.0	8.5	3631 3003	32	20	BF16A	RF381000	6.3-10
5.5	11.5	3831 3011	50	25	BF25A	RF381400	9-14
7.5	15.5	3831 3011	63	32	BF32A	RF381800	13-18
11.0	22	3831 3011	80	40	BF32A	RF382500	20-25
15.0	29	3831 3011	100	63	BF50	RF95333	20-22
18.5	35	3831 3011	125	80	BF50	RF95342	28-32
22	41	3831 3024	160	100	BF65	RF95350	35-50
30	55	3831 3024	200	100	BF95	RF95365	46-65
37	66	3831 3024	200	125	BF95	RF95382	60-82
45	80	3831 3024	250	160	B145	RF200100	60-100
55	97	3831 3039	315	200	B180	RF200100	90-150
75	132	3831 3039	400	250	B250	RF200150	120-200
90	160	3831 3039	400	315	B250	RF420250	150-250
110	195	3831 3039	400	355	B310	RF420250	150-250
132	230	3811 3063	630	400	B400	RF420250	150-250
160	280	3811 3063	630	500	B400	RF420300	180-300
200	350	3811 3063	630	630	B500	RF420400	250-420

**80kA 400V, Star-Delta starters with fuses**





Motor		Fuse switch type	Fuse rating					Current range (A)
Rated output (kW)	Rated current (A)		gG	aM	Line	Delta	Star	
4.0	8.6	3631 3003	20	10	BF9A	BF9A	BF9A	
5.5	11.5	3631 3003	25	16	BF12A	BF12A	BF9A	
7.5	15.2	3631 3003	32	20	BF16A	BF16A	BF9A	6.3-10
11.0	22	3631 3005	40	25	BF25A	BF25A	BF9A	9-14
15.0	29	3631 3005	50	32	BF25A	BF25A	BF12A	13-18
18.5	35	3638 3011	63	40	BF25A	BF25A	BF18A	17-23
22	41	3638 3011	80	50	BF32A	BF32A	BF18A	24-32
30	55	3638 3011	100	63	BF38A	BF38A	BF25A	32-38
37	66	3638 3011	125	80	BF50	BF50	BF32A	35-50
45	80	3638 3011	125	100	BF65	BF65	BF32A	35-50
55	97	3831 3024	160	125	BF80	BF80	BF38A	46-65
75	132	3831 3024	200	160	BF80	BF80	BF50	60-100
90	160	3831 3024	250	200	B115	B115	BF65	90-150
110	195	3831 3024	250	200	B115	B115	BF65	120-200
132	230	3831 3039	315	250	B145	B145	BF80	120-200
160	280	3831 3039	400	315	B180	B180	B115	120-200
250	430	3811 3063	500	500	B250	B250	B145	150-250
295	540	3811 3063	630	630	B310	B310	B180	240-400

**50 kA 400V, between SM circuit breakers and contactors series BG and BF**

P (kW)	I <sub>n</sub> (A)	Current adjustment range (A)	Circuit breaker	Contactor
<0.6	-	0.1 - 0.16	SM1R0016	BG6...
0.06	-	0.16 - 0.25	SM1R0025	BG6...
0.09	-	0.25 - 0.4	SM1R0040	BG6...
0.12	-	0.4 - 0.63	SM1R0063	BG6...
0.25	0.85	0.63 - 1	SM1R0100	BG6...
0.55	1.4	1 - 1.6	SM1R0160	BG6...
0.75	1.9	1.6 - 2.5	SM1R0250	BG6...
1.5	3.5	2.5 - 4	SM1R0400	BG6...
2.2	4.8	4 - 6.5	SM1R0650	BG6...
4	8	6.3 - 10	SM1R1000	BG9.../BF9...
5.5	11	9 - 14	SM1R1400	BF12...
7.5	15	13 - 18	SM1R1800	BF16...
11	21	20 - 25	SM1R2500	BF25...
15	29	22 - 32	SM1R3200	BF32...
18.5	35	28 - 40	SM1R4000	BF40...
22	41	40 - 50	SM2R5000	BF50...
30	55	45 - 63	SM2R6300	BF65...
37	67	57 - 75	SM3R7500	BF80...
45	80	80 - 100	SM3R9900	BF95...

IP rating chart			
The system provides a classification from solid objects to liquids in relation to electrical equipment and enclosures. IP rating consists of <b>2 codes</b> (i.e. IP65).			
First digit	Protection against solid objects	Second digit	Protection against moisture
0	No protection	0	No protection
1	Protection against objects >50mm	1	Protection against vertically dripping water
2	Protection against objects >12.5mm	2	Protection against spraying water ±15° from vertical
3	Protection against objects >2.5mm	3	Protection against spraying water ±60° from vertical
4	Protection against objects 1.0mm	4	Protection against spraying water ±90° from vertical
5	Dust protection (limited ingress)	5	Protection against low pressure water jets
6	Dust tight protection	6	Protection against high pressure water jets
		7	Protection against temporary immersion (15cm and 1cm)
		8	Protection against continuous immersion under pressure

NB: IP69K refers to the product ability to resist ingress of high temperature (steam) and high pressure washdowns normally used to sanitise equipment.

IK rating chart			
Degree of protection against mechanical wear and tear. IK rating consists of <b>2 codes</b> (i.e. IK06).			
Code	 Weight	Height (cm)	Impact Energy (J)
01	 0.2kg	7.5	0.15
02		10	0.20
03		17.5	0.35
04		25	0.50
05		35	0.70
06		20	1
07	 0.5kg	40	2
08		29.5	5
09	 1.7kg	20	10
10		40	20

Conversion tables					
Length	from:	to	meter	foot	inch
	1 meter ( m )		1	3.281	39.37
	1 inch ( in / " )		0.0254	0.08378	1
1 foot ( ft / ' )		0.3048	1	12	
Weight	from:	to	kg	lb	oz
	1 kilogram ( kg )		1	2.205	35.27
	1 pound ( 1b )		0.454	1	16
1 ounce ( oz )		0.028	0.0625	1	
Pressure	from:	to	n/m <sup>2</sup>	bar	PSI
	1 n/m <sup>2</sup> or pascal		1	0.00001	0.000145
	1 bar		100000	1	14.504
1 PSI		6849.76	0.0689476	1	

Power factor correction						
Individual motor compensation						
Capacitor rating in kVAr			To improve P.F to 0.95 or better at all loads			
motor kW	2 pole 3000rpm	4 pole 1500rpm	6 pole 1000rpm	8 pole 750rpm	10 pole 600rpm	12 pole 500rpm
1.5	0.5	1	1	1.5	1.5	1.5
2.2	0.75	1	1	1.5	1.5	1.5
4	1.0	1.5	2	2.5	3	3
5.5	1.5	2	3	3.5	4	4
7.5	2.5	3	3.5	4	5	5
11	4	4	4.5	6	6	6
15	5	5	6	8	8	10
18.5	6	6	7	8	10	12
22	7	8	9	10	12	14
30	9	10	11	14	14	16
37	12	12	14	16	18	18
45	14	14	15	18	20	22
55	15	16	18	20	22	26
63	16	18	20	22	24	28
75	20	22	24	26	28	32
90	25	26	30	32	35	30
110	28	30	32	35	38	45
132	30	32	32.6	38	45	60

### Calculating capacitor size requirements for power factor correction

It is imperative that correct capacitor sizes be selected when calculating capacitor requirements. In the case of group compensation it is recommended that the first capacitor step be equal to half the value of the following steps, to allow a smooth overall more finely tuned correction system.

Table 2 below will assist in calculating capacitor values required in specific applications. Prior knowledge of the following is required:

- a) Power factor before applying capacitors (*left column*)
- b) Required power factor after applying capacitors (*top row*)
- c) Total consumption in kW (per kW)

The correct capacitor size can then be calculated by crossing the horizontal and vertical values of table 2.

**Example:**

1. Convert the plant load to kW (kVA x Power Factor = kW)  
400 kVA x 0.70 PF = 280kW (useful power).
2. To correct a load of 400 kVA at 0.70 PF to 0.96. Follow the 0.70 value (in the left vertical column table 2) horizontally until below the 0.96 value (in the top horizontal row) the value is 0.729.
3. Capacitor required to correct from 0.70 to 0.96 ( Power x Capacitor from table value )  
280kW x 0.729 = 204.12 kVAr

**Savings:**

280kW at 0.70 PF = 400 kVA  
 280kW at 0.96 PF = 292 kVA  
 Reduction = 108 kVA ( 27% less of transformer load )



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[www.em.co.za/powerfactor](http://www.em.co.za/powerfactor)

Table 2

PF load before applying capacitors	Target power factor												
	0.80	0.85	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	Unity
0.40	1.537	1.668	1.805	1.832	1.861	1.924	1.959	1.988	2.037	2.003	2.085	2.146	2.288
0.41	1.474	1.605	1.742	1.769	1.798	1.831	1.860	1.896	1.935	1.973	2.021	2.082	2.225
0.42	1.413	1.544	1.681	1.709	1.738	1.771	1.800	1.836	1.874	1.913	1.961	2.022	2.164
0.43	1.356	1.487	1.624	1.651	1.680	1.713	1.742	1.778	1.816	1.855	1.903	1.964	2.107
0.44	1.290	1.421	1.558	1.585	1.614	1.647	1.677	1.712	1.751	1.790	1.837	1.899	2.041
0.45	1.230	1.360	1.501	1.532	1.561	1.592	1.626	1.659	1.695	1.737	1.784	1.846	1.988
0.46	1.179	1.309	1.446	1.473	1.502	1.533	1.567	1.600	1.636	1.677	1.725	1.786	1.929
0.47	1.130	1.260	1.397	1.425	1.454	1.485	1.519	1.552	1.588	1.629	1.677	1.758	1.881
0.48	1.076	1.206	1.343	1.370	1.400	1.430	1.464	1.497	1.534	1.575	1.623	1.684	1.826
0.49	1.030	1.160	1.297	1.326	1.355	1.386	1.420	1.453	1.489	1.530	1.578	1.639	1.782
0.50	0.982	1.112	1.248	1.276	1.303	1.337	1.369	1.403	1.441	1.481	1.529	1.590	1.732
0.51	0.936	1.066	1.202	1.230	1.257	1.291	1.323	1.357	1.395	1.435	1.483	1.544	1.686
0.52	0.894	1.024	1.160	1.188	1.215	1.249	1.281	1.315	1.353	1.393	1.441	1.502	1.644
0.53	0.850	0.980	1.116	1.144	1.171	1.205	1.237	1.271	1.309	1.349	1.397	1.458	1.600
0.54	0.809	0.939	1.075	1.103	1.130	1.164	1.196	1.230	1.268	1.308	1.356	1.417	1.559
0.55	0.769	0.899	1.035	1.063	1.090	1.124	1.156	1.190	1.228	1.268	1.316	1.377	1.519
0.56	0.730	0.860	0.996	1.024	1.051	1.085	1.117	1.151	1.189	1.229	1.277	1.338	1.480
0.57	0.692	0.822	0.958	0.986	1.013	1.047	1.079	1.113	1.151	1.191	1.239	1.300	1.442
0.58	0.655	0.785	0.921	0.949	0.976	1.010	1.042	1.076	1.114	1.154	1.202	1.263	1.405
0.59	0.618	0.748	0.884	0.912	0.939	0.973	1.005	1.039	1.077	1.117	1.165	1.226	1.368
0.60	0.584	0.714	0.849	0.878	0.905	0.939	0.971	1.005	1.043	1.083	1.131	1.192	1.334
0.61	0.549	0.679	0.815	0.843	0.870	0.904	0.936	0.970	1.008	1.048	1.096	1.157	1.299
0.62	0.515	0.645	0.781	0.809	0.836	0.870	0.902	0.934	0.974	1.014	1.062	1.123	1.265
0.63	0.483	0.613	0.749	0.777	0.804	0.838	0.870	0.904	0.942	0.982	1.030	1.091	1.233
0.64	0.450	0.580	0.716	0.744	0.771	0.805	0.837	0.871	0.909	0.949	0.997	1.058	1.200
0.65	0.419	0.549	0.685	0.713	0.740	0.774	0.806	0.840	0.878	0.918	0.966	1.027	1.169
0.66	0.388	0.518	0.654	0.682	0.709	0.743	0.775	0.809	0.847	0.887	0.935	0.996	1.138
0.67	0.358	0.488	0.624	0.652	0.679	0.713	0.745	0.779	0.817	0.857	0.905	0.966	1.108
0.68	0.329	0.459	0.595	0.623	0.650	0.684	0.716	0.750	0.788	0.828	0.876	0.937	1.079
0.69	0.299	0.429	0.565	0.593	0.620	0.654	0.686	0.720	0.758	0.798	0.840	0.907	1.049
0.70	0.270	0.400	0.536	0.564	0.591	0.625	0.657	0.691	0.729	0.769	0.811	0.878	1.020
0.71	0.242	0.372	0.508	0.536	0.563	0.597	0.629	0.663	0.701	0.741	0.783	0.850	0.992
0.72	0.213	0.343	0.479	0.507	0.534	0.568	0.600	0.634	0.672	0.712	0.754	0.821	0.963
0.73	0.186	0.316	0.452	0.480	0.507	0.541	0.573	0.607	0.645	0.685	0.727	0.794	0.936
0.74	0.159	0.289	0.425	0.453	0.480	0.514	0.546	0.580	0.618	0.658	0.700	0.767	0.909
0.75	0.132	0.262	0.398	0.426	0.453	0.487	0.519	0.553	0.591	0.631	0.673	0.740	0.882
0.76	0.105	0.235	0.371	0.399	0.426	0.460	0.492	0.526	0.564	0.604	0.652	0.713	0.855
0.77	0.079	0.209	0.345	0.373	0.400	0.434	0.466	0.500	0.538	0.578	0.620	0.687	0.829
0.78	0.053	0.183	0.319	0.347	0.374	0.408	0.440	0.474	0.512	0.552	0.594	0.661	0.803
0.79	0.026	0.156	0.292	0.320	0.347	0.381	0.413	0.447	0.485	0.525	0.567	0.634	0.776
0.80	-	0.130	0.266	0.294	0.321	0.355	0.387	0.421	0.459	0.499	0.541	0.608	0.750
0.81	-	0.104	0.240	0.268	0.295	0.329	0.361	0.395	0.433	0.473	0.515	0.582	0.724
0.82	-	0.078	0.214	0.242	0.269	0.303	0.335	0.369	0.407	0.447	0.489	0.556	0.698
0.83	-	0.052	0.188	0.216	0.243	0.277	0.309	0.343	0.381	0.421	0.463	0.530	0.672
0.84	-	0.026	0.162	0.190	0.217	0.251	0.283	0.317	0.355	0.395	0.437	0.504	0.645
0.85	-	-	0.136	0.164	0.191	0.225	0.257	0.291	0.329	0.369	0.417	0.478	0.620
0.86	-	-	0.109	0.140	0.167	0.198	0.230	0.264	0.301	0.343	0.390	0.450	0.593
0.87	-	-	0.083	0.114	0.141	0.172	0.204	0.238	0.275	0.317	0.364	0.424	0.567
0.88	-	-	0.054	0.085	0.112	0.143	0.175	0.209	0.246	0.288	0.335	0.395	0.538
0.89	-	-	0.028	0.059	0.086	0.117	0.149	0.183	0.230	0.262	0.309	0.369	0.512
0.90	-	-	-	0.031	0.058	0.089	0.121	0.155	0.192	0.234	0.281	0.341	0.484
0.91	-	-	-	-	0.027	0.058	0.090	0.124	0.161	0.203	0.250	0.310	0.453
0.92	-	-	-	-	-	0.031	0.063	0.097	0.134	0.176	0.223	0.283	0.426
0.93	-	-	-	-	-	-	0.032	0.066	0.103	0.145	0.192	0.252	0.395

Capacitor ratings at different voltages													
525V	kVAr at			capacitance total (uF)	capacitance in delta (uF)	current in delta (A)				line current (A)			
	440V	415V	400V			525V	440V	415V	400V	525V	440V	415V	400V
10	9	8	164	82	8	7	7	13	12	12			
15	13	12	247	123	11	11	10	20	19	18			
20	18	17	329	164	15	14	14	26	25	24			
25	22	21	411	206	19	18	17	33	31	30			
30	27	25	493	247	23	21	21	39	37	36			
40	36	33	658	329	30	29	28	52	50	48			
45	40	37	740	370	34	32	31	59	56	54			
50	44	41	822	411	38	36	34	66	62	60			
60	53	50	987	493	45	43	41	79	74	72			
75	67	62	1234	617	57	54	52	98	93	89			
80	71	66	1316	658	61	57	55	105	99	95			
90	80	74	1480	740	68	64	62	118	111	107			
100	89	83	1645	822	76	71	69	131	124	119			
120	107	99	1974	987	91	86	83	157	149	143			
125	111	103	2056	1028	95	89	86	164	155	149			
150	133	124	2467	1234	114	107	103	197	186	179			
175	156	145	2879	1439	133	125	121	230	217	209			
180	160	149	2961	1480	136	129	124	236	223	215			
200	178	165	3290	1645	152	143	138	262	248	239			
210	187	174	3454	1727	159	150	145	276	260	251			
225	200	186	3701	1851	170	161	155	295	278	268			
240	214	198	3948	1974	182	171	165	315	297	286			
250	222	207	4112	2056	189	179	172	328	309	298			
270	240	223	4441	2221	205	193	186	354	334	322			
275	245	227	4524	2262	208	196	189	361	340	328			
300	267	248	4935	2467	227	214	207	394	371	358			
325	289	269	5346	2673	246	232	224	426	402	388			
330	294	273	5428	2714	250	236	227	433	408	394			
350	311	289	5757	2879	265	250	241	459	433	418			
360	320	298	5922	2961	273	257	248	472	446	429			
375	334	310	6169	3084	284	268	258	492	464	447			
400	356	331	6580	3290	303	286	275	525	495	477			
420	374	347	6909	3454	318	300	289	551	520	501			
425	378	351	6991	3496	322	304	293	558	526	507			
450	400	372	7402	3701	341	322	310	590	557	537			
475	423	393	7814	3907	360	339	327	623	588	567			
480	427	397	7896	3948	364	343	331	630	594	573			
500	445	413	8225	4112	379	357	344	656	619	596			
600	534	496	9870	4935	455	429	413	787	743	716			
700	623	579	11515	5757	530	500	482	919	866	835			
10	7	6	116	58	6	5	5	11	9	8			
20	14	12	231	116	13	11	10	22	18	17			
30	21	19	347	173	19	16	15	33	28	25			
40	28	25	462	231	25	21	20	44	37	34			
50	35	31	578	289	32	27	25	55	46	42			
60	42	37	693	347	38	32	30	66	55	50			
70	49	44	809	404	44	37	35	77	65	59			
80	56	50	924	462	51	43	40	88	74	67			
90	63	56	1040	520	57	48	45	99	83	75			
100	70	62	1155	578	63	53	50	110	92	84			
120	84	75	1387	693	76	64	60	132	111	101			
140	98	87	1618	809	89	74	70	154	129	117			
160	112	100	1849	924	102	85	80	176	147	134			
180	126	112	2080	1040	114	96	90	198	166	151			
200	140	125	2311	1155	127	106	100	220	184	174			
220	155	137	2542	1271	140	117	110	242	203	191			
240	169	150	2773	1387	152	128	120	264	221	209			
260	183	162	3004	1502	165	138	130	286	240	226			
280	197	175	3235	1618	178	149	141	308	258	243			
300	211	187	3466	1733	190	160	151	330	276	261			
320	225	200	3697	1849	203	170	161	352	295	278			
400	281	250	4622	2311	254	213	201	440	369	348			

Standard rated capacitor voltage 440V or 525V

- Notes:**
1. "capacitance total" refers to total calculated capacitance of the delta connected capacitor at rated capacitor voltage
  2. "capacitance in delta" refers to calculated capacitance between any two terminals of delta wired capacitor
  3. "line current" refers to calculated current at terminals of delta capacitor
  4. calculated values may vary in practice due to tolerances allowed in manufacturing standards, and the effect of cables, discharge resistors, etc

**Capacitor selection regarding harmonics**

S.H S.T	Capacitor without reactor	Capacitor without reactor	Capacitor with reactor	Capacitor with reactor
		Standard type	Standard class	Reinforced class
THDU/ THDI		15-25%	25-35%	35-50%
		≤ 3% / ≤ 10%	≤ 4% / ≤ 20%	≤ 6% / ≤ 40%

- Notes:**
- S.H and S.T are given in kVA
  - S.H: weighted power of harmonic generators in kVA
  - S.T: power of the transformer HV/LV



**Socomec busbar support fault levels**

Adhering to the maximum distances between two supports ensures the busbar supports are able to withstand the given short circuit current values. At these values, deformation of the copper bars may occur. These deformations are permitted by standard IEC 60439-1 as long as they adhere to the insulation distances.

**SBC 10 Busbar supports**

Peak Isc		15kA	24kA	48kA	63kA	82kA	114kA	space between phases	in cabinet 45° C bars 80° C
Rms Isc		9kA	12kA	23kA	30kA	39kA	52kA		
Bar (mm)	No.	Max. L (distance between centres of sets of supports in mm)						d (mm)	Iz (A)
25 x 10	1	1000	1000	500	375	275	200	65	-
25 x 10	2	1000	1000	525	400	300	200	90	850
40 x 10	1	1000	1000	650	475	375	250	65	700
40 x 10	2	1000	1000	700	525	400	275	90	1250
50 x 10	1	1000	1000	725	550	425	300	65	850
50 x 10	2	1000	1000	800	600	475	325	90	1550
60 x 10	1	1000	1000	800	625	475	325	65	1000
60 x 10	2	1000	1000	900	675	525	350	90	1800
80 x 10	1	1000	1000	975	725	550	400	65	1300
80 x 10	2	1000	1000	1000	850	650	350	90	2300
100 x 10	1	1000	1000	1000	850	650	400	65	1550
100 x 10	2	1000	1000	1000	975	675	350	90	2750

**SBC ER Busbar supports**

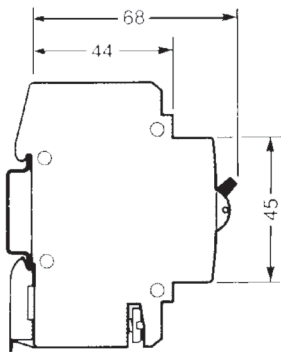
Peak Isc		63kA	82kA	114kA	152kA	165kA	187kA	space between phases	in cabinet 45° C bars 80° C
Rms Isc		30kA	39kA	52kA	69kA	75kA	85kA		
Bar (mm)	No.	Max. L (distance between centres of sets of supports in mm)						d (mm)	Iz (A)
50 x 5	1	600	500	325	175	150	-	70	600
50 x 5	2	600	500	325	175	150	100	70	1050
60 x 5	1	625	525	350	200	175	-	70	700
60 x 5	2	625	525	350	200	175	125	70	1250
80 x 5	1	625	525	350	200	175	125	70	900
80 x 5	2	625	525	350	200	175	125	70	1550
100 x 5	1	650	550	375	225	200	175	70	1100
100 x 5	2	650	550	375	225	200	175	70	1900
50 x 10	1	1000	1000	650	250	200	150	70	850
50 x 10	2	1000	1000	650	250	200	150	70	1550
60 x 10	1	1000	1000	675	275	225	175	70	1050
60 x 10	2	1000	1000	675	275	225	175	70	1850
80 x 10	1	1000	1000	700	300	250	175	70	1300
80 x 10	2	1000	1000	700	300	250	175	70	2300
100 x 10	1	1000	1000	725	325	275	175	70	1550
100 x 10	2	1000	1000	725	325	275	175	70	2750
120 x 10	1	1000	1000	725	350	275	200	70	1900
120 x 10	2	1000	1000	725	350	275	200	70	3350

**SBE 44 Busbar supports**

Peak Isc		10kA	15kA	24kA	38kA	48kA	63kA	space between phases	in cabinet 45° C bars 80° C
Rms Isc		6kA	9kA	12kA	19kA	23kA	30kA		
Bar (mm)	No.	Max. L (distance between centres of sets of supports in mm)						d (mm)	Iz (A)
15 x 3	1	950	625	400	250	175	-	35	160
15 x 5	1	1000	825	500	300	175	-	35	220
20 x 5	1	1000	1000	675	300	175	-	35	280
20 x 8	1	1000	1000	775	300	175	-	35	370
32 x 5	1	1000	1000	675	250	170	-	35	410



Use of MCBs in DC systems



Protection and control of circuits against overloads and short circuits – in commercial and industrial electrical distribution systems

EN 60898-1  
NF C 61-410  
IEC 60947-2  
SANS 60947-2

DC applications

Because of their quick make and break design and excellent arc quenching capabilities, Hager circuit breakers are suitable for use on DC. When selecting a circuit breaker for any DC application it is necessary to consider 2 main points:

a) system voltage

The system voltage and the type of system determines the number of poles required to provide the necessary breaking capacity and arc control. The table gives the maximum DC voltage and breaking capacity for one pole or two poles connected in the series.

The positioning of these breaking poles in the system depends on whether the system is earthed or insulated and if it is earthed whether one polarity is earthed or the centre point is earthed.

b) type of DC systems: 3 different types

- Network connected to the earth - one polarity earthed (+ve or -ve):  
If -ve is earthed, all poles will be placed in series in the +ve leg.  
If the +ve is earthed, all poles will be placed in the -ve leg.  
Note: an extra pole will be needed on the earthed polarity to provide isolation.
- Network connected to the earth - middle point earthed:  
The number of poles required to break I<sub>sc</sub> should be placed on each polarity.
- Network insulated to the earth:  
The number of poles required to break I<sub>sc</sub> should be split between the two polarities.

Table 1			breaking capacity L/R = 15ms				
range	I <sub>n</sub>	nb of poles in series needed for breaking	<48V	60V	125V	250V	500V
MV	6 to 63A	1P	15	–	–	–	–
		2P	20	20	–	–	–
		3P	25	25	20	–	–
		4P	35	35	25	–	–
NF/NFN NGN, NCN	1 to 63A	1P	15	15	10	–	–
		2P	20	20	15	6	–
		3P	25	25	20	10	–
		4P	35	35	25	15	10
NRN	6 to 20A	1P	25	25	20	–	–
		2P	35	35	25	15	–
		3P	40	40	35	20	–
		4P	45	45	40	25	10
	25 to 40A	1P	20	20	15	–	–
		2P	25	25	20	10	–
		3P	30	30	30	15	–
		4P	35	35	35	20	10
50 and 63A	1P	15	15	10	–	–	
	2P	20	20	15	6	–	
	3P	25	25	20	10	–	
	4P	35	35	25	15	10	
HMC, HMD, HMK	80 to 125A	1P	15	15	10	–	–
		2P	20	20	15	6	–
		3P	30	30	30	15	–
		4P	35	35	35	20	10
HLF	80 to 125A	1P	12	12	8	–	–
		2P	15	15	10	4	–
		3P	25	25	25	10	–
		4P	30	30	30	15	5

Table 2 magnetic trip		1	2	3	4
		I <sub>t1</sub>	I <sub>t2</sub>	I <sub>rm1</sub>	I <sub>rm2</sub>
Curve B	AC 50Hz	1.13 I <sub>n</sub>	1.45 I <sub>n</sub>	3 I <sub>n</sub>	5 I <sub>n</sub>
	DC	1.13 I <sub>n</sub>	1.45 I <sub>n</sub>	4 I <sub>n</sub>	7 I <sub>n</sub>
Curve C	AC 50Hz	1.13 I <sub>n</sub>	1.45 I <sub>n</sub>	5 I <sub>n</sub>	10 I <sub>n</sub>
	DC	1.13 I <sub>n</sub>	1.45 I <sub>n</sub>	7 I <sub>n</sub>	15 I <sub>n</sub>
Curve D	AC 50Hz	1.13 I <sub>n</sub>	1.45 I <sub>n</sub>	10 I <sub>n</sub>	20 I <sub>n</sub>
	DC	1.13 I <sub>n</sub>	1.45 I <sub>n</sub>	15 I <sub>n</sub>	30 I <sub>n</sub>



**Drive rating chart 525 - 690V**

Drive series	Heavy Duty				(Default) Light Duty			
	150% (60sec) / 180% (3sec)			Rated Amps	120% (60sec) / 150% (3sec)			Rated Amps
	525V kW	575V kW	690V kW		525V kW	575V kW	690V kW	

Nominal voltage range 525V - 600V (-15% ~ +10%)

VFD037C53A-21	3.7	4	-	4.6	5.5	6	-	6.7
VFD055C53A-21	5.5	6	-	6.9	8	9	-	9.9
VFD075C53A-21	7	7.5	-	8.3	10	11	-	12.1
VFD110C53A-21	11	12	-	13	15	17	-	18.7
VFD150C53A-21	15	15	-	16.8	20	22	-	24.2

Nominal voltage range 525V - 690V (-15% ~ +10%)

VFD220C63B-21	17	18	22	20	25	27	32	30
VFD300C63B-21	20	22	26	24	30	32	39	36
VFD370C63B-21	25	27	33	30	37	41	49	45
VFD450C63B-21	30	33	40	36	45	49	59	54
VFD550C63B-21	38	41	50	45	55	61	73	67
VFD750C63B-21	45	50	60	54	71	78	94	86
VFD900C63B-21	56	61	74	67	87	95	114	104
VFD1100C63B-21	72	79	95	86	104	114	137	125
VFD1320C63B-21	87	95	114	104	125	137	164	150
VFD1600C63B-21	104	115	137	125	150	165	197	180
VFD2000C63B-21	125	137	165	150	184	200	241	220
VFD2500C63B-21	150	165	198	180	242	265	318	290
VFD3150C63B-21	184	202	242	220	292	320	384	350

KW values may vary according to power factor and motor efficiency. Values are a guide line only and the user should cross check drive selection against the motor nameplate. For more information, please speak to an EM technical representative.

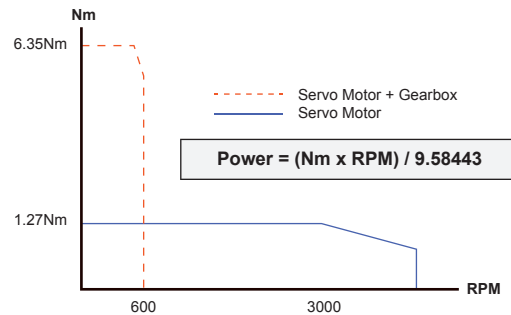
**Drive dual rating chart**

Dual rating allows drives to be used across a range of applications according to overload capacity required, for example:

Light Duty / Normal Duty - Fan and pump application  
Heavy Duty - Compressor, crusher, spindle and conveyor

Drive series	(Default) Heavy Duty		Normal Duty	
	150% (60sec) / 200% (3sec)		120% (60sec) / 150% (3sec)	
	kW	Rated Amps	kW	Rated Amps
VFD1A6ME/MS21	0.2	1.6	0.3	1.8
VFD2A8ME/MS21	0.4	2.8	0.55	3.2
VFD4A8ME/MS21	0.75	4.8	0.9	5
VFD7A5ME/MS21	1.5	7.5	1.8	8.5
VFD11AME/MS21	2.2	11	3	12.5
VFD1A5ME/MS43	0.4	1.5	0.55	1.8
VFD2A7ME/MS43	0.75	2.7	1.1	3
VFD4A2ME/MS43	1.5	4.2	1.6	4.6
VFD5A5ME/MS43	2.2	5.5	2.8	6.5
VFD9A0ME/MS43	4	9	4.5	10.5
VFD13AME/MS43	5.5	13	6	15.7
VFD17AME/MS43	7.5	17	8.5	20.5
VFD25AMS43AFS	11	25	12	28
VFD32AMS43AFS	15	32	17	36
VFD38AMS43AFS	18.5	38	20	41.5
VFD45AMS43AFS	22	45	24	49

**Gear ratio chart**



**Example:**

Servo Motor - ECMA-C10604RS  
Rated Torque - 1.27 Nm  
Rated Speed - 3000 RPM

Gearbox - WAB-060-005-K-P1  
Ratio - 5:1  
Rated Torque - 60 Nm

$T_{out} = T_m \times R$   
 $T_{out} = 1.27 \times 5$   
 $T_{out} = 6.35Nm$

$S_{out} = S_m / R$   
 $S_{out} = 3000 / R$   
 $S_{out} = 600 RPM$

$T_{out}$  = Torque Output  
 $S_{out}$  = Speed Output  
 $T_m$  = Motor rated Torque

$S_m$  = Motor rated Speed  
 $R$  = Gearbox reduction ratio

Drive	Motor rating kW	Full Load torque (kg-m)	Brake unit		Braking resistor for each brake unit				Resistor value		Min Equiv Resistor Value	
			Part No.	No.	Type	No.	Series	Parallel	W	Ohm		
<b>"ME" Series</b>												
VFD1A6ME21ANN	230V	0.20	0.1	-	-	BR80W/750RJ	1	-	-	80	750	190
VFD2A8ME21ANN		0.40	0.3	-	-	BR80W/200RJ	1	-	-	80	200	95
VFD4A8ME21ANN		0.75	0.5	-	-	BR80W/200RJ	1	-	-	80	200	63.3
VFD7A5ME21ANN		1.50	1	-	-	BR200W/91RJ	1	-	-	200	91	45.7
VFD11A5ME21ANN		2.20	1.5	-	-	BR300W/70RJ	1	-	-	300	70	38
VFD1A5ME43ANN	460V	0.40	0.3	-	-	BR80W/750RJ	1	-	-	80	750	380
VFD2A7ME43ANN		0.75	0.5	-	-	BR80W/750RJ	1	-	-	80	750	190
VFD4A2ME43ANN		1.50	1	-	-	BR200W/360RJ	1	-	-	200	360	126.7
VFD5A5ME43ANN		2.20	1.5	-	-	BR300W/250RJ	1	-	-	300	250	108.6
VFD9A0ME43ANN		3.70	2.5	-	-	BR400W/150RJ	1	-	-	400	150	84.4
VFD13A5ME43ANN		5.50	3.7	-	-	BR1KW/75RJ	1	-	-	1000	75	50.7
VFD17A5ME43ANN		7.50	5.1	-	-	BR1KW/75RJ	1	-	-	1000	75	40
<b>"MS" Series</b>												
VFD1A6MS21ANS	230V	0.20	0.1	-	-	BR80W/750RJ	1	-	-	80	750	190
VFD2A8MS21ANS		0.40	0.3	-	-	BR80W/200RJ	1	-	-	80	200	95
VFD4A8MS21ANS		0.75	0.5	-	-	BR80W/200RJ	1	-	-	80	200	63.3
VFD7A5MS21ANS		1.50	1	-	-	BR200W/91RJ	1	-	-	200	91	45.7
VFD11AMS21ANS		2.20	1.5	-	-	BR300W/70RJ	1	-	-	300	70	38
VFD1A5MS43AFS	460V	0.40	0.3	-	-	BR80W/750RJ	1	-	-	80	750	380
VFD2A7MS43AFS		0.75	0.5	-	-	BR80W/750RJ	1	-	-	80	750	190
VFD4A2MS43AFS		1.50	1	-	-	BR200W/360RJ	1	-	-	200	360	126.7
VFD5A5MS43AFS		2.20	1.5	-	-	BR300W/250RJ	1	-	-	300	250	108.6
VFD9A0MS43AFS		3.70	2.500	-	-	BR400W/150RJ	1	-	-	400	150	84.4
VFD13AMS43AFS		5.50	3.700	-	-	BR1KW/75RJ	1	-	-	1000	75	50.7
VFD17AMS43AFS		7.50	5.100	-	-	BR1KW/75RJ	1	-	-	1000	75	40
VFD25AMS43AFS		11.00	7.400	-	-	BR1.5KW/43RJ	1	-	-	1500	43	33
VFD32AMS43AFS		15.00	10.200	-	-	BR1KW/16RJ	2	2	-	2000	32	26.2
VFD38AMS43AFS		18.00	12.200	-	-	BR1KW/16RJ	2	2	-	2000	32	26.2
VFD45AMS43AFS	22.00	14.900	-	-	BR1.5KW/13RJ	2	2	-	3000	26	23	
<b>"E" Series</b>												
VFD004E43T	460V	0.40	0.21	-	1	BR80W/750RJ	1	-	-	80	750	422.2
VFD007E43T		0.75	0.51	-	1	BR80W/750RJ	1	-	-	80	750	422.2
VFD015E43T		1.50	1.02	-	1	BR200W/360RJ	1	-	-	200	360	126.7
VFD022E43A		2.20	1.49	-	-	BR200W/250RJ	1	-	-	300	250	84.4
VFD037E43A		3.70	2.5	-	-	BR300W/70RJ	2	2	-	600	140	84.4
VFD055E43A		5.50	3.72	-	-	BR1KW/75RJ	1	-	-	1000	75	63.3
VFD075E43A		7.50	5.08	-	-	BR1KW/75RJ	1	-	-	1000	75	42.2
VFD110E43A		11.00	7.45	-	-	BR1.5KW/43RJ	1	-	-	1500	43	42.2
VFD150E43A		15.00	10.16	-	-	BR1KW/20RJ	2	2	-	2000	40	21.1
VFD185E43A		18.50	12.52	-	-	BR1.2KW/15RJ	2	2	-	2400	30	17.7
VFD220E43A		22.00	14.89	-	-	BR1.5KW/13RJ	2	2	-	3000	26	17.7
<b>"C 2000" Series</b>												
VFD040C43E	460V	4	2.7	-	-	BR1KW/75RJ	1	-	-	1000	75	54.3
VFD055C43E		5.5	3.7	-	-	BR1KW/75RJ	1	-	-	1000	75	54.3
VFD075C43E		7.5	5.1	-	-	BR1KW/75RJ	1	-	-	1000	75	47.5
VFD110C43E		11	7.5	-	-	BR1.5KW/43RJ	1	-	-	1500	43	42.2
VFD150C43E		15	10.2	-	-	BR1KW/16RJ	2	-	-	2000	32	26.2
VFD185C43E		18.5	12.2	-	-	BR1KW/16RJ	2	2	-	2000	32	23
VFD220C43E		22	14.9	-	-	BR1.5KW/13RJ	2	2	-	3000	26	23
VFD300C43E		30	20.3	-	-	BR1KW/16RJ	4	2	2	4000	16	14.1
VFD370C43A		37	25.1	VFDB4045	1	BR1.2KW/15RJ	4	2	2	4800	15	12.7
VFD450C43A		45	30.5	VFDB4045	1	BR1.5KW/13RJ	4	2	2	6000	13	12.7
VFD550C43A		55	37.2	VFDB4030	1	BR1KW/5,1RJ	4	-	4	8000	10.2	9.5
VFD750C43A		75	50.8	VFDB4045	2	BR1.2KW/15RJ	4	2	2	9600	7.5	6.3
VFD900C43A		90	60.9	VFDB4045	2	BR1.5KW/13RJ	4	2	2	12000	6.5	6.3
VFD1100C43A		110	74.5	VFDB4110	2	BR1.2KW/15RJ	10	2	5	12000	6	6
VFD1320C43A		132	89.4	VFDB4160	1	BR1.5KW/12RJ	12	2	6	18000	4	4
VFD1600C43A		160	108.3	VFDB4160	1	BR1.5KW/12RJ	12	2	6	18000	4	4
VFD1850C43A		185	125.3	VFDB4185	1	BR1.5KW/12RJ	14	2	7	21000	3.4	3.4
VFD2200C43A		220	148.9	VFDB4110	2	BR1.2KW/15RJ	10	2	5	24000	3	3
VFD2800C43A		280	189.6	VFDB4160	2	BR1.5KW/12RJ	12	2	6	36000	2	2
VFD3150C43A		315	213.3	VFDB4160	2	BR1.5KW/12RJ	12	2	6	36000	2	2
VFD3550C43A	355	240.3	VFDB4185	2	BR1.5KW/12RJ	14	2	7	42000	1.7	1.7	
VFD4500C43A	450	304.7	VFDB4185	3	BR1.5KW/12RJ	12	2	6	54000	1.3	1.1	
<b>"CP 2000" Series</b>												
VFD040CP4EA-21	460V	4	2.5	-	-	BR400W/150RJ	1	-	-	1000	75	54.3
VFD055CP4EB-21		5.5	2.7	-	-	BR1KW/75RJ	1	-	-	1000	75	54.3
VFD075CP4EB-21		7.5	3.7	-	-	BR1KW/75RJ	1	-	-	1000	75	47.5
VFD110CP4EB-21		11	5.1	-	-	BR1KW/75RJ	1	-	-	1500	43	42.2
VFD150CP4EB-21		15	7.4	-	-	BR1.5KW/43RJ	2	2	-	2000	32	26.2
VFD185CP4EB-21		18.5	10.2	-	-	BR1KW/16RJ	2	2	-	2000	32	23
VFD220CP4EA-21		22	12.2	-	-	BR1KW/16RJ	2	2	-	3000	26	23
VFD300CP4EB-21		30	14.9	-	-	BR1.5KW/13RJ	4	2	2	4000	16	14.1
VFD370CP4EB-21		37	20.3	-	-	BR1KW/16RJ	4	2	2	4800	15	12.7
VFD450CP43S-21		45	25	VFDB4045	1	BR1.2KW/15RJ	4	2	2	6000	13	12.7
VFD550CP43S-21		55	30.5	VFDB4030	2	BR1.5KW/13RJ	4	4	-	8000	10.2	9.5
VFD750CP43B-21		75	37.2	VFDB4045	2	BR1KW/5,1RJ	4	2	2	9600	7.5	6.3
VFD900CP43A-21		90	50.8	VFDB4045	2	BR1.2KW/15RJ	4	2	2	12000	6.5	6.3
VFD1100CP43A-21		110	60.9	VFDB4110	1	BR1.5KW/13RJ	10	2	5	12000	6	6
VFD1320CP43B-21		132	74.5	VFDB4160	1	BR1.2KW/15RJ	12	2	6	18000	4	4
VFD1600CP43A-21		160	89.4	VFDB4160	1	BR1.5KW/12RJ	12	2	6	18000	4	4

### Inductive proximity switches

#### Namur version *namur-DIN 19234 ( 2 wire )*

Two wire non-amplified DC sensors contain only the oscillator and are adapted to control an electronic amplified threshold circuit. Only a few components are required, guaranteeing maximum operational safety and reliability. The sensor is not susceptible to inductive or capacitive irradiations into the amplifier.

Ideally suited for explosion proof applications connected intrinsically safe amplifiers.

Nominal voltage: 8 VDC ( 7.7 ÷ 9 V ) - Load resistant 1 kΩ  
 Output current: Presence of metal ≤ 1 mA  
 Absence of metal ≤ 3 mA

#### DC version *direct voltage ( 3 wire )*

Amplified Dc sensors containing an output amplifier. In addition to the oscillator they are supplied with functions NO or NC in NPN or PNP. As standard this version if sensor is protected against short circuit and against polarity and peaks created by the disconnection of inductive loads.

#### AC version *alternative voltage ( 2 wire )*

Two wire amplified AC sensors containing a thyristor output amplifier, in addition to the oscillator the load ( i.e. relay ) is connected in series. Due to this system attention must be paid ( particularly in the low voltage range ) if electronic controls have high resistance inputs, as there is a residual current flow even when in the open state. All AC sensors protected against overvoltage created by the power supply.

### Capacitive proximity switches

#### Capacitive sensors

These are electronic transducers which give output signals when any material ( wood, marble, metals, glass, coffee, fodder, etc. ) affects their sensing part without necessarily entering in contact with them. They have high resistance to knocks and vibrations and can operate in severe ambient conditions since they are completely static. The devices can be supplied with a rapid or delayed intervention.

#### Reduction factors

<i>inductive sensors</i>		<i>capacitive sensors</i>	
Aq37	1	Metals	c.a.1
Stainless steel	0.85	Water	c.a.1
Brass, bronze	0.55	Plastic	c.a.0.5
Aluminium	0.45	Glass	c.a.0.5
Copper	0.40	Wood	c.a.0.4

