

TECHNIQUE

HEW-KABEL/CDT

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Technique

C O N T E N T S
C O N T E N T S

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Conductor constructions

according to DIN VDE 0295 class 1

Class 1:

Solid conductors for single and multicore cables

Nominal cross section mm ²	Conductor resistance at 20 °C maximum value	
	Circular copper conductor	
	bare Ohm/km	metal plated Ohm/km
0,5	36,0	36,7
0,75	24,5	24,8
1	18,1	18,2
1,5	12,1	12,2
2,5	7,41	7,56
4	4,61	4,70
6	3,08	3,11
10	1,83	1,84
16	1,15	1,16
25	0,727 ¹⁾	
35	0,524 ¹⁾	
50	0,387 ¹⁾	
70	0,268 ¹⁾	
95	0,193 ¹⁾	
120	0,153 ¹⁾	
150	0,124 ¹⁾	
185		
240		
300		

¹⁾ For mineral-insulated cables

Conductor constructions

according to DIN VDE 0295 class 2

Class 2:

Stranded conductors for single and multicore cables

Nominal cross section mm ²	Minimum number of single wires in conductor		Conductor resistance at 20 °C maximum value	
	Circular copper conductor	Compacted circular copper conductor	Copper conductor	
			bare Ohm/km	metal plated Ohm/km
0,5	7	-----	36,0	36,7
0,75	7	-----	24,5	24,8
1	7	-----	18,1	18,2
1,5	7	6	12,1	12,2
2,5	7	6	7,41	7,56
4	7	6	4,61	4,70
6	7	6	3,08	3,11
10	7	6	1,83	1,84
16	7	6	1,15	1,16
25	7	6	0,727	0,734
35	7	6	0,524	0,529
50	19	6	0,387	0,391
70	19	12	0,268	0,270
95	19	15	0,193	0,195
120	37	18	0,153	0,154
150	37	18	0,124	0,126
185	37	30	0,0991	0,100
240	61	34	0,0754	0,0762
300	61	34	0,0601	0,0607
400	61	53	0,0470	0,0475

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Conductor constructions

according to DIN VDE 0295 class 5 and 6

Class 5+6:

Fine wire copper conductors for single and multicore cables

Nominal cross section mm ²	Maximum diameter of single wire mm (Class 5)	Maximum diameter of single wire mm (Class 6)	Conductor resistance at 20 °C maximum value	
			bare single wires Ohm/km	metal plated single wires Ohm/km
0,5	0,21	0,16	39,0	40,1
0,75	0,21	0,16	26,0	26,7
1	0,21	0,16	19,5	20,0
1,5	0,26	0,16	13,3	13,7
2,5	0,26	0,16	7,98	8,21
4	0,31	0,16	4,95	5,09
6	0,31	0,21	3,30	3,39
10	0,41	0,21	1,91	1,95
16	0,41	0,21	1,21	1,24
25	0,41	0,21	0,780	0,795
35	0,41	0,21	0,554	0,565
50	0,41	0,31	0,386	0,393
70	0,51	0,31	0,272	0,277
95	0,51	0,31	0,206	0,210
120	0,51	0,31	0,161	0,164
150	0,51	0,31	0,129	0,132
185	0,51	0,41	0,106	0,108
240	0,51	0,41	0,0801	0,0817
300	0,51	0,41	0,0641	0,0654

Conductor constructions

according to US-standards

AWG	Cross section	Conductor construction	Conductor resistance at 20 °C max. Ohm/km		
			tp	sp	np
32	0,034	7 x 0,079	620	567	607
30	0,057	7 x 0,102	374	330	363
28	0,089	7 x 0,127	225	209	223
26	0,141	7 x 0,160	142	133	141
26	0,155	19 x 0,102	135	126	138
24	0,227	7 x 0,203	88,6	82,7	86,9
24	0,241	19 x 0,127	85,9	79,7	84,9
22	0,355	7 x 0,254	56,1	52,1	54,4
22	0,382	19 x 0,160	53,1	49,5	52,5
20	0,563	7 x 0,320	35,1	32,8	34,1
20	0,616	19 x 0,203	32,4	30,1	32,0
18	0,897	7 x 0,404	21,9	20,6	21,3
18	0,963	19 x 0,254	20,4	19,0	20,0
16	1,229	19 x 0,287	15,7	14,8	15,6
14	1,941	19 x 0,361	10,03	9,44	9,84
12	3,085	19 x 0,455	6,29	5,94	6,17
10	4,743	37 x 0,404	4,13	3,90	4,07
8	8,604	133 x 0,287	2,30	2,16	2,28
6	13,613	133 x 0,361	1,45	1,37	1,43
4	21,153	133 x 0,450	0,918	0,865	0,902
2	33,696	665 x 0,254	0,600	0,557	0,580
1	41,398	817 x 0,254	0,488	0,455	0,472
0	52,951	1045 x 0,254	0,380	0,354	0,370
00	67,392	1330 x 0,254	0,298	0,278	0,291
0000	106,865	2109 x 0,254	0,183	0,177	0,183

Technique

HEW-colour code for measuring cable

according to DIN VDE 47100

Core No.	Colour of core	Core No.	Colour of core	Core No.	Colour of core
1	white	22	brown-blue	43	blue-black
2	brown	23	white-red	44	red-black
3	green	24	brown-red	45	white-brown-black
4	yellow	25	white-black	46	yellow-green-black
5	grey	26	brown-black	47	grey-pink-black
6	pink	27	grey-green	48	red-blue-black
7	blue	28	yellow-green	49	white-green-black
8	red	29	pink-green	50	brown-green-black
9	black	30	yellow-pink	51	white-yellow-black
10	violet	31	green-blue	52	yellow-brown-black
11	grey-pink	32	yellow-blue	53	white-grey-black
12	red-blue	33	green-red	54	grey-brown-black
13	white-grey	34	yellow-red	55	white-pink-black
14	brown-green	35	green-black	56	pink-brown-black
15	white-yellow	36	yellow-black	57	white-blue-black
16	yellow-brown	37	grey-blue	58	brown-blue-black
17	white-grey	38	pink-blue	59	white-red-black
18	grey-brown	39	grey-red	60	brown-red-black
19	white-pink	40	pink-red	61	black-white
20	pink-brown	41	grey-black		
21	white-blue	42	pink-black		

HEW-Colour code for connection cables

Number of cores	Colour code
2	red x white
3	red x red x white
4	red x red x white x white

Colour abbreviations

according to DIN, IEC* and CENELEC HD 757

Colour	German abbreviations according to DIN 47002	Abbreviations to DIN IEC 757
black	SW	BK
brown	BR	BN
red	RT	RD
orange	OR	OG
yellow	GE	YE
green	GN	GN
blue	BL	BU
violet	VI	VT
grey	GR	GY
white	WS	WH
pink	RS	PK
turquoise	TK	TQ

* IEC = International Electrotechnical Commission

Core identification according to DIN VDE 0293 Multicore flexible cables

Number of cores	Cables with earth (-J)	Cables without earth (-O)
2	-----	brown x blue
3	green-yellow x brown x blue	black x blue x brown
4	green-yellow x black x blue x brown	black x blue x brown x black
5	green-yellow x black x blue x brown x black	black x blue x brown x black x black
6 and more	green-yellow, additional cores with printed numbers	Cores with printed numbers according to part 5

Multicore cables for fixed installation

Number of cores	Cables with earth (-J)	Cables without earth (-O)
2	green-yellow x black*	black x blue
3	green-yellow x black x blue	black x blue x brown
4	green-yellow x black x blue x brown	black x blue x brown x black
5	green-yellow x black x blue x brown x black	black x blue x brown x black x black
6 and more	green-yellow, additional cores with printed numbers	black with printed numbers

* Acc. to VDE 0100 part 540, table 2 this construction is permissible for conductor cross sections starting from 10 mm² Cu or 16 mm² Al only.

Technique

Abbreviations for materials and symbols for constructions

TE	- Fluoropolymers
Y	- Thermoplastics
GL	- Glass fibre
GLI	- Mica
C	- Copper screen
(St)	- Static screen
P	- Stainless or galvanized steel wire braid
GA	- Yarn
SI	- Silicone rubber
R	- Elastomers
	- EPDM
	- EVM
	- ACM
	- HNBR
	- CSM
	- FPM
	- CR
	- CM
	- XVH
	- ZYRAD
TPE	- Thermoplastic elastomers
	- TPE-E
	- TPE-O
	- TPE-S
	- TPE-U
	- TPE-V
STP	- Special thermoplastics
	- PPO
	- PEI
	- PEEK
	- PEI/SIR
	- PPS
Cu	- bare
	- tp, tin plated
	- np, nickel plated
	- sp, silver plated
RNi	- Pure nickel
WM	- Resistance material

Other conductor materials on request

H - Symbol for twisting (2 or more cores, flat or twisted without sheath, additional sheath optional (sheathing materials on request)).

D	- Solid conductor
F	- Stranded conductor, fine wires
FF	- Stranded conductor, extra fine wires
ZW	- Twin flat flexible cord
ZÜ	- Ignition cable
AWG	- (A)merican (W)ire (G)auge
SiBd	- Simatic®-colour coding, couple or star quad twisting

Abbreviations for materials and symbols for constructions

Excerpt: DIN/VDE

J	- Installation cable (solid conductor)
JE	- like J- for electric engineering
Li	- Stranded conductor
C	- Screen: copper braid
Q	- Screen: galvanized steel wire
(St)	- Static screen
Bd	- Bunch twisting
Lg	- Layer twisting

HEW-KABEL/CDT identification tracer:

Blue/orange/red – three threads twisted

Example for HEW-type designation:

TEHCTEPY- Cu sp 5xAWG 12/19/EE

TE	= Fluoropolymer insulation
H	= Twisting
C	= Copper screen
TE	= Fluoropolymer inner sheath
P	= Steel wire braid
Y	= Thermoplastic sheath
Cu sp	= Conductor material
5 x	= Number of cores
AWG 12	= (A)merican (W)ire (G)auge
19	= Number of single wires
EE	= Operating voltage

Technique

Abbreviations for harmonized cables

according to VDE 0281/VDE 0282

H 05 S S F 3 G 1.5

Identification of designation: _____

- A Approved national type
- H Harmonized types

Rated voltage U: _____

- 03 300/300 V
- 05 300/500 V
- 07 450/750 V

Insulation material: _____

- G (EVA) Ethylene-Vinylacetate-Copolymer
- N2 (CR) Chloroprene for welding cables
- R Natural and/or synthetic rubber
- S (SIR) silicone rubber
- V (PVC) Polyvinylchloride

Construction elements: _____

- C Screen
- T Additional textile braid over twisted cores
- T6 Additional textile braid over single core

Sheath material: _____

- J Glass fibre braid
- N (CR) Chloroprene
- Q (PUR) Polyurethane
- R Natural and/or synthetic rubber
- S (SIR) silicone rubber
- T Textile braid
- V (PVC) Polyvinylchloride

Special features in construction: _____

- D3 Strain relief
- D5 Center inlet (no supporting structure)
- H Flat, separable cable
- H2 Flat, non-separable cable
- H7 Double insulating
- H8 Spiralized cables

Type of conductor: _____

- F Fine wires in flexible cables
- H Extra fine wires in flexible cables
- K Fine wires in cables for fixed installation
- R Stranded, round, class 2
- U Solid, round, class 1
- Y Tinsels

Number of cores _____

Earth conductor _____

- G with earth
- X without earth

Conductor cross section _____

Abbreviations for insulation and sheath materials

according to VDE 0207 or DIN 76722

VDE-abbreviations	Material	HEW-abbreviations
Y	PVC = polyvinylchloride	Y
X	PVC = polyvinylchloride (vulcanized)	Y
2Y	LDPE = high pressure-polyethylene	Y
2X	LDPE = high pressure-polyethylene (vulcanized)	Y
2Y	HDPE = low pressure-polyethylene	Y
4Y	PA = polyamide	Y
5Y	PTFE = polytetrafluorethylene	TE.../E
6Y	FEP = perfluorethylenpropylene-copolymer	TE.../K
7Y	ETFE = ethylene-tetrafluorethylene-copolymer	TE.../Z
8Y	PI/F = polyimide foil	Y
9Y	PP = polypropylene	Y
10Y	PVDF = polyvinylidenfluoride	Y
10X	PVDF = polyvinylidenfluoride (vulcanized)	Y
11Y	TPE-U = PUR polyurethane	Y
12Y	TPE-EE = (thermoplastic elastomer based on polyester-ester)	Y
12X	TPE-EE = (thermoplastic elastomer based on polyester-ester) vulcanized	Y
13 Y	TPE-E = (thermoplastic elastomer based on polyester-ester)	Y
13X	TPE-E = (thermoplastic elastomer based on polyester-ester) vulcanized	Y
31Y	TPE-S = (thermoplastic elastomer based on polystyrole)	Y
31X	TPE-S = (thermoplastic elastomer based on polystyrole) vulcanized	Y
41Y	TPE-A = (thermoplastic elastomer based on polyamide)	Y
51Y	PFA = perfluoralkoxy-tetrafluorethylene-copolymer	TE.../P
71Y	ECTFE = monochlorotrifluorethylene	TE
91Y	TPE-O = (thermoplastic elastomer based on polyolefine)	Y
91 X	TPE-O = (thermoplastic elastomer based on polyolefine) vulcanized	Y
2G	SIR = silicone rubber	SI
2G	SIR/FRNC = silicone rubber flame retardant non corrosive	SI
3G	EPR = ethylene-propylene-rubber	R
4G	EVA = ethylene-vinylacetate	R
5G	CR = chloroprene	R
6G	CSM = Hypalon®	R
53G	CM = chlorized polyethylene	R

Technique

Conversion of British and American measures and units

Length

1 inch	= 25,4 mm
1 foot	= 0,3048 m
1 yard	= 0,9144 m
1 statute mile	= 1609,341 m
1 nautical mile	= 1853,181 m
1 cm	= 0,3937 inches
1 m	= 39,37 inches

Area

1 square inch	= 6,4516 cm ²
1 square foot	= 0,0929 m ²
1 square yard	= 0,8361 m ²
1 acre	= 4047 m ²
1 square mile	= 2,5899 km ²
1 cm ²	= 0,155 sq. in.
1 m ²	= 10,764 sq. ft.

Volume

1 cu. inch	= 16,387 cm ³
1 cu. foot	= 28,3167 dm ³
1 cu. yard	= 0,764551 m ³
1 gallon (US)	= 3,78540 l
1 gallon (Brit.)	= 4,546 l
1 quart (US)	= 0,946 l
1 barrel (US)	= 158,8 l
1 m ³	= 35,3148 cu. ft.
1 dm ³	= 61,0239 cu. in.

Weight

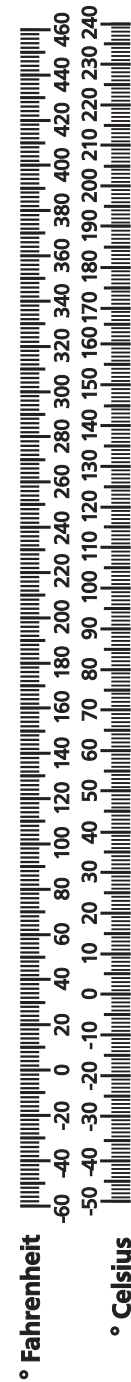
1 ounce (oz)	= 28,35 p
1 pound (lb)	= 0,4536 kp
1 quarter	= 12,7 kp
1 hundredweight	
(centweight; cwt)	= 50,802 kp
1 kp	= 2,2046 lbs.
	= 35,274 oz.

Temperature

°C (Celsius)	= 0,5556 * (F-32)
°F (Fahrenheit)	= 1,8 * C + 32

Power

1 PS	= 0,736 kW
1 hp	= 1,014 PS
	= 0,7453 kW
1 kW	= 1,36 PS
	= 1,31 hp



Current rating

according to VDE 0100 part 523

Apart from the ambient temperature several other important factors have to be taken into consideration when calculating load currents.

Special attention has to be paid to the method of installation, the environmental conditions, fuse protection (overvoltage protection) and the corresponding choice of insulation and sheath materials.

Table 1 shows an excerpt from VDE 0100 part 523 concerning current ratings of cables at an ambient temperature of 30 °C.

Table 2 shows the percentage of current rating at ambient temperatures up to 175 °C.

Conductors of insulated cables may be operated continuously as listed below.

Group 1: One or more single cores installed in pipes

Group 2: Multicore cables

Group 3: Solid, open air installed cables - installation distance between each cable min. 1 x o.d.

Current rating /Z of insulated cables and cables not installed in ground
ambient temperature 30 °C

Current rating /Z of cables with increased heat resistance
ambient temperature > 55 °C

Table 1

Nominal cross section [mm ²]	Group 1 Cu cond. [A]	Group 2 Cu cond. [A]	Group 3 Cu cond. [A]
0,75	-----	12	15
1	11	15	19
1,5	15	18	24
2,5	20	26	32
4	25	34	42
6	33	44	54
10	45	61	73
16	61	82	98
25	83	108	129
35	103	135	158
50	132	168	198
70	165	207	245
95	197	250	292
120	235	292	344
150	-----	335	391
185	-----	382	448
240	-----	453	528
300	-----	504	608
400	-----	-----	726
500	-----	-----	830

Table 2

Ambient temperature °C		Current rating I _Z in % of values of table 1
permissible conductor temperature 100 °C	permissible conductor temperature 180 °C	
from 55 up to 65	from 55 up to 145	100
from 65 up to 70	from 145 up to 150	92
from 70 up to 75	from 150 up to 155	85
from 75 up to 80	from 155 up to 160	75
from 80 up to 85	from 160 up to 165	65
from 85 up to 90	from 165 up to 170	53
from 90 up to 95	from 170 up to 175	38

Technique

Making up in barrels of silicone single cores

Cross section stranded	o.d. approx. mm	Capacity [metres] depending on barrel size		
		400	560	800
0,25 mm ²	1,9	7500	10000	12500
0,5 mm ²	2,1	6000	9000	12500
0,75 mm ²	2,4	5000	7000	10000
1 mm ²	2,5	4000	6000	9000
1,5 mm ²	2,8	3000	5000	7500
2,5 mm ²	3,4	2000	3000	5000
4 mm ²	4,2	1500	2500	3500
6 mm ²	4,9	----	2000	2500

Cross section solid	o.d. approx. mm	Capacity [metres] depending on barrel size		
		400	560	800
0,5 mm ²	2,0	5000	8000	10000
0,75 mm ²	2,2	3500	5500	9500
1 mm ²	2,3	3000	5500	8000
1,5 mm ²	2,6	3000	5000	7000
2,5 mm ²	3,2	----	----	----
4 mm ²	3,9	----	----	----

Capacity of HEW-KABEL/CDT wooden drums

o.d. approx (mm)	Capacity [metres] depending on drum size							
	500	620	700	800	1000	1250	1400	1600
4	2400	3400	6200	7500				
4,5	1800	2600	4800	5800				
5	1500	2200	4000	4800				
5,5	1200	1800	3200	3800				
6	1000	1500	2600	3300	7400			
6,5	930	1300	2200	2800	6200			
7	780	1100	1900	2400	5400			
7,5	680	980	1700	2000	4700	8900		
8	590	850	1500	1800	4100	7800		
8,5	520	760	1300	1600	3600	6900	9100	
9	460	670	1100	1400	3300	6100	8000	
9,5	410	580	1000	1200	2900	5500	7200	
10	390	560	1000	1200	2700	5100	6600	10000
11	290	430	790	960	2200	4100	5400	8700
12	240	350	670	820	1800	3400	4600	7400
13	220	320	560	690	1500	3000	3900	6100
14		280	480	600	1300	2500	3200	5500
15		220	400	510	1100	2200	2900	4700
16		210	390	440	990	1900	2400	4000
17			320	410	860	1700	2100	3600
18			270	350	810	1500	1900	3200
19			260	300	690	1300	1700	2900
20			250	280	670	1200	1600	2600
21			200	270	580	1100	1400	2300
22				220	560	980	1300	2100
23				210	460	920	1200	2000
24				200	440	810	1000	1700
25					390	780	1000	1700
26					380	750	930	1500
27					360	650	890	1300
28					300	620	780	1300
29					280	530	750	1200
30					280	510	720	1100
31					260	490	620	1000
32					230	490	620	930
33					210	410	590	930
34					210	390	500	900
35					200	390	500	860
36					200	370	470	740
37						370	470	740
38						300	390	710
39						300	390	630
40						280	370	600
41						280	370	570
42						260	350	570
43						260	300	570
44						220	300	480
45						210	280	480
46						210	280	450
47						210	280	450
48							260	430
49							260	430
50							260	430

Technique

Capacity of HEW-KABEL/CDT plastic reels

o.d. approx (mm)	Capacity [metres] depending on reel size						
	125	160	200	250	355	500	800
0,8	800	1900	3200	5200			
0,9	640	1500	2500	4100			
1,0	520	1200	2000	3400			
1,1	410	1000	1700	2700			
1,2	350	830	1300	2300	5300		
1,3	300	730	1200	1900	4500		
1,4	260	600	1000	1700	3800		
1,5	220	530	910	1400	3400		
1,6	190	470	800	1200	2900		
1,7	170	410	710	1100	2600		
1,8	150	360	630	1000	2300		
1,9	140	340	560	920	2100		
2,0	120	300	490	830	1800		
2,1	110	250	470	740	1700	13000	
2,2		250	410	660	1500	11000	
2,3		210	360	630	1400	10000	
2,4		200	340	560	1300	10000	
2,5		200	330	540	1200	9300	
2,6			290	480	1100	8400	
2,7			280	430	1000	7900	
2,8			240	410	950	7300	18000
2,9			230	400	910	6700	16000
3,0			220	350	830	6400	15000
3,2				300	740	5500	13000
3,4				280	660	5000	12000
3,6				240	570	4400	11000
3,8				230	510	3900	9700
4,0					450	3600	8900
4,2					430	3200	8000
4,4					370	2900	7300
4,6					350	2600	6500
4,8					310	2500	6000
5,0					300	2300	5700
5,2					260	2000	5200
5,4					250	1900	4800
5,6					220	1700	4500
5,8					210	1600	4100
6,0					200	1600	3800







Heat resistance classes

according to VDE 0530










Class	Insulation material	Varnish	Maximum operating temperature	HEW insulation- + sheath materials
Y	Cotton, artificial and natural silk, polyamide-fibre, paper, polyvinylchloride (PVC), polyethylene (PE), vulc. natural rubber	-----	90 °C	PVC, PE, CSM, HDPE, LDPE, PA
A	Cotton, artificial and natural silk, polyamide, paper, varnished textiles, polyester resins	Asphalt varnish, synthetic resin varnish, insulation oil and synthetic dielectric liquids	105 °C	TPE
E	Special wire varnishes, special plastic foils, moulding compound with cellulose, paper and cotton laminates	synthetic resin varnishes, polyester resins, each with maximum operation temperature ≥ 120 °C	120 °C	EVM, PP
B	Glass fibre, mica products, special plastic foils, moulding parts with mineral filler	like „E“, but ≥ 130 °C epoxy resin	130 °C	PETP, STP
F	Glass fibre, mica products, aromatic polyamide, varnished glass-fibre textiles, varnished asbestos	resins with maximum operation temperature ≥ 155 °C	155 °C	ETFE
H	Glass fibre, mica products aromatic polyamide silicone rubber polyimide foil, PTFE	silicone resins with maximum operation temperature ≥ 180 °C	180 °C	Silicone, PTFE, FEP
C	Mica, porcelain, glass, quartz and similar fire resistant materials	like „H“, but ≥ 225 °C	more than 180 °C	PTFE, PFA, FEP, PI/F, glass fibre, mica, FPM, ceramics

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National and international approvals

Country	Approvals	Testing place/testing authority
Denmark		Demko
Germany		VDE-Prüfstelle (Verband Deutscher Elektrotechniker e.V. = Association of German Electro technicians)
Germany		VDE-Prüfstelle (Verband Deutscher Elektrotechniker e.V. = Association of German Electro technicians)
Germany		Germanischer Lloyd Hamburg
Germany		Physikalisch Technische Bundesanstalt
Europe		Communauté Européenne
Europe		DIN GOST TÜV Berlin-Brandenburg
Finnland		Fimko Ltd. Finland
France		Institut scientifique de Service public

National and international approvals

Country	Approvals	Testing place/testing authority
Canada		Canadian Standards Association
Netherlands		Naamloze Vennootschap tot Keuring van Electro-technischen Materialen
Poland		Główny Instytut Górnictwa
Sweden		Svenska Elektriska Materielkontrollanstalten
Switzerland		Schweizerischer Elektrotechnischer Verein (SEV) = Swiss Electrotechnical association
Switzerland		Schweizerischer Elektrotechnischer Verein (SEV) = Swiss Electrotechnical association
Czech Republic		Fyzikálne technický Zkusebni ustav, Ostrava Radvanice
USA		Underwriters Laboratories (UL)
Norway		Nemko

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