SUMMARY

Power cables

Telecom cables

Indoor cables

Outdoor network cables

Consumers' connection cables

Data cables

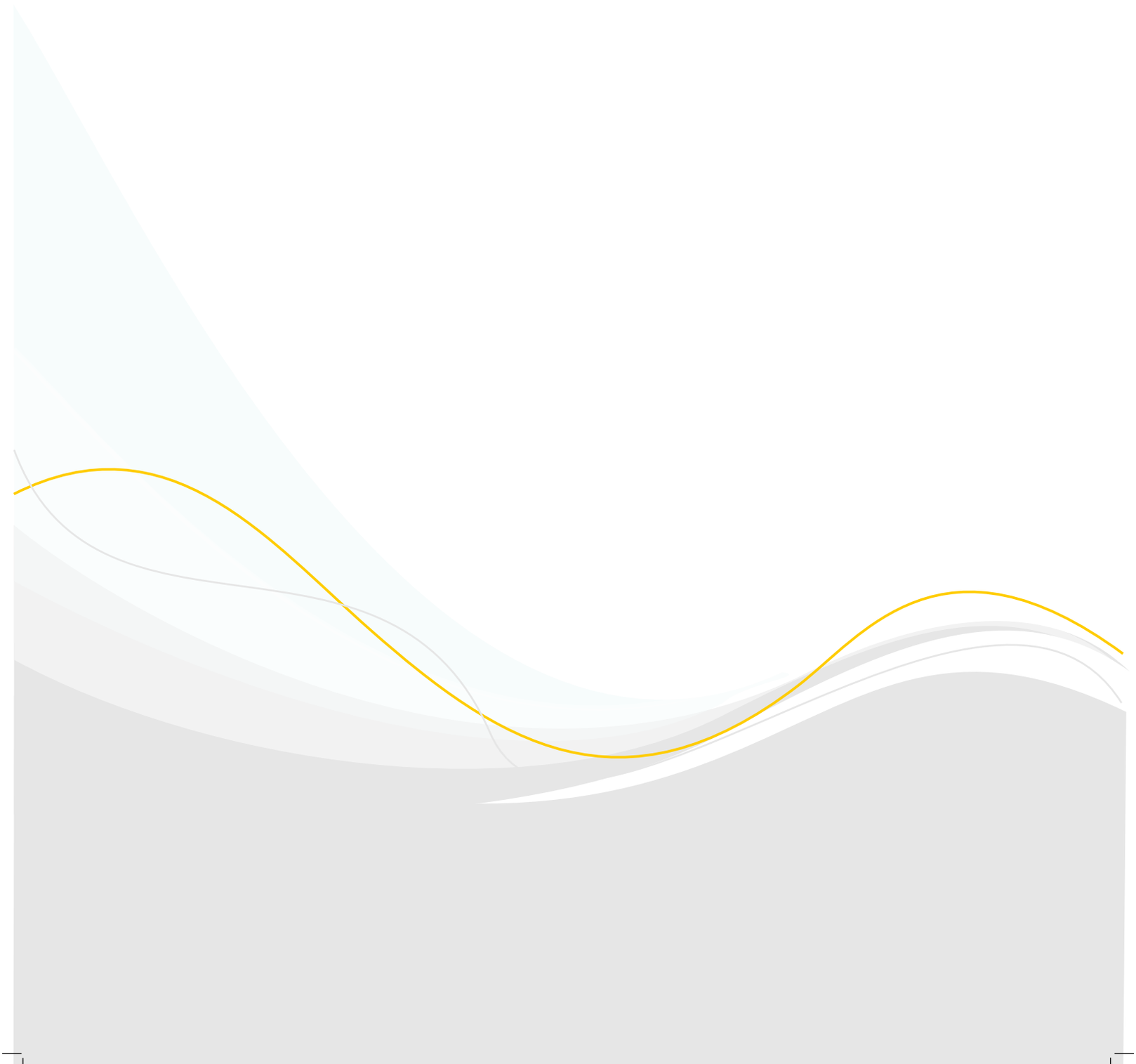
Instrumentation cables

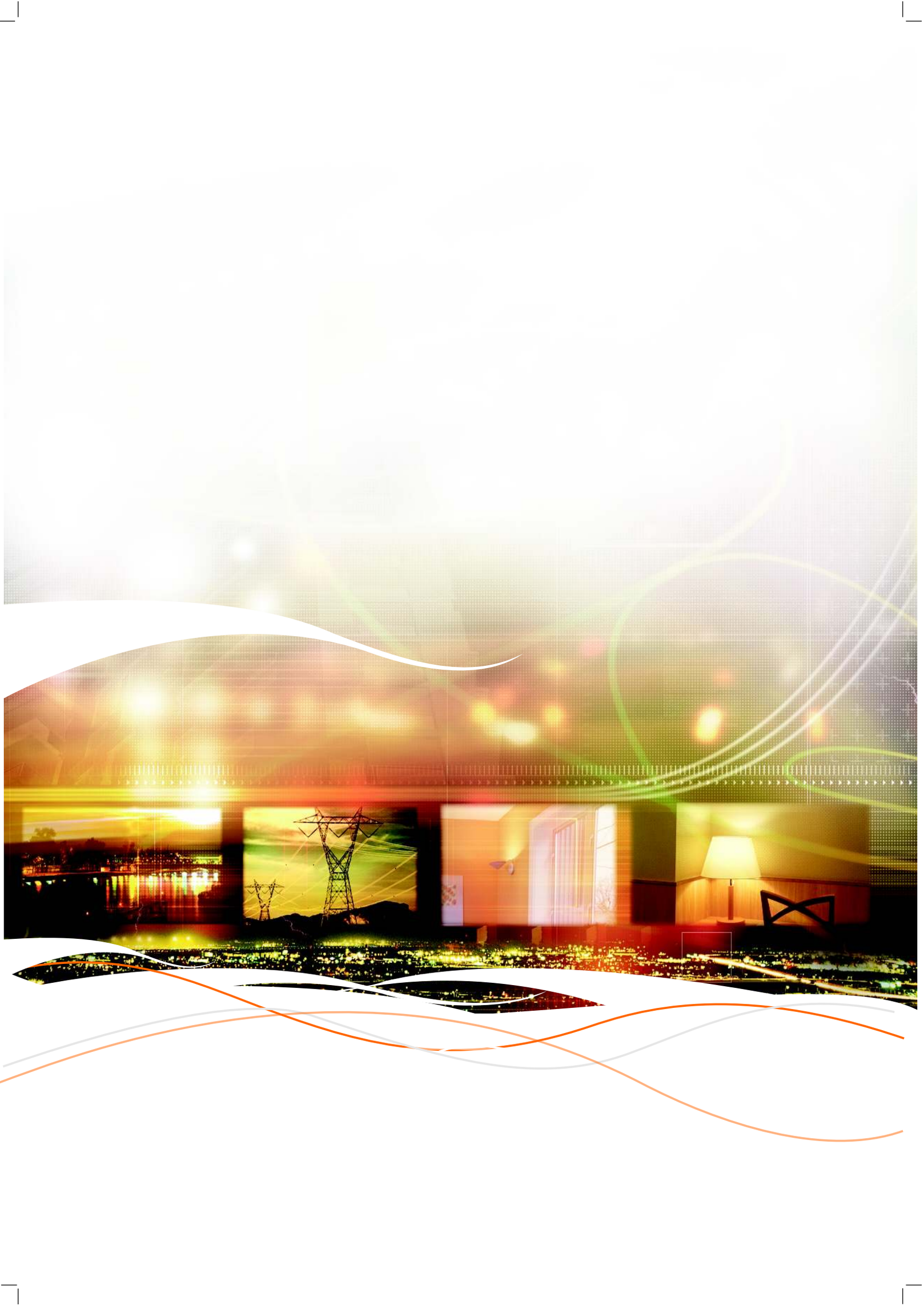
Coaxial cables

TECHNICAL PART

I Building wires and cables

Low Voltage building wires and cables:





Solid and stranded wires Copper PVC insulated

H05V-U, H07V-U & H07V-R

APPLICATIONS

They are used for indoor fixed installations in dry locations, in switchboards and distributors. The cables could be installed in surface mounted or conduits.
They should not be buried nor drowned in concrete.

CONDUCTOR CONSTRUCTION

- Solid copper class 1 for H07/H05-VU.
- Stranded copper class 2 for H07-VR.

CORE IDENTIFICATION

By colours.

TECHNICAL DATA

Nominal Voltage:
H05-VU 300/500Vcc.
H07-VU & H07-VR 450/750Vcc.
Maximum Operating temperature: +70° C
Maximum short circuit temperature: +160° C.

DESCRIPTION

CORE
Copper

INSULATION
PVC

H07V-U

H07V-R

H05V-U, H07V-U & H07V-R

Type	Overall Diameter mm	net Weight Kg/Km	Electrical resistance at 20°C (Ω/km)	Current carrying Capacity (A)	Voltage drop cosl=0,8 (V/A/km)
H05V-U					
0,5	2,0	8,3	36	8,7	-
0,75	2,2	11,1	24,5	11,2	-
1	2,3	13,6	18,1	13,5	-
H07V-U					
1,5	2,8	20	12,1	17,5	23
2,5	3,4	32	7,41	24	14,2
4	3,9	47	4,61	32	8,9
6	4,4	66	3,08	41	6,04
H07V-R					
1,5	3,1	22	12,1	17,5	23
2,5	3,7	34	7,41	24	14,2
4	4,3	50	4,61	32	8,9
6	4,7	70	3,08	41	6,04
10	6,1	116	1,83	57	3,68
16	7,1	176	1,15	76	2,40
25	8,8	275	0,727	96	1,59
35	9,9	375	0,524	119	1,21
50	11,5	518	0,387	144	0,95
70	12,8	707	0,268	184	0,72
95	14,6	957	0,193	223	0,58
120	16,2	1193	0,153	259	0,50
150	17,9	1488	0,124	299	0,45
185	20,2	1838	0,0991	341	0,40
240	22,7	2372	0,0754	403	0,36
300	25,5	2962	0,0601	464	0,33
400	28,6	3917	0,0470	556	0,30

(1) Maximum intensities valid for: conductors set on a single pipe on a visible assembly, or embedded into a wall, or void space, or chute or plinth at an ambient temperature of the air of 30° C.

Solid CABLES
PVC/PVC INSULATED COPPER 500 V

FR-N05VV-U/FR-N05VV-R

APPLICATIONS

They are used in common household installations indoors. The two or three-conductor cables are used in single-phase current while the four or five-conductor cables are used in three-phase current. They should be installed in pipes, plinth or in visible installations. They should be neither buried nor drawned in concrete.

CONDUCTOR CONSTRUCTION

- For sections ≤ 6 mm² : class 1 (FR-N05VV-U)
- For Section > 6 mm² : class 2 (FR-N05VV-R)

CONDUCTOR IDENTIFICATION

Number of conductors	Option A	Option B
2		Black, Blue
3	Green / Yellow Black, Blue	Black, Blue, Brown
4	Green / Yellow, Black, Blue, Brown	Blue, Brown , Black, Grey
5	Green / Yellow, Black, Blue Brown, Black	Black, Blue, Brown Black, Black

Cables of option A are described with a letter G.

TECHNICAL DATA

Nominal Voltage: 300/500Vcc.
Maximum Operating temperature: +70° C
Maximum short circuit temperature: +160° C.

DESCRIPTION

CORE
Copper

INSULATION
PVC

FILLER
PVC

OUTER SHEATH
Grey PVC

FR-N05VV-U/FR-N05VV-R

Type	Overall Diameter mm	net Weight Kg/Km	Electrical resistance at 20°C (Ω/km)	Current carrying Capacity (A)	Voltage drop (1) between phase cosl=0,8 (V/A/km)
FR-N05VV-U					
2x1,5	9,0	119	12,10	22,0	23,10
2x2,5	10,0	161	7,41	30,0	14,20
2x4	11,0	209	4,61	40,0	8,95
2x6	12,0	268	3,08	51,0	6,06
3x1,5	9,0	137	12,10	22,0	23,10
3x2,5	11,0	192	7,41	30,0	14,20
3x4	12,0	253	4,61	40,0	8,95
3x6	13,0	342	3,08	51,0	6,06
4x1,5	10,0	162	12,10	18,5	20,00
4x2,5	11,0	231	7,41	25,0	12,30
4x4	13,0	318	4,61	34,0	7,75
4x6	15,0	434	3,08	43,0	5,24
5x1,5	11,0	190	12,10	18,5	20,00
5x2,5	12,0	270	7,41	25,0	12,30
5x4	14,0	392	4,61	34,0	7,75
5x6	16,0	515	3,08	43,0	5,24
FRN05VV-R					
2x10	16,0	478	1,83	70,0	3,60
2x16	18,0	661	1,15	94,0	2,30
2x25	22,0	994	0,727	119,0	1,50
2x35	25,0	1329	0,524	147,0	1,10
3x10	17,0	585	1,83	70,0	3,60
3x16	20,0	845	1,15	94,0	2,30
3x25	24,0	1267	0,727	119,0	1,50
3x35	27,0	1674	0,524	147,0	1,10
4x10	19,0	716	1,83	60,0	3,10
4x16	22,0	1042	1,15	80,0	2,00
4x25	26,0	1599	0,727	101,0	1,30
4x35	29,0	2082	0,524	126,0	0,90
5x10	20,3	854	1,83	60,0	3,10
5x16	24,0	1271	1,15	80,0	2,00
5x25	29,0	1917	0,727	101,0	1,30
5x35	29,05	2496	0,524	126,0	0,90

(1) Maximum intensities valid for cables set up on a shelf at a temperature of 30° C. Intensities and voltage drops of the two or three-conductor cables correspond to a single-phase current and hose of the four or five-conductor cables to a three-phase current.

Solid and stranded wires Copper PVC insulated VDE 0250

(N)YIFY

APPLICATIONS

For power supply networks for light mechanical stress and it is suitable to nail with is PVC bridge between cores

CONDUCTOR CONSTRUCTION

Solid or stranded copper

TECHNICAL DATA:

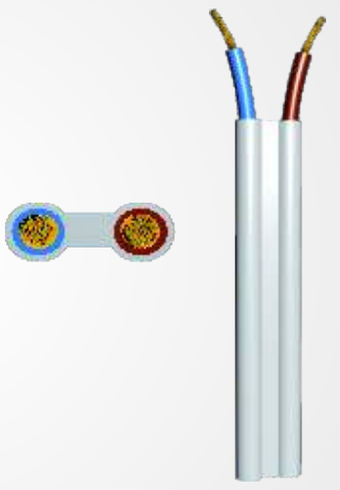
Maximum operating temperature : 70 °C
short circuit temperature : 160°C

DESCRIPTION

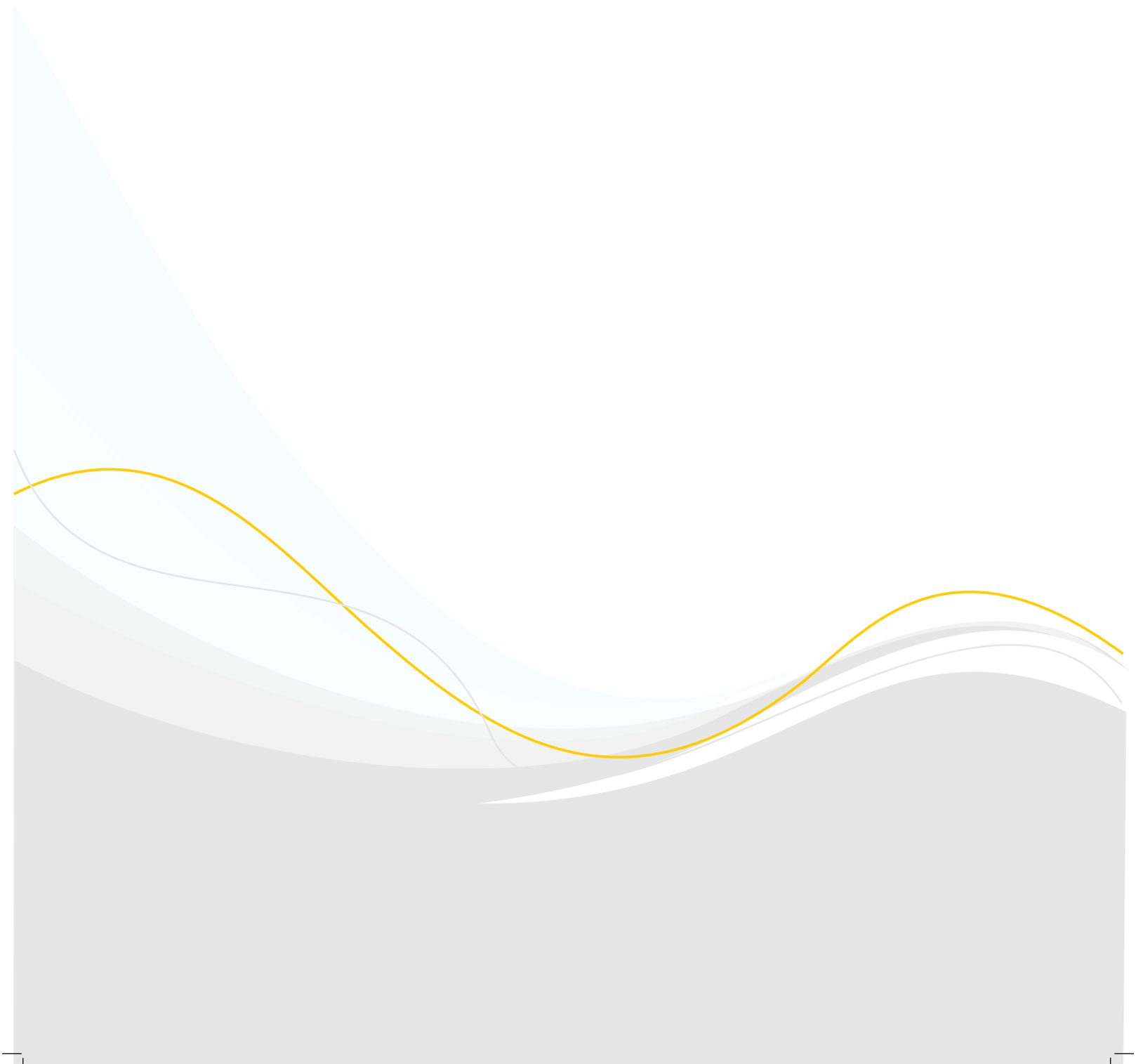
CORE
Copper

INSULATION
PVC

OUTER SHEATH
PVC



Type	Nominal thickness (mm)		Nominal external dimensions (mm)	Nominal weight (Kg/Km)	DC résistance at 20 °C (Ω/Km)	Admissible current (A)
	insulation	sheath				
2 x 1,5	0,4	0,8	3,9 x 10,9	53	12,1	19
2 x 2,5	0,5	0,9	4,7 x 12,5	81	7,41	25
2 x 4	0.6	0,9	5,5 x 14,6	115	4,61	34
3 x 1,5	0,4	0,8	3,9 x 18,2	80	12,1	19
3 x 2,5	0,5	0,9	4,7 x 20,3	122	7,41	25
3 x 4	0,6	0,9	5,5 x 23,9	172	4,61	34



FLEXIBLE WIRES PVC INSULATED COPPER NFC32-201; HD21.3; NT88.05

H05V-K / H07V-K

APPLICATIONS

The H07V-K cables may be used in equipment wiring, switching and distribution installations in conduits on or under plaster in a dry location.

CONDUCTOR CONSTRUCTION

- Stranded copper class 5.

CORE IDENTIFICATION

By colours.

TECHNICAL DATA

Nominal Voltage : H05V-K 300/500Vcc.
H07V-K 450/750Vcc.
Maximum Operating temperature : +70°C
Maximum short circuit temperature: +160°C.

DESCRIPTION

CORE
Copper

INSULATION
PVC

H05V-K/H07VK

Type	Overall Diameter mm	net Weight Kg/Km	Electrical resistance at 20°C (Ω/km)	Current carrying Capacity (A)	Voltage drop cosl=0,8 (V/A/km)
H05V-K					
0,5	2,1	8,5	39	8	-
0,75	2,3	11,3	26	11	-
1	2,5	14	19,5	13,5	-
H07V-K					
1,5	2,9	20	13,3	17,5	26
2,5	3,5	31	7,98	24	15
4	4,1	47	4,95	32	9,5
6	4,7	65	3,30	41	6,3
10	6,0	109	1,91	57	3,7
16	7,0	162	1,21	76	2,3
25	8,7	254	0,780	96	1,5
35	9,8	345	0,554	119	1,1
50	11,7	482	0,386	144	0,74
70	13,4	680	0,272	184	0,52
95	15,4	904	0,206	223	0,40
120	17,0	1141	0,161	259	0,31
150	19,0	1422	0,129	299	0,25
185	21,0	1734	0,106	341	0,20
240	24,0	2275	0,0801	403	0,15

(1) Maximum intensities valid for: conductors set on a single conduit on an apparent installation, or embedded into a wall, or under plinth at an ambient temperature of the air of 30° C.

COPPER FLEXIBLE CONDUCTORS PVC/PVC INSULATED 500 V HD 21-5

H05VV-F

APPLICATIONS

They are used
- In households, kitchens, offices including humid locations.
- To supply household machines subjected to low mechanical stresses (such as washing machines, refrigerators etc.)

These cables are not appropriate for outdoor use, in industrial or agricultural workshops, nor for commercial electric tools.

CONDUCTOR CONSTRUCTION

- Stranded copper class 5.

CORES IDENTIFICATION

Number of conductors	Option A	Option B
2		Blue, Brown
3	Green / Yellow, Blue, Brown	Black, Grey, Brown
4	Green / Yellow Brown, Black, Grey	Black, grey Blue, Brown
5	Green / Yellow, Blue, Brown, Grey, Black	Black, Grey, Black, Blue, Brown

Cables of option A are described with a letter G.
Example HO5VV-F 5G2,5 mm2

TECHNICAL DATA

Nominal Voltage: 300/500Vcc.
Maximum Operating temperature : +70° C
Maximum short circuit temperature : +160° C.

DESCRIPTION

CORE
Copper

INSULATION
PVC

OUTER SHEATH
PVC

H05VV-F

Type	Overall Diameter mm	net Weight Kg/Km	Electrical resistance at 20°C (Ω/km)	Current carrying Capacity (A)	Voltage drop cosl=0,8 (V/A/km)
H05VV-F					
2x0,75	6,2	55	26	14	49,8
2x1	6,6	64	19,5	17	37,3
2x1,5	7,6	87	13,3	22	25,5
2x2,5	9,2	133	7,98	30	15,3
3x0,75	6,6	65	26	14	49,8
3x1	7	77	19,5	17	37,3
3x1,5	8,3	110	13,3	22	25,5
3x2,5	10,0	167	7,98	30	15,3
4x0,75	7,1	78	26	12	43,1
4x1	7,8	96	19,5	14	32,3
4x1,5	9,2	137	13,3	18,5	22,1
4x2,5	10,9	205	7,98	25	13,2
5x0,75	8,0	97	26	12	43,1
5x1	8,6	114	19,5	14	32,3
5x1,5	10,3	168	3,3	18,5	22,1
5x2,5	12,1	248	7,98	25	13,2

(1) Maximum intensities valid for a single cable fastened by a clamp and separated from the wall or set on conduits protected from the sun at a temperature of 30° C. Intensities and voltage drops for cables having 2 or 3 conductors used in a single phase circuit and for those with 4 or 5 conductors in a three-phase circuit.

FLAT FLEXIBLE CABLES PVC INSULATED 300 V HD 21-5

H03VH-H

APPLICATIONS

They are used
- In households, kitchens, offices.
- To supply household machines subjected to very low mechanical stresses .

Cables with conductors 0,5 mm2 shall not be used with lengths over 2m.

CONDUCTOR CONSTRUCTION

- Stranded copper class 5.

TECHNICAL DATA

Nominal Voltage: 300/500Vcc.
Maximum Operating temperature : +70°C
Maximum short circuit temperature : +150°C

DESCRIPTION

CORE
Copper

INSULATION
PVC

Type	Exterior Diameter Approximate mm	Approximate Weight Kg/km	Maximum linear electric resistance at 20°C Ω /km	Current carrying Capacity (A) (1)
H03VH-H				
2x0,50	2,70 x 5,4	23,7	39,0	10,0
2x0,75	2,70 x 5,4	27,1	26,0	13,5

(1)Maximum intensities valid for a single cable fastened by a clamp and separated from the wall or set on conduits protected from the sun at a temperature of 30° C.

Power network cables

SOLID and Stranded COPPER / ALUMINIUM CABLES XLPE INSULATION NFC32-321,NT 88.199

U1000R02V&U1000AR02V (N)2XY

APPLICATIONS

These cables are suitable for fixed installations, preferably in cable ducts, indoors, outdoors, in water or underground if no mechanical damages are to be expected. .

CONDUCTOR CONSTRUCTION

U1000RO2V

- Copper: Class 1 or 2 for Sections ≤ 6mm²
  Class 2 for Sections > 6mm²

U1000ARO2V

- Aluminum: Class 2

TECHNICAL DATA

Nominal Voltage: 0,6/1 KV.
Maximum Operating temperature: +90°C
Maximum short circuit temperature: +250°C

CORES IDENTIFICATION

Number of conductors	G (Protective Conductor)	X (without Protective Conductor)
2		Blue, brown
3(1)	Green / Yellow Blue, Brown	Black, Blue, Brown
3(2)	Green / Yellow Blue, Brown	Brown, Black, Grey
4	Green / Yellow Brown, Black, Grey	Blue, Brown , Black, Grey
5	Green / Yellow, Blue Brown, Black, Grey	Blue, Brown, Black, Grey, Black
> 5	Numbers or Colours	
Cables Marking	G	X

(1) Only for sections of 1.5 mm 2 and 2.5 mm 2
(2) For sections higher or equal to 4 mm 2

DESCRIPTION

CORE
Copper or Aluminium

INSULATION
XLPE

FILLER
PVC

OUTER SHEATH
Black PVC

U1000R2V&U1000AR2V
(N)2XY

Type	Overall Diameter Approximate mm	Approximate weight Kg/Km		Current carrying Capacity (A)				Voltage drop (1) between phase cos φ = 0.8 V/A/Km	
				Buried cable		open air			
		R2V	AR2V	R 2V	AR2V	R2V	AR2V	R2V	AR2V
1x1,5	5,4	41		31		24		20,21	
1x2,5	5,8	54		41		33		12,17	
1x4	6,3	71		53		45		7,66	
1x6	6,8	97		66		58		5,21	
1x10	8,1	142		87		80		3,13	
1x16	9,1	206	106	113	87	107	84	2,01	3,40
1x25	10,8	305	149	144	111	138	101	1,40	2,23
1x35	11,9	408	189	174	134	169	126	1,00	1,64
1x50	13,3	553	240	206	160	207	154	0,78	1,23
1x70	14,5	747	309	254	197	268	198	0,56	0,88
1x95	16,4	996	402	301	234	328	241	0,43	0,66
1x120	18,2	1242	492	343	266	382	280	0,36	0,54
1x150	19,9	1538	600	387	300	441	324	0,31	0,45
1x185	22,2	1887	730	434	337	506	371	0,26	0,38
1x240	25,0	2427	925	501	388	599	439	0,22	0,31
1x300	27,5	3016	1140	565	440	693	508	0,19	0,26
1x400	30,4	3975	1472	662	515	825	663	0,17	0,22
1x500	38,5	4880	-	749	-	946	-	0,15	-
2X1,5	9,6	130		37		26		24,82	
2x2,5	10,4	164		48		36		15,24	
2x4	11,3	212		63		49		9,52	
2x6	12,8	290		80		63		6,38	
2x10	15,3	431		104		86		3,82	
2x16	17,4	606	402	136	104	115	91	2,44	3,90
2x25	20,8	898	578	173	133	149	108	1,57	2,50
2x35	23,4	1194	747	208	160	185	135	1,16	1,80
3x1,5	10,0	148		31		23		21,50	
3x2,5	10,9	192		41		31		13,20	
3x4	11,9	252		53		42		8,25	
3x6	13,5	350		66		54		5,50	
3x10	16,2	527		87		75		3,30	
3x16	18,4	756	450	113	87	100	77	2,10	3,40
3x25	22,1	1127	648	144	111	127	97	1,36	2,20
3x35	24,9	1515	844	174	134	158	120	1,00	1,62
3x50	27,9	2033	1075	206	160	192	146	0,76	1,22
3x70	30,7	2707	1367	254	197	246	187	0,55	0,86
3x95	34,6	3577	1758	301	234	298	227	0,42	0,64
3x120	39,1	4522	2225	343	266	346	263	0,35	0,53
3x150	43,1	5609	2738	387	300	395	304	0,30	0,44
3x185	48,7	6973	3432	434	337	450	347	0,25	0,37
3x240	54,5	8904	4310	501	388	538	409	0,21	0,30
3x300	59,9	10996	5253	565	440	621	471	0,18	0,25

(1) Maximum intensities valid for: 3 cables with single cores set up in triangle/layers or 1 cable with 3, 4, 5 cores used for three-phase circuit or 1 cable with two conductors used in a single-phase circuit and for cables set up in underground conduits at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C.

N F - U S E

U1000R2V&U1000AR2V
(N)2XY

Type	Overall Diameter Approximate mm	Approximate weight Kg/Km		Current carrying Capacity (A)				Voltage drop (1) between phase cos Φ = 0.8 V/A/Km	
				Buried cable		open air			
		R2V	AR2V	R 2V	AR2V	R2V	AR2V	R2V	AR2V
3x16+10	19,8	902		113		100		2,10	
3x25+16	23,5	1350	775	144	111	127	97	1,36	2,20
3x35+16	25,5	1731	966	174	134	158	120	1,00	1,62
3x50+25	29,1	2346	1240	206	160	192	146	0,76	1,22
3x50+35	29,7	2422	1253	206	160	192	146	0,76	1,22
3x70+35	32,3	3141	1593	254	197	246	187	0,55	0,86
3x70+50	33,2	3250	1607	254	197	246	187	0,55	0,86
3x95+50	36,4	4165	2048	301	234	298	227	0,42	0,64
3x120+70	41,0	5331	2614	343	266	346	263	0,35	0,53
3x150+70	44,3	6459	3174	387	300	395	304	0,30	0,44
3x185+70	49,2	7938	3990	434	337	450	347	0,25	0,37
3x185+95	50,3	8128	4022	434	337	450	347	0,25	0,37
3x240+95	54,6	10116	4968	501	388	538	409	0,21	0,30
3x240+120	55,9	10324	5077	501	388	538	409	0,21	0,30
3x300+150	61,6	12770	6137	565	440	621	471	0,18	0,25
4x1,5	10,8	172		31		23		21,50	
4x2,5	11,7	227		41		31		13,20	
4x4	12,9	302		53		42		8,25	
4x6	14,6	424		66		54		5,50	
4x10	17,6	644		87		75		3,30	
4x16	20,1	933	524	113	87	100	77	2,10	3,40
4x25	24,2	1402	764	144	111	127	97	1,36	2,20
4x35	27,3	1889	996	174	134	158	120	1,00	1,62
4x50	30,9	2565	1288	206	160	192	146	0,76	1,22
4x70	34,0	3436	1649	254	197	246	187	0,55	0,86
4x95	38,3	4547	2122	301	234	298	227	0,42	0,64
4x120	43,5	5765	2702	343	266	346	263	0,35	0,53
4x150	47,8	7133	3305	387	300	395	304	0,30	0,44
4x185	53,9	8851	4129	434	337	450	347	0,25	0,37
4x240	59,9	11825	5700	501	388	538	409	0,21	0,30
5x1,5	11,6	204		31		23	21,50		
5x2,5	12,6	271		41		31	13,20		
5x4	13,9	365		53		42	8,25		
5x6	16,6	496		66		54	5,50		
5x10	19,1	788		87		75	3,30		
5x16	22,0	1148	637	113	87	100	77	2,10	3,40
5x25	26,5	1732	934	144	111	127	97	1,36	2,20
5x35	29,9	2338	1221	174	134	158	120	1,00	1,62

(1) Maximum intensities valid for: 3 single-core cables set up in triangle/layers or 1 cable with 3, 4, 5 three-phase current or 1 cable with two conductors used in a single-phase current and for cables set up in underground pipes at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C.

U1000R2V

Type	Overall Diameter Approximate mm	Approximate weight Kg/Km	Current carrying Capacity (A)		Voltage drop (1) between phase cos φ = 0.8 V/A/Km
			Buried cable	open air	
7x1,5	12,4	244	22	15	24,80
10x1,5	15,2	327	18,5	13	24,80
12x1,5	15,6	368	18	12,5	24,80
14x1,5	16,3	413	17	12	24,80
19x1,5	18,0	521	15	10,5	24,80
24x1,5	20.8	641	14	10	24,80
27x1,5	21.2	702	13,5	9,5	24,80
30x1,5	21.9	764	12,5	9	24,80
37x1,5	23.6	910	12	8	24,80
7x2,5	13.6	330	28	20,5	15,20
10x2,5	16.8	448	24,5	18	15,20
12x2,5	17.3	509	24	17	15,20
14x2,5	18.1	576	22	16	15,20
19x2,5	20.0	738	19,5	14,5	15,20
24x2,5	23,2	912	18	13	15,20
27x2,5	23.9	1004	17	12,5	15,20
30x2,5	24,5	1097	16,5	12	15,20
37x2,5	26.4	1315	15,5	11	15,20

(1) Maximum intensities valid for: 3 single-core cables set up in triangle/layers or 1 cable with 3, 4, 5 cores three-phase current or 1 cable with two conductors used in a single-phase current and for cables set up in underground pipes at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C.

SOLID and Stranded COPPER CABLES PVC INSULATION NFC32-321, NT 88.199,VDE HD603

NYY / NAYY

APPLICATIONS

These cables are suitable for fixed installations, preferably in cable ducts, indoors, outdoors, in water or underground if no mechanical damages are to be expected.

CONDUCTOR CONSTRUCTION

- Copper: Class 1 or 2 for Sections ≤ 6mm²
  Class 2 for Sections > 6mm²

Circular or sector - shaped for sections ≥ 50mm²

TECHNICAL DATA

Nominal Voltage: 0,6/1 KV
Test voltage: 4KV.
Maximum conductor temperature in service: +70°C
Maximum short circuit temperature : +160°C sections ≤300 mm²
: +140°C sections > 300 mm²

CORES IDENTIFICATION

Number of conductors	J (Protective Conductor)	O (without Protective Conductor)
2		Blue, brown
3	Green / Yellow Blue, Brown	Brown, Black, Grey
4	Green / Yellow Brown, Black, Grey	Blue, Brown , Black, Grey
5	Green / Yellow, Blue Brown, Black, Grey	Blue, Brown, Black, Grey, Black
> 5	Numbers or Colours	
Cables Marking	-J	-0

DESCRIPTION

CORE
Copper

INSULATION
PVC

Filler
PVC

OUTER SHEATH
Black or grey PVC

NYY / NAYY

Type	Overall Diameter mm	weight Kg/Km		Current carrying Capacity				Voltage drop cosf = 0.8	
				Buried cable		Open air			
		CUI	ALU	CUI	ALU	CUI	ALU	CUI	ALU
1x16 RM	9,9	243	147	108	85	85	66	1,9	3,2
1x25 RM	11,6	357	203	135	105	118	92	1,3	2,1
1x35 RM	12,7	469	240	165	130	140	110	0,94	1,5
1x50 RM	14,3	632	305	195	155	175	135	0,73	1,2
1x70 RM	15,4	837	385	240	190	220	175	0,53	0,83
1x95 RM	17,6	1120	495	290	225	275	215	0,4	0,62
1x120 RM	19,4	1388	590	330	260	325	255	0,33	0,51
1x150 RM	21,1	1710	700	370	290	370	290	0,29	0,42
1x185 RM	23,6	2104	865	420	330	430	335	0,25	0,36
1x240 RM	26,3	2696	1080	480	375	520	405	0,21	0,29
1x300 RM	29,3	3350	1330	540	420	600	470	0,18	0,24
1x400 RM	33,6	4080	1670	635	495	725	565	0,16	0,21
1x500 RM	42,5	5080	2200	725	565	845	660	0,14	0,19
2x1,5 RE	11,2	188		32		22		23,2	
2x1,5 RM	11,2	188		32		22		23,2	
2x2,5 RE	12	228		42		30		14,2	
2x2,5 RM	12	228		42		30		14,2	
2x4 RE	13,7	311		54		40		8,9	
2x4 RM	13,7	311		54		40		8,9	
2x6 RE	14,7	380		67		51		6,0	
2x6 RM	14,7	380		67		51		6,0	
2x10 RM	17,3	557		90		70		3,6	
2x16 RM	19,4	756	440	116	95	94	68	2,3	3,6
2x25 RM	23,2	1118	650	148	113	119	91	1,5	2,3
2x35 RM	25,4	1424	780	178	136	147	115	1,1	1,7
3x1,5 RE	11,7	211		26		18,5		20,2	
3x1,5 RM	11,7	211		26		18,5		20,2	
3x2,5 RE	12,5	263		34		25		12,4	
3x2,5 RM	12,5	263		34		25		12,4	
3x4 RE	14,4	364		44		34		7,7	
3x4 RM	14,4	364		44		34		7,7	
3x6 RE	15,5	454		56		43		5,2	
3x6 RM	15,5	454		56		43		5,2	
3x10 RM	18,3	672		74		60		3,1	
3x16 RM	20,9	953	490	96	77	80	63	2,0	3,2
3x25 RM	24,6	1387	720	123	105	101	80	1,3	2,1
3x35 RM	27	1788	875	147	120	126	100	0,94	1,5
3x50 RM	30,8	2278	1135	174	140	153	120	0,72	1,1
3x50 SM	26,6	1750		174		153		0,72	
3x70 RM	34,4	3060	1475	216	175	196	155	0,52	0,81
3x70 SM	30	2400		216		196		0,52	
3x95 RM	38,5	4041	1980	256	210	238	185	0,39	0,6
3x95 SM	33,9	3250		256		238		0,39	
3x120 RM	41,2	4925	2400	290	240	276	220	0,33	0,5
3x120 SM	36,7	4020		290		276		0,33	

NYY / NAYY

Type	Overall Diameter mm	weight Kg/Km		Current carrying Capacity				Voltage drop cosf = 0.8	
				Buried cable		Open air			
		CUI	ALU	CUI	ALU	CUI	ALU	CUI	ALU
3x150 RM	44,9	6110	2900	328	270	319	250	0,28	0,41
3x150 SM	40,7	4930		238		319		0,28	
3x185 RM	48,6	7439	3720	367	305	364	280	0,24	0,35
3x185 SM	44,9	6150		367		364		0,24	
3x240 RM	54,2	9542	4700	424	355	430	330	0,2	0,28
3x240 SM	50	7920		424		430		0,2	
3x10+6 RM	17,9	709	550	74		60		3,1	
3x16+10 RM	20,5	1015	785	96	77	80	63	2,0	3,2
3x25+16 RM	24,7	1543	935	123	105	101	82	1,3	2,1
3x35+16 RM	26,7	1962	1250	147	120	126	100	0,94	1,5
3x50+25 RM	29,2	2520		174	140	153	120	0,72	1,1
3x50+25 SM	26,8	2100	1615	174		153		0,72	
3x70+35 RM	33	3363		216	175	196	155	0,52	0,81
3x70+35 SM	31,6	2750	2165	216		196		0,52	
3x95+50 RM	38,4	4548		256	210	238	185	0,39	0,6
3x95+50 SM	36,3	3750	2650	256		238		0,39	
3x120+70 RM	41,8	5633		290	240	276	220	0,33	0,5
3x120+70 SM	39,3	4740	3140	290		276		0,33	
3x150+70 RM	46,2	6818		328	270	319	250	0,28	0,41
3x150+70 SM	43,3	5635	4030	328		319		0,28	
3x185+95 RM	51,6	8486		367	305	364	280	0,24	0,35
3x185+95 SM	47,7	7100	5075	367		3164		0,24	
3x240+120 RM	57,8	10822		424	355	430	330	0,2	0,28
3x240+120 SM	53,6	9160		424		430		0,2	
4x1,5 RE	12,4	244		26		18,5		20,2	
4x1,5 RM	12,4	244		26		25		20,2	
4x2,5 RE	13,4	308		34		25		12,4	
4x2,5 RM	13,4	308		34		34		12,4	
4x4 RE	15,5	432		44		34		7,7	
4x4 RM	15,5	432		44		43		7,7	
4x6 RE	16,7	544		56		43		5,2	
4x6 RM	16,7	544		56		60		5,2	
4x10 RM	19,8	815		74		60		3,1	
4x16 RM	22,7	1168	575	96	77	80	63	2,0	3,2
4x25 RM	26,8	1708	850	123	105	101	80	1,3	2,1
4x35 RM	29,7	2233	1035	147	120	126	100	0,94	1,5
4x35 SM	25,6	1670		147		126		0,94	
4x50 RM	30,3	2816	1365	174	140	153	120	0,72	1,1
4x50 SM	29	2225		174		153		0,72	
4x70 RM	33,6	3799	1795	216	175	196	155	0,52	0,81
4x70 SM	32,8	3115		216		196		0,52	
4x95 RM	38	5067	2390	256	210	238	185	0,39	0,39
4x95 SM	37,3	4240		256		238		0,39	
4x120 RM	41,4	6217	2900	290	240	276	220	0,33	0,6
4x120 SM	40,7	5270		290		276		0,33	
4x150 RM	45,6	6595	3530	328	270	319	250	0,28	0,41
4x150 SM	44,7	6450		328		319		0,28	
4x185 RM	50,2	9477	4500	367	305	364	280	0,24	0,35

NYY / NAYY

Type	Overall Diameter mm	weight Kg/Km		Current carrying Capacity				Voltage drop cosf = 0.8	
				Buried cable		Open air			
		CUI	ALU	CUI	ALU	CUI	ALU	CUI	ALU
4x185 SM	49,3	8030		367		364		0,24	
4x240 RM	56,5	12179	5695	424	355	430	330	0,2	0,28
4x240 SM	55,2	10400		424		430		0,2	
5x1,5 RE	13,3	280		26		18,5		20,2	
5x1,5 RM	13,3	280		26		18,5		20,2	
5x2,5 RE	14,4	356		34		25		12,4	
5x2,5 RM	14,4	356		34		25		12,4	
5x4 RE	16,7	505		44		34		7,7	
5x4 RM	16,7	505		44		34		7,7	
5x6 RE	18,1	640		56		43		5,2	
5x6 RM	18,1	640		56		43		5,2	
5x10 RM	21,9	992		74		60		3,1	
5x16 RM	24,8	1391	705	95	77	80	63	1,98	3,2
5x25 RM	29,6	2063	1050	123	105	101	80	1,28	2,1
5x35 RM	29,7	2635	1300	147	120	126	100	0,94	1,5

(1) Maximum intensities valid for: 3 single-core cables set up in triangle/layers or 1 cable with 3, 4, 5 three-phase current or 1 cable with two conductors used in a single-phase current and for cables set up in underground pipes at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 70° C.

NYY Control

Type	Overall Diameter Approximate mm	Approximate mass Kg/Km	Current carrying Capacity (A)		Inter-phase voltge drop cosφ =0.8 V/A/Km
			Buried cable	open air	
7x1,5	14,2	340	19	12	23,20
10x1,5	17,2	452	16,5	10,5	23,20
12x1,5	17,7	505	16	10	23,20
14x1,5	18,4	565	15,5	9,5	23,20
19x1,5	20,2	708	14	8,5	23,20
24x1,5	23,2	867	13	8	23,20
27x1,5	23,2	941	13,5	7,5	23,20
30x1,5	24,4	1027	12	7	23,20
37x1,5	26,2	1235	10,5	6,5	23,20
7x2,5	15,4	439	26	17	14,30
10x2,5	18,8	592	21,5	14,5	14,30
12x2,5	19,3	668	21	14	14,30
14x2,5	20,2	752	20	13,5	14,30
19x2,5	22,2	954	18	12	14,30
24x2,5	25,6	1176	16,5	11	14,30
27x2,5	25,6	1283	15,5	10,5	14,30
30x2,5	27,0	1404	15	10	14,30
37x2,5	29,2	1714	14	9,5	14,30

(1) Maximum intensities valid for: 3 single-core cables set up in triangle/layers or 1 cable with 3, 4,5 three-phase current or 1 cable with two conductors used in a single-phase current and for cables set up in underground pipes at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 70° C.

BARE COPPER OVERHEAD CONDUCTORS (NF C 34-110-3)

CONDUCTOR CONSTRUCTION

Circular stranded plain bare hard-drawn copper

DESCRIPTION

CORE

Copper

Type	Number x nominal diameter wire No x Φ (mm)	conductor (mm)	Weight (Kg/Km)	calculated tensile strength (daN)	Resistance at 20°C (Ω / km)
12,4	7 x 1,50	4,5	108	509	1,829
14,1	7 x 1,60	4,8	123	563	1,154
17,8	7 x 1,80	5,4	156	713	0,7563
22	7 x 2,00	6,0	193	880	0,5337
34,4	7 x 2,50	7,5	301	1137	0,3819
29,2	19 x 1,40	7,0	258	1165	0,2806
38	19 x 1,60	8,0	337	1480	0,1980
48	19 x 1,80	9,0	426	1874	0,1578
60	19 x 2,00	10,0	526	2313	0,1264
75	19 x 2,24	11,2	660	2822	0,1024
93	19 x 2,50	12,5	822	3513	0,0779
116	37 x 2,00	14,0	1028	4407	0,0625
228	37 x 2,80	19,6	2015	7915	0,0467
288	37 x 3,15	22,0	2550	9744	0,0374

BARE COPPER OVERHEAD CONDUCTORS DIN 48201

CONDUCTOR CONSTRUCTION

Circular stranded plain bare hard-drawn copper

DESCRIPTION

CORE

Copper

Type	Number x nominal diameter wire No x Φ (mm)	conductor (mm)	Weight (Kg/Km)	calculated tensile strength (daN)	Continuous curent carrying capacity (1) (A)	Resistance at 20°C (Ω / km)
10	7 x 1,35	4,1	90	402	90	1,829
16	7x1,70	5,1	143	637	125	1,154
25	7 x 2,10	6,3	218	972	160	0,7563
35	7 x 2,50	7,5	310	1377	200	0,5337
50	7 x 3,00	9,0	446	1984	250	0,3819
	19 x 1,80	9,0	437	1938	250	0,3819
70	19 x 2,10	10,5	596	2638	310	0,2806
95	19 x 2,50	12,5	845	3739	380	0,1980
120	19 x 2,80	14,0	1060	4690	440	0,1578
150	37 x 2,25	15,8	1337	5898	510	0,1264
185	37 x 2,50	17,5	1649	7281	585	0,1024
240	61 x 2,25	20,3	2209	9723	700	0,0779
300	61 x 2,50	22,5	2725	12004	800	0,0625
400	61 x 2,89	26,0	3640	16042	960	0,0467
500	61 x 3,23	29,1	4545	1110	1110	0,0374

SOFT BARE COPPER CONDUCTOR

CONDUCTOR CONSTRUCTION

Circular stranded class 2 compacted soft copper

INSTALLATION CONDITIONS

Minimum bending Radius:

Fixed installation: 6 x cable diam.

During laying: 12 x cable diam.

Maximum tensile stress: 5 daN / mm²

DESCRIPTION

CORE

Soft copper

Type	conductor (mm)	Weight (Kg/Km)	Electrical resistance (Ω / km)	Permissible short-circuit current (1) Cut-out time (s)		
				KA 0,5 (s)	KA 1,0 (s)	KA 2,0 (s)
10	3,8	89	1,83	2,10	1,50	1,10
16	4,8	142	1,15	3,40	2,40	1,70
25	6,0	222	0,727	5,30	3,80	2,70
35	7,0	311	0,524	7,40	5,20	3,70
50	8,1	444	0,387	10,0	7,10	5,00
70	9,8	622	0,268	14,5	10,3	7,20
95	11,4	844	0,193	20,1	14,2	10,0
120	12,8	1067	0,153	25,4	18,0	12,6
150	14,3	1333	0,124	31,4	22,2	15,6
185	15,7	1644	0,0991	39,2	27,7	19,5
240	18,3	2133	0,0754	51,6	36,5	25,7
300	20,7	2667	0,0601	64,7	45,8	32,2
400	23,3	3457	0,0470	86,3	61,1	42,9
500	26,7	4439	0,0366	107,8	76,3	53,7

TINNED COPPER CONDUCTOR IEC 60228

CONDUCTOR CONSTRUCTION

Circular stranded class 2 tinned soft copper

INSTALLATION CONDITIONS

Minimum bending Radius:

Fixed installation: 6 x cable diam.

During laying: 12 x cable diam.

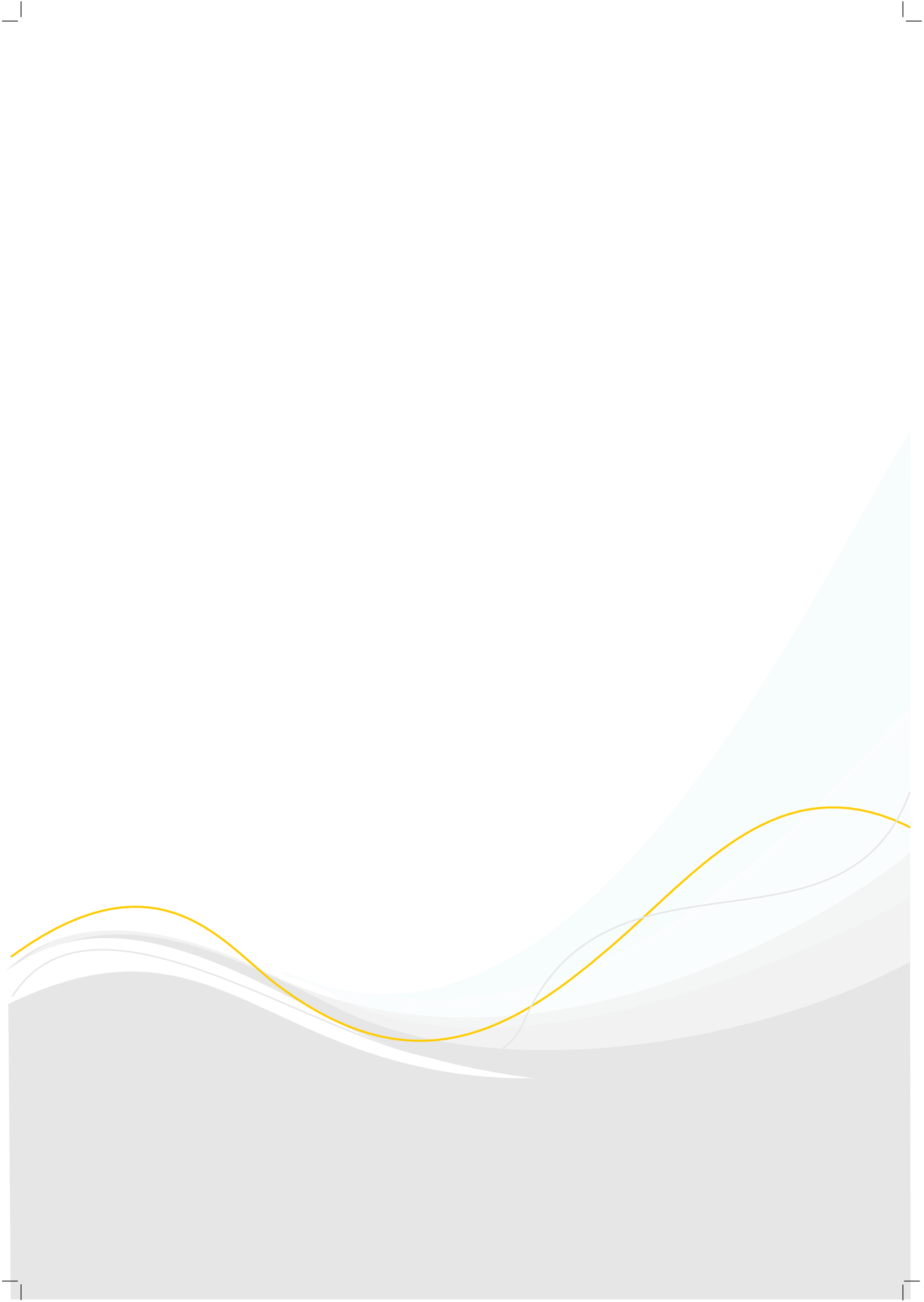
Maximum tensile stress: 5 daN / mm²

DESCRIPTION

CORE

Tinned copper

Type	Number of wires	Conductor (mm)	Weight (Kg/Km)	Resistance at 20°C (Ω / km)	Permissible short-circuit current (1) Cut-out time (s)		
					KA	KA	KA
					0,5 (s)	1,0 (s)	2,0 (s)
10	7	4,1	89	1,84	2,10	1,50	1,10
16	7	5,1	142	1,16	3,40	2,40	1,70
25	7	6,3	222	0,734	5,30	3,80	2,70
35	7	7,5	311	0,529	7,40	5,20	3,70
50	19	9,0	444	0,391	10,0	7,10	5,00
70	19	10,5	622	0,270	14,5	10,3	7,20
95	19	12,5	844	0,195	20,1	14,2	10,0
120	19	14,0	1067	0,154	25,4	18,0	12,6
150	37	15,8	1333	0,126	31,4	22,2	15,6
185	37	17,5	1644	0,100	39,2	27,7	19,5
240	61	20,3	2133	0,0762	51,6	36,5	25,7
300	61	22,5	2667	0,0607	64,7	45,8	32,2



SINGLE CORE MEDIUM VOLTAGE CABLE
IEC 60502
COPPER OR ALUMINIUM UNARMOURED OR ARMOURED

APPLICATIONS
For installations in ground, in water, out-door, indoor and in ducts for power stations, industry and distribution networks.

CONDUCTOR CONSTRUCTION
Aluminium or copper: Class 2

TECHNICAL DATA
NOMINAL VOLTAGE:
3,6/6KV, 6/10 KV 8,7/15 KV, 12/20KV, 18/30KV
Maximum conductor temperature in service: +90°C
Maximum short circuit temperature : +250°C

DESCRIPTION

CORE
Copper or Aluminium

CONDUCTOR SCREEN
Extruded semi conductor

INSULATION
XLPE

INSULATION SCREEN
Extruded semi conductor

TAPE
A semi-conductive tape is applied over the outer layer

METALLIC SCREEN
Over the semi conductive layer is applied a copper tape or copper wires.

BEDDING(FOR ARMOURED CABLES)
PVC or PE

ARMOUR
Aluminium alloy tape or steel wire

OUTER SHEATH
PVC RED or PE

XLPE 3,6/6KV-18/30KV

Type	Approximate outer diameter mm		approx. Weight Kg/Km				Current carrying Capacity (A)				Voltage drop (1) between phases cosf = 0.8 V/A/KM	
	unarmoured	armoured	unarmoured		armoured		Burried cable		Open air			
	CU		CU	ALU	CU	ALU	CU	Alu	CU	ALU	CU	ALU
3,6/6 KV												
1x16	18,3	22,5	460	369	684	577	125	98	120	95	2,2	-
1x25	19,8	23,8	581	438	815	651	165	125	160	125	1,4	2,3
1x35	20,9	25,3	698	497	972	744	195	150	200	150	1,1	1,7
1x50	22,3	26,5	861	574	1145	825	230	180	235	185	0,81	1,3
1x70	23,3	27,5	1058	656	1365	920	285	220	295	230	0,60	0,91
1x95	25,2	29,4	1330	784	1668	805	340	260	360	280	0,46	0,69
1x120	26,8	31,4	1587	896	2053	894	385	300	420	325	0,38	0,56
1x150	28,3	32,7	1888	1025	2303	948	430	335	475	370	0,33	0,48
1x185	30,2	34,8	2239	1174	2707	1034	485	380	550	425	0,28	0,40
1x240	32,7	37,5	2792	1410	3333	1816	560	440	650	510	0,24	0,33
1x300	35,7	40,5	3413	1685	4020	2126	630	500	740	580	0,21	0,28
6/10 KV												
1x16	20,3	24,3	530	439	766	666	125	98	120	95	2,2	-
1x25	21,6	26,0	647	504	923	767	165	125	160	125	1,4	2,3
1x35	22,9	27,1	776	575	1060	841	195	150	200	150	1,1	1,7
1x50	24,1	28,5	933	646	1252	939	230	180	235	185	0,81	1,3
1x70	25,3	29,5	1146	743	1472	1034	285	220	295	230	0,60	0,91
1x95	27,0	31,6	1410	864	1796	1202	340	260	360	280	0,46	0,69
1x120	28,8	33,2	1685	994	2088	1338	385	300	420	325	0,38	0,56
1x150	30,1	34,7	1979	1116	2428	1490	430	335	475	370	0,33	0,48
1x185	32,2	36,8	2349	1284	2841	1684	485	380	550	425	0,28	0,40
1x240	34,5	39,1	2990	1515	3442	1941	560	440	650	510	0,24	0,33
1x300	36,9	41,9	3486	1758	4126	2250	630	500	740	580	0,21	0,28
8,7/15 KV												
1x25	23,9	28,6	714	564	1037	891	165	125	170	130	1,40	2,30
1x35	25,2	29,7	851	632	1174	959	195	150	200	160	1,10	1,70
1x50	26,4	31,1	1001	703	1354	1059	230	180	245	190	0,81	1,30
1x70	28,1	33,0	1249	811	1640	1203	280	220	305	235	0,60	0,91
1x95	30,1	34,8	1562	951	1961	1350	335	260	375	290	0,46	0,69
1x120	31,8	36,5	1853	1090	2273	1512	385	300	425	330	0,38	0,56
1x150	33,4	39,3	2162	1206	2699	1664	430	335	485	375	0,33	0,48
1x185	35,1	40,0	2568	1406	3048	1898	490	380	560	430	0,28	0,40
1x240	37,8	44,2	3193	1635	3839	2197	560	440	660	510	0,24	0,33
1x300	40,6	45,9	3865	1899	4461	2495	640	500	750	590	0,21	0,28
12/20 KV												
1x25	27,2	31,8	888	744	1241	1085	165	125	170	130	1,4	2,3
1x35	27,3	31,9	969	768	1330	1111	195	150	200	160	1,1	1,7
1x50	28,7	33,1	1148	861	1518	1205	230	180	245	190	0,81	1,3
1x70	29,7	34,3	1355	953	1761	1323	280	220	305	235	0,60	0,91
1x95	31,6	36,2	1645	1099	2086	1492	335	260	375	290	0,46	0,69
1x120	33,2	38,0	1919	1228	2407	1657	385	300	425	330	0,38	0,56
1x150	34,7	39,3	2238	1467	2740	1802	430	335	485	375	0,33	0,48
1x185	36,6	41,4	2606	1541	3168	2011	490	380	560	430	0,28	0,40
1x240	38,9	43,9	3172	1790	3809	2308	560	440	660	510	0,24	0,33
1x300	41,5	46,5	3795	2067	4493	2617	640	500	750	590	0,21	0,28
18/30 KV												
1x50	33,9	38,7	1426	1138	1889	1576	230	180	245	190	0,81	1,3
1x70	36,3	42,7	1720	1300	2190	1770	280	220	305	235	0,60	0,91
1x95	37,9	44,9	2030	1450	2560	1980	335	260	375	290	0,46	0,69
1x120	39,6	46,6	2330	1610	2890	2170	385	300	425	330	0,38	0,56
1x150	41,2	48,3	2650	1740	3230	2320	430	335	485	375	0,33	0,48
1x185	42,9	50,1	3070	1970	3670	2580	490	380	560	430	0,28	0,40
1x240	45,9	53,4	3720	2240	4390	2910	560	440	660	510	0,24	0,33
1X300	50,5	55	4619	2348	5549	3050	580	450	735	577	0,21	0,28
1X400	52	58	5600	2635	6709	3183	590	473	845	673	0,18	0,25

(1) Maximum intensities valid for: 3 single-core cables set up in triangle/layers set up in buried conduits at 20° C or set up in conduits in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C. Heat resistance of the ground: 1 Km/W

THREE CORE MEDIUM VOLTAGE
IEC 60502
COPPER OR ALUMINIUM unarmoured or armoured

APPLICATIONS
For installations in ground, in water, out-door, indoor and in ducts for power stations, industry and distribution networks.

CONDUCTOR CONSTRUCTION
Aluminium or copper: Class 2

TECHNICAL DATA
NOMINAL VOLTAGE:
3,6/6KV, 6/10 KV 8,7/15 KV, 12/20KV, 18/30KV
Maximum conductor temperature in service: +90°C
Maximum short circuit temperature : +250°C

Cores identification
By colored tapes applied under the screen.

DESCRIPTION

CORE
Copper or Aluminium

INNER LAYER
Extruded semi conductor

INSULATION
XLPE

OUTER LAYER
Extruded semi conductor

TAPE
A semi-conductive tape is applied over the outer layer

SCREEN
Over the semi conductive layer is applied a copper tape or copper wires.

FILLER OR BEDDING (for armoured cables)
PVC or PE

ARMOUR
Steel tape or steel wire

OUTER SHEATH
PVC RED or PE

Unarmoured

Armoured

XLPE, 6/6KV-12/20KV

Type	Overall Diameter Approximate mm		Approximate weight Kg/Km				Current carrying Capacity (A)				Voltage drop (1) between phases cosf = 0.8 V/A/KM	
	unarmoured	armoured	unarmoured		armoured		Burried cable		Open air			
	CU		CU	ALU	CU	ALU	CU	Alu	CU	ALU	CU	ALU
3,6/6 KV												
3x16	39,8	42,2	2216	1909	2890	2584	125	96	120	92	2,20	-
3x25	42,9	45,3	2706	2228	3432	2954	160	125	155	120	1,50	2,30
3x35	45,8	48,0	3251	2581	3993	3323	190	150	190	145	1,10	1,70
3x50	48,6	51,0	3886	2929	4702	3745	225	175	225	175	0,83	1,3
3x70	51,0	53,8	4647	3308	5566	4227	275	215	280	215	0,61	0,92
3x95	55,3	57,7	5756	3939	6684	4867	330	255	340	260	0,47	0,69
3x120	59,1	61,3	6746	4533	7789	5493	370	290	385	300	0,39	0,57
3x150	62,1	64,3	7960	5091	8972	6103	420	325	445	345	0,34	0,48
3x185	66,4	69,0	9377	5838	10525	6986	470	365	510	395	0,29	0,40
3x240	72,2	74,6	11587	6996	12785	8194	540	425	590	465	0,24	0,33
6/10 KV												
3x16	44,5	46,1	2651	2345	3304	2998	125	96	120	92	2,20	-
3x25	47,5	49,1	3170	2692	3868	3390	160	125	155	120	1,50	2,30
3x35	50,1	52,3	3690	3020	4514	3844	190	150	190	145	1,10	1,70
3x50	52,9	55,1	4351	3394	5221	4264	225	175	225	175	0,83	1,3
3x70	55,7	57,7	5192	3853	6069	4730	275	215	280	215	0,61	0,92
3x95	59,5	61,9	6278	4461	7276	5459	330	255	340	260	0,47	0,69
3x120	63,2	65,6	7353	5057	8413	6117	370	290	385	300	0,39	0,57
3x150	66,2	68,8	8510	5641	9655	6786	420	325	445	345	0,34	0,48
3x185	70,5	73,3	9961	6422	11217	7678	470	365	510	395	0,29	0,40
3x240	75,8	79,6	12151	7560	14257	9666	540	425	590	465	0,24	0,33
8,7/15KV												
3x25	52,8	56,9	3319	2720	4497	4098	160	125	160	125	1,50	2,30
3x35	55,5	59,9	3836	3008	5104	4476	190	145	195	150	1,10	1,70
3x50	58,1	62,7	4418	3340	5776	4908	225	175	230	175	0,83	1,30
3x70	62,2	67,1	5399	3868	6887	5569	270	210	280	200	0,61	0,92
3x95	66,4	71,4	6553	4476	8174	6322	330	255	345	265	0,47	0,69
3x120	70,1	75,2	7646	5123	9354	7082	370	290	395	305	0,39	0,57
3x150	73,9	79,2	8836	5676	10675	7758	415	320	450	345	0,34	0,48
3x185	77,5	84,5	10269	6607	13139	9817	465	360	510	395	0,29	0,40
3x240	84,1	90,9	12667	7696	15631	11111	540	420	600	470	0,24	0,33
12/20 KV												
3x16	59,3	60.9	4403	4097	5752	5050	125	96	125	95	2,20	-
3x25	59,1	62.4	4601	4123	5691	5127	160	125	160	125	1,50	2,30
3x35	59,3	62.6	4878	4208	5973	5217	190	145	195	150	1,10	1,70
3x50	62,1	65.4	5596	4639	6747	5696	225	175	230	175	0,83	1,3
3x70	64,3	67.9	6425	5086	7656	6215	270	210	280	220	0,61	0,92
3x95	68,4	71.8	7584	5767	8895	6963	330	255	345	265	0,47	0,69
3x120	72,4	75.7	8811	6515	10156	7731	370	290	395	305	0,39	0,57
3x150	75,4	80.3	10029	7160	12324	9316	415	320	450	345	0,34	0,48
3x185	79,7	84.8	11602	8063	14043	10347	465	360	510	395	0,29	0,40
3x240	84,7	89.7	13773	9182	16410	11643	540	420	600	470	0,24	0,33

(1) Maximum intensities valid for: cables set up set up in buried conduits at 20° C or set up in conduits in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C. Heat resistance of the ground: 1 Km/ W.

Low Voltage Aerial Bundled Cables
Aluminium / Copper Cables
XLPE INSULATION
NFC 33 209, NT 88.35

Aluminium/Copper
Aerial twisted Cables

APPLICATIONS

Used for overhead distribution.
Cables with neutral messenger are designed for rural and urban areas.

These cables are not suitable for underground installation

CONDUCTOR CONSTRUCTION

Aluminium or copper: Class 2

For the messenger: AGS aluminiun alloy.

TECHNICAL DATA

Nominal Voltage: 0,6/1 KV
Test voltage: 4KV.
Maximum conductor temperature in service: +90°C
Maximum short circuit temperature: +250°C
Neutral breaking load min.: 1660 daN

IDENTIFICATION OF THE CONDUCTORS

- Cables for distribution:
The neutral messenger is printed with white ink or embossed with the standard number or the name of the manufacturer.

- Cables for connexion:
Conductors are numbered in white ink or embossed.

DESCRIPTION

CORE

Aluminium or copper for phases.
AGS aluminium Alloy for the neutral

INSULATION

Black XLPE

Aluminium/Copper Aerial twisted Cables

Type	Overall Diameter mm	approx. Weight Kg/Km	Current Carrying Capacity Amperes	Drop voltage V/A/Km
ALUMINIUM				
2x16	15	142	83	3,98
2x25	18	216	111	2,54
4x16	18	283	75	3,44
1x35+54,6	26	363	117	1,65
1x50+54,6	25	416	143	1,27
1x70+54,6	27	479	180	0,87
3x35+54,6	33	661	138	1,65
3x50+54,6	36	819	168	1,27
3x70+54,6	38	1009	213	0,87
3x35+54,6+16	33	731	138	1,65
3x50+54,6+16	36	890	168	1,27
3x70+54,6+16	38	1080	213	0,87
3x35+54,6+2x16	33	802	138	1,65
3x50+54,6+2x16	36	960	168	1,27
3x70+54,6+2x16	38	1151	213	0,87
3x70+1x70	32	1525	213	1,65
3x70+1x70+16	32	1600	213	1,27
3x70+1x70+2x16	32	1670	213	0,87
3x95+50+16	40	1170	247	0,67
3x120+70+16	42	1420	299	0,55
3x150+1x70	47	1325	344	0,46
3x150+1x70+16	47	1360	344	0,46
3x150+1x70+2x16	47	1400	344	0,46
COPPER				
2x6	12	150	53	-
2x10	13	235	72	-
2x16	15	360	95	-
2x25	18	526	-	-
4x6	14	300	53	-
4x10	16	470	72	-
4x16	19	710	95	-
4x25	22	1052	-	-

Maximum intensities valid for cables installed on facade in the open air at 30° C; Air connection bundled cables strang between poles in the open air at 30° C; For distribution bundled cables with neutral messenger.
The voltage drops are valid for cores at a temperature of 90° C.
Copper bundled cables are manufactured according the old standard UTE 33 209

All aluminium alloy conductors NFC 34 125,EN 50182

ASTER Almelec (AAAC)

APPLICATIONS

These conductors are used for the long spans network. They could be supplied Greased or not Greased.

CONDUCTOR CONSTRUCTION

Aster (Aluminium Alloy) Greased or not Greased.

DESCRIPTION

CORE

Aluminium alloy assembled wires.

Type	Composition: Cores number x Diam.mm	Ext. Diameter mm	Approximate mass Kg/Km	Max. Resistance Maximum at 20° C Ω /Km	Breaking Load daN
22,0	7 x 2,00	6,0	60	1,50	715
34,4	7 x 2,50	7,5	94	0,958	1115
54,6	7 x 3,15	9,5	149	0,603	1775
75,5	19 x 2,25	11,3	208	0,438	2455
117	19 x 2,80	14,0	322	0,283	3800
148,1	19 x 3,15	15,8	407	0,224	4810
181,6	37 x 2,50	17,5	500	0,183	5900
228	37 x 2,80	19,6	627	0,146	7405
288	37 x 3,15	22,1	794	0,115	9370
366	37x3,55	24,9	1008	0,090	11536
570	61x3,45	31,1	1576	0,058	18533

Aluminium conductor steel reinforced
NFC 34 125, EN 50182

CROCUS
(ACSR)

APPLICATIONS

These bi-metallic conductors are used for the long spans network. They are recommended in the hard climatic environments or for river crossings.

CONDUCTOR CONSTRUCTION

Bi-metallic conductors assembled in concentric layers.
The central layer is made up of zinc coated steel wires. The external layers are made of aluminum wires.
The internal layer is greased. The external layers could be greased or not greased.

DESCRIPTION

CORE

Inner layer of Zinc coated steel wires covered with Aluminium wires.

Type	Composition Cores number x Diam.mm		Ext. Diameter mm	Approximate Weight Kg/Km	Max. Resistance at 20° C Ω /Km	Breaking Load daN
	Steel	Alu				
116,2	7 x 2,00	30 x 2,00	14,0	432	0,306	4930
147,1	7 x 2,25	30 x 2,25	15,7	547	0,243	6180
181,6	7 x 2,50	30 x 2,50	17,5	675	0,197	7420
228	7 x 2,80	30 x 2,80	19,6	847	0,157	9210
288	7 x 3,15	30 x 3,15	22,1	1071	0,124	11380
297	19 x 2,25	36 x 2,8	22,45	1210	0,131	14720
412	19 x 2,40	32 x 3,60	26,4	1580	0,089	17330

Industrial cables

SOLID and Stranded COPPER/ALUMINIUM ARMOURED CABLES XLPE INSULATION NFC32-322

U1000RVFV&U1000ARVFV

APPLICATIONS

These cables are suitable for fixed installations, directly buried, in cable ducts, indoors, outdoors, or in water .They are specially used in an environment where mechanical damages could be expected.

CONDUCTOR CONSTRUCTION

U1000RVFV
- Copper: Class 1 or 2 for Sections ≤6mm²
  Class 2 for Sections > 6mm²

U1000ARVFV
- Aluminum: Class 2

TECHNICAL DATA

Nominal Voltage: 0,6/1 KV.
Maximum Operating temperature : +90° C
Maximum short circuit temperature : +250° C

CORES IDENTIFICATION

Number of conductors	G (With protective conductor)	X (Without protective conductor)
2		Blue, brown
3(1)	Green / Yellow Blue, Brown	Black, Blue, Brown
3(2)	Green / Yellow Blue, Brown	Brown, Black, Grey
4	Green / Yellow Brown, Black, Grey	Blue, Brown , Black, Grey
5	Green / Yellow, Blue Brown, Black, Grey	Blue, Brown, Black, Grey, Black
> 5	Numbers or Colours	
Cables Marking	G	X

(1) Only for sections of 1.5 mm² and 2.5 mm²
(2) For sections higher or equal to 4 mm²

DESCRIPTION

CORE
Copper or Aluminium

INSULATION
XLPE

FILLER
PVC

INER SHEATH
PVC

ARMOUR
Steel tape or steel wire

OUTER SHEATH
PVC

U1000RVFV&U1000ARVFV

Type	External Diameter Approximate mm	Approximate Weight Kg/Km		Current carrying Capacity (A)				Voltage drop (1) between phase cosf = 0.8 V/A/KM	
				Burried cable		Open air			
		RVFV	ARVFV	RVFVV	AR2V	RVFV	AR2VFV	RVFV	ARVFV
2x1,5	10,8	201		37		26		24,84	
2x2,5	12	256		48		36		15,26	
2x4	13,2	319		63		49		9,54	
2x6	15,2	430		80		63		6,4	
2x10	17,2	578		104		86		3,84	
2x16	19,4	779	575	136	104	115	91	2,46	3,90
2x25	22,8	1105	785	173	133	149	108	1,59	2,50
2x35	25,6	1440	993	208	160	185	135	1,17	1,89
3x1,5	11,6	235		31		23		21,51	
3x2,5	12,5	288		41		31		13,21	
3x4	13,8	367		53		42		8,26	
3x6	15,9	496		66		54		5,54	
3x10	18,3	692		87		75		3,32	
3x16	20,4	938	632	113	87	100	77	2,13	3,40
3x25	24,1	1348	869	144	111	127	97	1,37	2,20
3x35	27,1	1777	1106	174	134	158	120	1,02	1,63
3x50	30,3	2340	1382	206	160	192	146	0,77	1,22
3x70	33,3	3061	1721	254	197	246	187	0,56	0,87
3x95	38,8	4397	2578	301	234	298	227	0,43	0,66
3x120	43,5	5465	3168	343	266	346	263	0,36	0,54
3x150	47,7	6670	3799	387	300	395	304	0,31	0,45
3x185	53,3	8168	4627	434	337	450	347	0,27	0,38
3x240	58,5	10179	5582	501	388	538	409	0,22	0,31
3x300	64,9	12527	6785	565	440	621	471	0,20	0,27
3x50+35	32,3	2765	1596	206	160	192	146	0,77	1,22
3x70+35	35,3	3544	1996	254	197	246	187	0,56	0,87
3x70+50	36,2	3667	2024	254	197	246	187	0,56	0,87
3x95+50	40,6	5022	2905	301	234	298	227	0,43	0,66
3x120+70	45,2	6296	3579	343	266	346	263	0,36	0,54
3x150+70	49,1	7571	4286	387	300	395	304	0,31	0,45
3x185+70	53,6	9116	5168	434	337	450	347	0,27	0,38
3x240+95	59,6	11510	6361	501	388	538	409	0,22	0,31
3x240+120	60,7	11721	6414	501	388	538	409	0,22	0,31
3x300+150	66,8	14371	7738	565	440	621	471	0,20	0,27

U1000RVFV&U1000ARVFV

Type	External Diameter Approximate mm	Approximate Weight Kg/Km		Current carrying Capacity (A)				Voltage drop (1) between phase cosf = 0.8 V/A/KM	
				Burried cable		Open air			
		RVFV	ARVFV	RVFVV	AR2V	RVFV	AR2VFV	RVFV	ARVFV
4x1,5	12,4	268		31		23		21,51	
4x2,5	13,5	336		41		31		13,21	
4x4	14,8	428		53		42		8,26	
4x6	17,1	585		66		54		5,54	
4x10	19,7	823		87		75		3,32	
4x16	22,1	1134	725	113	87	100	77	2,13	3,40
4x25	26,4	1655	1017	144	111	127	97	1,37	2,20
4x35	29,7	2190	1296	174	134	158	120	1,02	1,63
4x50	33,3	2905	1628	206	160	192	146	0,77	1,22
4x70	38,2	4241	2454	254	197	246	187	0,56	0,87
4x95	42,7	5470	3045	301	234	298	227	0,43	0,66
4x120	48,1	6835	3772	343	266	346	263	0,36	0,54
4x150	52,4	8305	4477	387	300	395	304	0,31	0,45
4x185	58,5	10170	5448	434	337	450	347	0,27	0,38
4x240	64,7	12789	6664	501	388	538	409	0,22	0,31
5x1,5	13,4	312		31		23		21,51	
5x2,5	14,4	389		41		31		13,21	
5x4	15,8	500		53		42		8,26	
5x6	18,6	698		66		54		5,54	
5x10	21,3	982		87		75		3,32	
5x16	24,0	1365	854	113	87	100	77	2,13	3,40
5x25	28,9	2019	1221	144	111	127	97	1,37	2,20

(1) Maximum intensities valid for: 3 cables with single cores set up in triangle/layers or 1 cable with 3, 4,5 used for three-phase circuit or 1 cable with two conductors used in a single-phase circuit and for cables set up in underground conduits at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C.

U1000RVFV

Type	Approximate External Diameter mm	Approximate weight Kg/Km	Current carrying capacity (A)		Voltage drop (1) between phase cosf = 0.8 V/A/KM
			Burried cable	Open air	
7x1,5	14,2	361	22	15	21,51
10x1,5	17,0	473	18,5	13	21,51
12x1,5	17,6	523	18	12,5	21,51
14x1,5	18,3	577	17	12	21,51
19x1,5	20,0	704	15	10,5	21,51
24x1,5	22,8	852	14	10	21,51
30x1,5	24,1	999	12,5	9	21,51
37x1,5	25,8	1163	12	8	21,51
7x2,5	15,4	460	28	20,5	13,21
10x2,5	18,8	617	24,5	18	13,21
12x2,5	19,3	684	24	17	13,21
14x2,5	20,1	759	22	16	13,21
19x2,5	22,0	941	19,5	14,5	13,21
24x2,5	25,4	1161	18	13	13,21
30x2,5	26,9	1374	16,5	12	13,21
37x2,5	28,8	1614	15,5	11	13,21

(1) Maximum intensities valid for: 3 single-core cables set up in triangle/layers or 1 cable with 3, 4, 5 three-phase current or 1 cable with two conductors used in a single-phase current and for cables set up in underground pipes at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C.

SOLID and Stranded COPPER ALUMINIUM CABLES XLPE INSULATION Halogen-Free with improved fire behavior NFC32-323

FR-N1X1G1 &FR-N1X1G1-AR

APPLICATIONS

These cables are used in all locations where a high degree of protection against fire and fire damage has to be provided for human life and equipment. These cables may be used indoors and outdoors. They may not be installed directly into the ground and into the water.

CONDUCTOR CONSTRUCTION

FR-N1XG1
Copper: Class 1 or 2 for Sections ≤ 6mm²
Class 2 for Sections > 6mm²
FR-N1X1G1-AR
Aluminium: Class 2

TECHNICAL DATA

Nominal Voltage: 0,6/1 KV.
Maximum Operating temperature: +90° C
Maximum short circuit temperature: +250° C

CORES IDENTIFICATION

Number of conductors	G (With protective conductor)	X (Without protective conductor)
2		Blue, Brown
3	Green / Yellow Blue, Brown	Brown, Black Grey
4	Green / Yellow Brown, Black, Grey	Blue, Brown Black, Grey
5	Green / Yellow Bleue, Black, Grey	Blue, Brown, Black Grey, Black
> 5	Numbers or Colours	
Cables Marking	G	X

DESCRIPTION

CORE
Copper or aluminium

INSULATION
Cross-linked compound

FILLER
FRNC compound

OUTER SHEATH
FRNC Green compound

FR-N1X1G1 &FR-N1X1G1-AR

Type	Approximate External Diameter mm	Approximate weight Kg/Km		Current carrying capacity A		A		Voltage drop beween phases cos Φ = 0.8 V/A/Km	
				Burried cable		Open air			
		Copper	Alu	Copper	Alu	Copper	Alu	Copper	Alu
1 x 1,5	6,0	50		31		24		21	
1 x 2,5	6,5	60		41		33		13	
1 x 4	7,0	80		53		45		8,1	
1 x 6	7,5	100		66		58		5,5	
1 x 10	8,5	150		87		80		3,3	
1 x 16	9,5	200	105	113	77	107	70	2,1	3,50
1 x 25	11,0	300	150	144	98	138	88	1,4	2,23
1 x 35	12,0	400	185	174	118	169	109	1,0	1,64
1 x 50	13,0	510	230	206	139	207	133	0,77	1,42
1 x 70	15,0	730	305	254	172	268	170	0,56	0,87
1 x 95	17,0	990	395	301	207	328	204	0,42	0,65
1 x 120	18,5	1250	485	343	232	382	239	0,35	0,53
1 x 150	20,5	1550	590	387	263	441	277	0,30	0,45
1 x 185	23,0	1900	725	434	294	506	316	0,26	0,37
1 x 240	25,5	2400	920	501	340	599	372	0,22	0,30
1 x 300	28,0	3000	1125	565	384	693	427	0,19	0,26
1 x 400	31,5	3800	1445	663	445	825	512	0,17	0,21
2 x 1,5	10,0	130		37		26		25	
2 x 2,5	10,5	170		48		36		15	
2 x 4	11,5	220		63		49		9,5	
2 x 6	12,5	260		80		63		6,3	
2 x 10	14,5	380		104		86		3,8	
2 x 16	16,0	520	350	136	77	115	83	2,4	
2 x 25	19,5	800	500	173	98	149	94	1,6	
2 x 35	21,5	1050	620	208	118	185	117	1,1	
3 x 1,5	10,5	150		31		23		21	
3 x 2,5	11,5	195		41		31		13	
3 x 4	12,5	255		53		42		8,3	
3 x 6	13,5	315		66		54		5,4	
3 x 10	15,5	470		87		75		3,2	
3 x 16	17,0	655	395	113	64	100	66	2,1	3,4
3 x 25	20,5	1050	570	144	81	127	84	1,3	2,2
3 x 35	23,0	1350	710	174	99	158	104	1,0	1,6
3 x 50	26,0	1800	1050	206	118	192	127	0,75	1,2
3 x 70	30,5	2500	1410	254	145	246	162	0,55	0,86
3 x 95	34,0	3400	1795	301	173	298	197	0,42	0,64
3 x 120	37,5	4200	2220	343	196	346	228	0,35	0,52
3 x 150	42,0	5200	2680	387	221	395	264	0,30	0,44
3 x 185	46,5	6500	3285	434	249	450	301	0,26	0,36

FR-N1X1G1 &FR-N1X1G1-AR

Type	Approximate External diameter mm	Approximate weight Kg/Km		Current carrying capacity A		A		Voltage drop beween phases cos Φ = 0.8 V/A/Km	
				Burried cable		Open air			
		Copper	Alu	Copper	Alu	Copper	Alu	Copper	Alu
4 x 1,5	11,0	180		31		23		21	
4 x 2,5	12,0	225		41		31		13	
4 x 4	13,5	310		53		42		8,3	
4 x 6	14,5	330		66		54		5,4	
4 x 10	17,0	590		87		75		3,2	
4 x 16	18,5	840	455	113	64	100	66	2,1	3,47
4 x 25	22,5	1300	680	144	81	127	84	1,3	2,21
4 x 35	25,0	1700	860	174	99	158	104	1,0	1,62
4 x 50	28,5	2300	1270	206	118	192	127	0,75	1,22
4 x 70	33,5	3200	1705	254	145	246	162	0,55	0,86
4 x 95	37,5	4300	2175	301	173	298	197	0,42	0,64
4 x 120	42,0	5400	2715	343	196	346	228	0,35	0,52
4 x 150	46,5	6700	3255	387	221	395	264	0,30	0,44
4 x 185	54,0	8600	4030	434	249	450	301	0,26	0,36
4 x 240	60,5	11000	5125	501	287	538	355	0,22	0,29
4 x 300	67,0	14000	6210	565	324	621	383	0,19	0,25

FR-N1X1G1 & FR-N1X1G1-AR

Type	Approximate External diameter mm	Approximate weight Kg/Km		Current carrying capacity A				Voltage drop beween phases cos Φ = 0.8 V/A/Km	
				Burried cable		Open air			
		Cui	Alu	Cui	Alu	Cui	Alu	Cui	Alu
3x50+35	27,5	2100	1175	206	118	192	127	0,75	1,22
3 x 70 +50	32,5	3000	1575	254	145	246	162	0,55	0,86
3 x 95 + 50	36,0	3800	1920	301	173	298	197	0,42	0,64
3 x 120+70	40,0	4800	2254	343	196	346	228	0,35	0,52
3 x 150+70	44,0	5800	2673	387	221	395	264	0,30	0,44
3 x 185 +70	48,0	7100	3345	434	249	450	301	0,26	0,36
3 x 240+95	55,5	9400	4275	501	287	538	355	0,22	0,29
7 x 1.5	13	260		22		17		21	
7 x 2.5	14,5	340		28		23		13	
8 x 1.5	15,0	290		22		17		21	
8 x 2.5	16,5	390		28		23		13	
10 x 1.5	16,0	360		18,5		16		21	
10 x 2.5	17,5	480		24,5		22		13	
12 x 1.5	16,5	380		18		14		21	
12 x 2.5	18,0	510		24		20		13	
14 x 1.5	17,0	430		17		14		21	
14 x 2.5	19,0	580		22		20		13	
19 x 1.5	19,0	550		15		13		21	
19 x 2.5	21,0	760		19,5		18		13	
24 x 1.5	22,0	680		14		12		21	
24 x 2.5	24,5	930		18		16		13	
30 x 1.5	23,5	790		12,5		10		21	
30 x 2.5	26,0	1100		16,5		14		13	
37 x 1.5	25,0	950		12		10		21	
37 x 2.5	28,0	1350		15,5		14		13	

(1) Maximum intensities valid for: 3 cables with single cores set up in triangle/layers or 1 cable with 3, 4,5 used for three-phase circuit or 1 cable with two conductors used in a single-phase circuit and for cables set up in underground conduits at 20° C or set up on cable shelves in the open air at 30° C. The voltage drops are valid for a temperature on the core of 90° C.

FLEXIBLE CONTROL CABLE

YSLY-JZ/YSLY-JB

APPLICATIONS

Flexible power, process control and instrumentation cable for industry and mechanical engineering.

CONDUCTOR CONSTRUCTION

Copper fine stranded class 5

TECHNICAL DATA

Nominal voltage Uo : 300 V
Nominal voltage U : 500 V
Test voltage : 2KV , 5 min
Insulation resistance : Min 20 Mohm x km

OTHER CHARACTERISTICS

Max permissible temperature at conductor :
In operation : +70° C
In short circuit : +150° C
Max operating temperature, fixed : -40 - +70° C
Temperature, moved, during installation : -5 - +70° C
Bending radius, fixed installation : 6Xd
Bending radius, moved application : 20Xd

CORE IDENTIFICATION

Numbers and greenyellow for YSLY - JZ cables
Colours acc. VDE 0293 for YSLY - JB cables

DESCRIPTION

CORE
Copper

INSULATION
PVC

OUTER SHEATH
PVC

YSLY - JZ / YSLY - JB

Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km
2x0,5	4,8	32	5x10	17,8	666	19x0,75	11,9	228
2x0,75	5,2	40	5x16	20,9	981	19x1	12,7	275
2x1	5,5	46	5x25	25,7	1500	19x1,5	14,1	368
2x1,5	6,2	61	5x35	30,2	2096	19x2,5	17,3	582
2x2,5	7,6	96	5x50	35,7	2969	21x0,5	11,1	187
2x4	8,8	137	7x0,5	6,7	67	21x0,75	12,4	248
2x6	10,8	203	7x0,75	7,3	86	21x1	13,4	306
2x10	13,6	334	7x1	8,0	107	21x1,5	14,9	409
2x16	15,6	473	7x1,5	8,9	144	21x2,5	18,4	654
2x25	19,0	712	7x2,5	10,9	226	25x0,5	12,6	225
3x0,5	5,1	38	7x4	12,8	337	25x0,75	14,0	298
3x0,75	5,5	48	7x6	15,9	503	25x1	15,1	367
3x1	5,8	57	7x10	19,6	819	25x1,5	16,8	489
3x1,5	6,6	76	7x16	23,0	1215	25x2,5	21,0	790
3x2,5	8,1	119	10x0,5	8,8	101	30x0,5	13,5	268
3x4	9,3	172	10x0,75	9,6	128	30x0,75	15,0	354
3x6	11,7	261	10x1	10,2	154	30x1	16,1	436
3x10	14,5	422	10x1,5	11,2	200	30x1,5	17,9	580
3x16	16,8	614	10x2,5	14,4	336	30x2,5	22,4	936
3x25	20,7	936	12x0,5	8,9	111	34x0,5	14,0	297
3x35	24,3	1311	12x0,75	9,9	147	34,75	15,7	400
3x50	28,4	1834	12x1	10,5	178	34x1	16,9	492
3x70	32,9	2537	12x1,5	11,9	243	34x1,5	18,8	655
4x0,5	5,5	46	12x2,5	14,8	389	34x2,5	23,4	1055
4x0,75	6,2	61	14x0,5	9,5	130	41x0,5	16,4	363
4x1	6,5	72	14x0,75	10,4	167	41x0,75	18,4	488
4x1,5	7,1	93	14x1	11,2	207	41x1	19,8	599
4x2,5	9,0	150	14x1,5	12,5	277	41x1,5	22,0	796
4x4	10,4	218	14x2,5	15,6	445	41x2,5	27,6	1292
4x6	12,8	323	15x0,5	10,0	139	42x0,5	16,6	371
4x10	16,0	534	15x0,75	11,1	184	42x0,75	18,6	498
4x16	18,6	779	15x1	12,0	227	42x1	20,0	611
4x25	23,0	1196	15x1,5	13,4	302	42x1,5	22,2	813
4x35	27,1	1672	15x2,5	16,6	483	42x2,5	27,9	1320
4x50	32,0	2370	15x0,5	10,0	145	50x0,5	17,5	442
4x70	38,3	3375	15x0,75	11,1	193	50x0,75	19,3	582
4x95	43,1	4368	15x1	12,0	238	50x1	20,8	715
4x120	47,0	5397	15x1,5	13,4	318	50x1,5	23,3	963
5x0,5	6,2	58	15x2,5	16,6	508	50x2,5	29,1	1557
5x0,75	6,7	74	18x0,5	10,7	166	61x0,5	18,5	521
5x1	7,1	88	18x0,75	11,9	219	61x0,75	20,7	698
5x1,5	8,0	117	18x1	12,7	264	61x1	22,1	848
5x2,5	9,8	184	18x1,5	14,1	353	61x1,5	24,9	1156
5x4	11,6	273	18x2,5	17,7	573	61x2,5	31,1	1869
5x6	14,2	405	19x0,5	10,5	167			

FLEXIBLE CONTROL CABLE

2YSL(St)CY

APPLICATIONS

As motor connceting cable in machine tools, handling devices,production and processing tools band conveyors and industrial robots.Recommanded for EMC application.Outdoor use only with UV protection (black color). Not for direct burial

CONDUCTOR CONSTRUCTION

Copper fine stranded class 5

TECHNICAL DATA

Nominal voltage Uo : 600 V
Nominal voltage U : 1000 V
Maximum permitted operating voltage in 3 phase systems: 1,7 kv
Test voltage : 3KV , 5 min
Insulation resistance : Min 20 Mohm x km

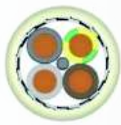
OTHER CHARACTERISTICS

Max permissible temperature at conductor :
In operation : +70° C
In short circuit : +150° C
Max operating temperature, fixed : -30 - +70° C
Temperature, moved, during installation : -5 - +70° C
Bending radius, fixed installation : 10Xd
Bending radius, moved application : 25Xd

CORE IDENTIFICATION

Colors according to VDE 0293(HD308)

DESCRIPTION



CORE
Copper

INSULATION
PE

TAPING
Polyester tape

SCREENING
Aluminium foil coverage 100%
Braiding of tinned copper wire coverage 75%

OUTER SHEATH
PVC Black or transparent

2YSL(St)CY

Type	Sheath Nom Diameter mm	Cable weight Kg/Km
4x1,5	10,7	150
4x2,5	12,0	201
4x4	14,4	294
4x6	16,6	419
4x10	19,2	613
4x16	21,7	857
4x25	26,1	1261
4x35	29,7	1695
4x50	33,8	2308
4x70	38,7	3150
4x95	44,4	4191
4x20	49,0	5235
4x150	54,2	6450
4x185	59,4	7778
4x240	67,1	10099
3x1,5	9,9	124
3x2,5	10,9	161
3x4+3x0,75	13,2	261
3x6+3x1	14,9	362
3x10+3x1,5	17,7	531
3x16+3x2,5	19,8	741
3x25+3x4	23,7	1092
3x35+3x6	26,7	1462
3x50+3x10	30,7	2044
3x70+3x10	35,1	2685
3x95+3x16	39,7	3537
3x120+3x16	44,3	4426
3x150+3x25	48,9	5566
3x185+3x35	53,5	6814
3x240+3x50	60,5	8942

FLEXIBLE CONTROL CABLE

YSLYCY -JZ / YSLYCY - JB

APPLICATIONS

As control and connecting cable in machines, conveyor belts, production lines, machine tool industries, progressive assembly lines, automatic handling apparatus for medium mechanical stress and for fixed installation. The copper screen assures a disturbance –free for data and signal transmission for measuring and control systems.

CONDUCTOR CONSTRUCTION

Copper fine stranded class 5

TECHNICAL DATA

Nominal voltage Uo : 300 V
Nominal voltage U : 500 V
Test voltage : 2KV , 5 min
Insulation resistance : Min 20 Mohm x km

OTHER CHARACTERISTICS

Max permissible temperature at conductor :
In operation : +70° C
In short circuit: +150° C
Max operating temperature, fixed : -40 - +70° C
Temperature, moved, during installation: -5 - +70° C
Bending radius, fixed installation : 6Xd
Bending radius, moved application : 20Xd

CORES IDENTIFICATION

For YSLYCY-JZ: Numbers and green yellow for the protective conductor
For YSLYCY-JB: Colors according to VDE0293 (HD 308)

CORE
Copper class 5

INSULATION
PVC

INNER SHEATH
PVC

SCREENING
Braiding of tinned copper wires
Coverage: 70%

.OUTER SHEATH
PVC black or transparent

YSLYCY

Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km
2x0,5	6,8	73	5x0,5	8,2	109	21x0,5	15,0	354
2x0,75	7,2	83	5x0,75	8,7	127	21x0,75	16,1	419
2x1	7,6	93	5x1	9,3	146	21x1	17,3	487
2x1,5	8,1	109	5x1,5	10,1	182	21x1,5	19,1	614
2x2,5	9,5	154	5x2,5	12,2	270	21x2,5	23,4	916
2x4	11,0	210	5x4	14,0	368	25x0,5	15,7	385
3x0,5	7,1	81	5x6	16,6	532	25x0,75	16,8	465
3x0,75	7,5	93	5x10	20,4	820	25x1	18,2	556
3x1	7,9	106	5x16	24,3	1193	25x1,5	20,1	710
3x1,5	8,7	130	5x25	29,7	1779	25x2,5	24,1	1053
3x2,5	10,2	185	5x35	34,8	2443	27x0,5	15,7	396
3x4	11,7	255	5x50	41,3	3433	27x0,75	16,8	479
3x6	13,9	363	5x70	47,6	4732	27x1	18,6	593
3x10	16,7	531	5x95	53,4	6034	27x1,5	20,1	736
3x16	19,2	734	7x0,5	8,9	130	27x2,5	24,3	1108
3x25	23,9	1102	7x0,75	9,5	154	32x0,5	16,3	443
3x35	27,7	1487	7x1	10,1	178	32x0,75	17,5	539
3x50	33,2	2102	7x1,5	11,0	223	32x1	19,1	658
3x70	38,9	2896	7x2,5	13,5	341	32x1,5	20,7	823
3x95	43,9	3784	7x4	15,4	492	32x2,5	25,0	1249
3x120	47,7	4595	7x6	18,3	683	34x0,5	17,5	481
4x0,5	7,5	91	7x10	22,6	1065	34x0,75	19,0	594
4x0,75	8,0	106	7x16	26,8	1549	34x1	20,4	701
4x1	8,7	127	10x0,5	10,8	180	34x1,5	22,2	888
4x1,5	9,2	151	10x0,75	11,6	214	34x2,5	26,8	1331
4x2,5	10,9	218	10x1	12,6	257	41x0,5	19,2	580
4x4	12,8	309	10x1,5	13,7	321	41x0,75	20,8	710
4x6	15,2	443	10x2,5	16,8	508	41x1	22,4	836
4x10	18,6	675	12x0,5	11,3	200	41x1,5	25,0	1075
4x16	21,8	958	12x0,75	12,0	239	41x2,5	30,5	1620
4x25	26,8	1430	12x1	12,9	281	50x0,5	20,5	649
4x35	31,3	1947	12x1,5	14,3	360	50x0,75	22,2	807
4x50	37,2	2738	12x2,5	17,2	561	50x1	23,9	959
4x70	42,7	3679	15x0,5	12,1	232	50x1,5	26,3	1233
4x95	48,1	4800	15x0,75	12,9	279	50x2,5	32,7	1936
4x120	52,4	5862	15x1	14,0	335	61x0,5	21,7	752
4x150	57,4	7123	15x1,5	15,2	440	61x0,75	23,7	950
4x185	62,6	8521	15x2,5	18,4	660	61x1	25,5	1132
			18x0,5	13,1	269	61x1,5	28,3	1473
			18x0,75	14,0	325	61x2,5	35,1	2309
			18x1	15,2	408			
			18x1,5	16,6	512			
			18x2,5	20,3	780			

FLEXIBLE CONTROL CABLE OIL RESISTANT SCREENED

300 / 500V

FLEXIBLE CONTROL CABLE

YSLCY

APPLICATIONS

For the electrical interconnection of components of production facilities and machine tools if a certain level of screening is required. Limited resistant against universal mineral oil and not intended for permanent use submerged in oil. This cable is intended for indoor use and should be installed mechanically protected

CONDUCTOR CONSTRUCTION

Copper fine stranded class 5

TECHNICAL DATA

Nominal voltage Uo : 300 V
Nominal voltage U : 500 V
Test voltage : 2KV , 5 min
Insulation resistance : Min 20 Mohm x km

OTHER CHARACTERISTICS

Max permissible temperature at conductor :
In operation : +70° C
In short circuit: +150° C
Max operating temperature, fixed : -40 - +70° C
Temperature, moved, during installation: -5 - +70° C
Bending radius, fixed installation : 6Xd
Bending radius, moved application : 20Xd

CORES IDENTIFICATION

For YSLCY-JZ: Numbers and green yellow for the protective conductor

CORE
Copper class 5

INSULATION
PVC

BANDING
Polyester tape

SCREENING
Braiding of tinned copper wires
Coverage: 70%.

OUTER SHEATH
PVC black or transparent

YSLYCY

Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km
2x0,5	5,6	48	5x0,5	7,0	78
2x0,75	5,9	55	5x0,75	7,5	93
2x1	6,3	61	5x1	8,0	110
2x1,5	6,8	72	5x1,5	8,8	144
2x2,5	8,3	104	5x2,5	10,7	211
2x4	9,7	149	5x4	12,6	303
3x0,5	5,9	56	5x6	15,2	455
3x0,75	6,2	65	5x10	18,7	720
3x1	6,7	74	5x16	22,2	1056
3x1,5	7,4	93	5x25	27,1	1573
3x2,5	8,9	140	5x35	31,7	2175
3x4	10,3	191	5x50	37,9	3080
3x6	12,4	296	5x70	43,9	4310
3x10	15,2	463	5x95	49,5	5526
3x16	17,6	654	7x0,5	7,7	97
3x25	21,8	992	7x0,75	8,2	117
3x35	25,2	1348	7x1	8,8	139
3x50	30,6	1938	7x1,5	9,7	180
3x70	35,7	2669	7x2,5	12,0	276
3x95	40,2	3424	7x4	14,0	414
3x120	43,9	4209	7x6	16,6	583
4x0,5	6,3	65	7x10	20,7	940
4x0,75	6,7	77	7x16	24,5	1380
4x1	7,4	92	12x0,5	9,8	151
4x1,5	8,0	114	12x0,75	10,6	184
4x2,5	9,7	171	12x1	11,4	220
4x4	11,3	244	12x1,5	12,8	290
4x6	13,7	371	12x2,5	15,7	467
4x10	17,0	599			
4x16	20,0	873			
4x25	24,4	1297			
4x35	28,4	1784			
4x50	34,0	2526			
4x70	39,2	3446			
4x95	44,3	4440			
4x120	48,3	5471			
4x150	53,4	6823			
4x185	58,2	8175			

FLEXIBLE CONTROL CABLE

HSLH - JZ

APPLICATIONS

Low smoke free halogen flexible power, process control and instrumentation cable for industry and mechanical engineering

CONDUCTOR CONSTRUCTION

Copper fine stranded class 5

TECHNICAL DATA

Nominal voltage Uo : 300 V
Nominal voltage U : 500 V
Test voltage : 2KV , 5 min
Insulation resistance : Min 20 Mohm x km

OTHER CHARACTERISTICS

Max permissible temperature at conductor :
In operation : +70° C
In short circuit: +150° C
Max operating temperature, fixed : -40 - +70° C
Temperature, moved, during installation: -5 - +70° C
Bending radius, fixed installation : 6Xd
Bending radius, moved application : 20Xd

CORES IDENTIFICATION

For YSLCY-JZ: Numbers and green yellow for the protective conductor

FIRE PROPERTIES

Flame retardant : IEC 60332-3-24 CAT C
Combustion gases: EN 50267
Acidity of gases : IEC 60754

CORE

Copper

INSULATION

Flame retardant non corrosive
Compound HI2

OUTER SHEATH

Flame retardant non corrosive
Compound HM2

HSLH

Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km
2x0,5	5,4	41	5x16	21,9	1050	19x0,5	12,4	221
2x0,75	6,2	55	5x25	27,9	1662	19x0,75	14,7	315
2x1	6,5	62	5x35	31,3	2209	19x1	15,5	371
2x1,5	7,0	76	5x50	36,8	3109	19x1,5	17,0	481
2x2,5	8,2	110	6x0,5	7,7	85	19x2,5	19,5	702
2x4	10,2	173	6x0,75	8,9	115	21x0,5	13,8	259
2x6	12,6	260	6x1	9,6	139	21x0,75	16,4	370
2x10	14,6	378	6x1,5	10,3	174	21x1	17,3	436
2x16	16,8	532	7x2,5	11,7	249	21x1,5	19,0	566
2x25	20,6	807	6x4	14,6	391	21x2,5	21,8	827
3x0,5	5,7	47	6x6	18,1	584	25x0,5	14,8	308
3x0,75	6,6	64	6x10	20,8	872	25x0,75	17,5	439
3x1	6,9	74	6x16	24,0	1267	25x1	18,5	519
3x1,5	7,6	96	7x0,5	9,6	116	25x1,5	20,3	673
3x2,5	8,9	138	7x0,75	11,2	159	25x2,5	23,1	971
3x4	11,0	217	7x1	12,0	192	30x0,5	15,3	341
3x6	13,4	318	7x1,5	13,0	242	30x0,75	18,2	488
3x10	15,6	471	7x2,5	14,8	347	30x1	19,2	577
3x16	17,9	672	10x0,5	10,1	137	30x1,5	21,1	750
3x25	22,4	1043	10x0,75	11,7	189	30x2,5	24,0	1085
3x35	25,2	1386	10x1	12,6	227	34x0,5	18,0	417
3x50	29,3	1926	10x1,5	13,6	287	34x0,75	21,2	585
3x70	32,9	2578	10x2,5	15,5	411	34x1	22,8	715
4x0,5	6,2	56	10x0,5	10,6	155	34x1,5	25,0	925
4x0,75	7,1	77	10x0,75	12,5	220	34x2,5	28,8	1359
4x1	7,7	93	10x1	13,2	258	41x0,5	18,2	426
4x1,5	8,5	120	10x1,5	14,5	333	41x0,75	21,4	598
4x2,5	9,7	169	10x2,5	16,5	478	41x1	23,0	730
4x4	12,0	266	14x0,5	11,1	165	41x1,5	25,3	945
4x6	14,7	391	14x0,75	13,2	235	41x2,5	29,1	1389
4x10	17,1	584	14x1	13,9	275	42x0,5	19,1	508
4x16	19,7	839	14x1,5	15,3	356	42x0,75	22,7	723
4x25	25,0	1324	14x2,5	17,4	511	42x1	24,0	855
4x35	28,0	1761	15x0,5	11,1	172	42x1,5	26,5	1120
4x50	33,0	2481	15x0,75	13,2	246	42x2,5	30,0	1612
4x70	38,3	3429	15x1	13,9	289	50x0,5	20,3	598
4x95	43,1	4435	15x1,5	15,3	374	50x0,75	24,1	855
4x120	47,0	5473	15x2,5	17,4	538	50x1	25,5	1014
5x0,5	6,7	68	16x0,5	11,9	196	50x1,5	28,1	1331
5x0,75	8,0	98	16x0,75	13,9	272	50x2,5	31,9	1925
5x1	8,4	113	16x1	14,7	320			
5x1,5	9,5	150	16x1,5	16,1	415			
5x2,5	10,8	211	16x2,5	18,3	597			
5x4	13,4	332	18x0,5	11,9	203			
5x6	16,6	498	18x0,75	13,9	283			
5x10	19,0	731	18x1	14,7	333			
			18x1,5	16,1	433			
			18x2,5	18,3	624			

FLEXIBLE CONTROL CABLES HALOGEN-FREE, FLAME RETARDANT SCREENED

FLEXIBLE CONTROL CABLE

HSLCH - JZ

APPLICATIONS

LSOH cable For the electrical interconnection of components of production facilities and machine tools if a certain level of screening is required. This cable is intended for indoor use.

CONDUCTOR CONSTRUCTION

Copper fine stranded class 5

TECHNICAL DATA

Nominal voltage Uo : 300 V
Nominal voltage U : 500 V
Test voltage : 2KV , 5 min
Insulation resistance : Min 20 Mohm x km

OTHER CHARACTERISTICS

Max permissible temperature at conductor :
In operation : +70° C
In short circuit : +150° C
Max operating temperature, fixed : -40 - +70° C
Temperature, moved, during installation: -5 - +70° C
Bending radius, fixed installation : 6Xd
Bending radius, moved application : 20Xd

CORES IDENTIFICATION

For HSLCH-JZ: Numbers and green yellow for the protective conductor

FIRE PROPERTIES

Flame retardant : IEC 60332-3-24 CAT C
Combustion gases: EN 50267
Acidity of gases : IEC 60754

CORE

Copper class 5

INSULATION

FRNC compound HI2

BANDING

Polyester tape

SCREENING

Braiding of tinned copper wires
Coverage: 70%.

OUTER SHEATH

FRNC compound HM2

HSLCH

Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km	Type	Sheath Nom Diameter mm	Cable weight Kg/Km
2x0,5	6,0	52	5x0,5	7,5	87	21x0,5	14,7	302
2x0,75	6,7	62	5x0,75	8,5	113	21x0,75	17,0	400
2x1	7,1	70	5x1	9,1	130	21x1	18,2	468
2x1,5	7,6	82	5x1,5	9,9	163	21x1,5	20,1	595
2x2,5	8,7	110	5x2,5	11,3	223	21x2,5	23,0	837
2x4	10,9	169	5x4	14,2	348	25x0,5	15,2	341
3x0,5	6,3	61	5x6	17,3	530	25x0,75	17,6	457
3x0,75	7,1	75	5x10	20,3	788	25x1	19,0	544
3x1	7,5	86	5x16	23,8	1134	25x1,5	20,9	692
3x1,5	8,3	107	5x25	29,2	1699	25x2,5	23,7	963
3x2,5	9,4	147	5x35	32,8	2245	27x0,5	15,2	357
3x4	11,6	218	5x50	38,9	3163	27x0,75	17,6	479
3x6	14,2	335	5x70	43,9	4309	27x1	19,4	590
3x10	16,5	507	5x95	49,5	5525	27x1,5	20,9	728
3x16	18,9	703	7x0,5	8,3	108	27x2,5	23,9	1028
3x25	23,5	1073	7x0,75	9,4	141	32x0,5	15,9	406
3x35	26,1	1395	7x1	10,0	164	32x0,75	18,4	549
3x50	31,4	1990	7x1,5	10,9	206	32x1	20,0	665
3x70	35,7	2667	7x2,5	12,6	292	32x1,5	21,6	827
3x95	40,2	3424	7x4	15,8	472	32x2,5	24,7	1174
3x120	43,9	4209	7x6	19,0	678	34x0,5	17,2	443
4x0,5	6,8	71	7x10	22,5	1023	34x0,75	19,9	596
4x0,75	7,7	91	7x16	26,3	1477	34x1	21,5	712
4x1	8,4	109	10x0,5	10,4	150	34x1,5	23,4	895
4x1,5	8,9	131	10x0,75	11,9	198	34x2,5	26,5	1253
4x2,5	10,2	180	10x1	12,7	231	41x0,5	19,1	520
4x4	12,8	281	10x1,5	13,9	290	41x0,75	22,4	712
4x6	15,6	429	10x2,5	16,1	436	41x1	24,0	839
4x10	18,4	656	12x0,5	10,7	168	41x1,5	26,3	1070
4x16	21,4	935	12x0,75	12,2	223	41x2,5	30,1	1514
4x25	26,3	1403	12x1	13,1	261	50x0,5	20,5	625
4x35	29,4	1840	12x1,5	14,5	336	50x0,75	23,7	845
4x50	34,9	2596	12x2,5	16,6	497	50x1	25,4	998
4x70	39,2	3446	15x0,5	11,5	201	50x1,5	27,8	1272
4x95	44,3	4440	15x0,75	13,2	269	50x2,5	32,1	1835
4x120	48,3	5469	15x1	14,3	322	61x0,5	21,6	723
4x150	53,4	6823	15x1,5	15,6	424	61,75	25,3	997
4x185	58,2	8173	15x2,5	17,9	596	61x1	27,1	1180
			18x0,5	12,7	238	61x1,5	29,8	1523
			18x0,75	14,7	342	61x2,5	34,4	2196
			18x1	15,7	400			
			18x1,5	17,1	501			
			18x2,5	19,6	706			

SOLID and Stranded COPPER CABLES PVC INSULATION And SCREENED VDE 0276-627, IEC 60502,NT 88-22

NYCY

APPLICATIONS

These cables are used for fixed installation in buildings, in free air, in ground, in dry or humid locations

CONDUCTOR CONSTRUCTION

Copper: Class 1

TECHNICAL DATA

Nominal Voltage: 0,6/1 KV.
Maximum Operating temperature : +90° C
Maximum short circuit temperature : +160° C

CORE IDENTIFICATION

Colours according to VDE 0293 (HD308)
For more than 5 cores: numbers

DESCRIPTION

CORE

Copper

INSULATION

PVC

FILLER

PVC

CORE COVERING

Concentric conductors of copper wires and copper tape.

OUTER SHEATH

Black PVC

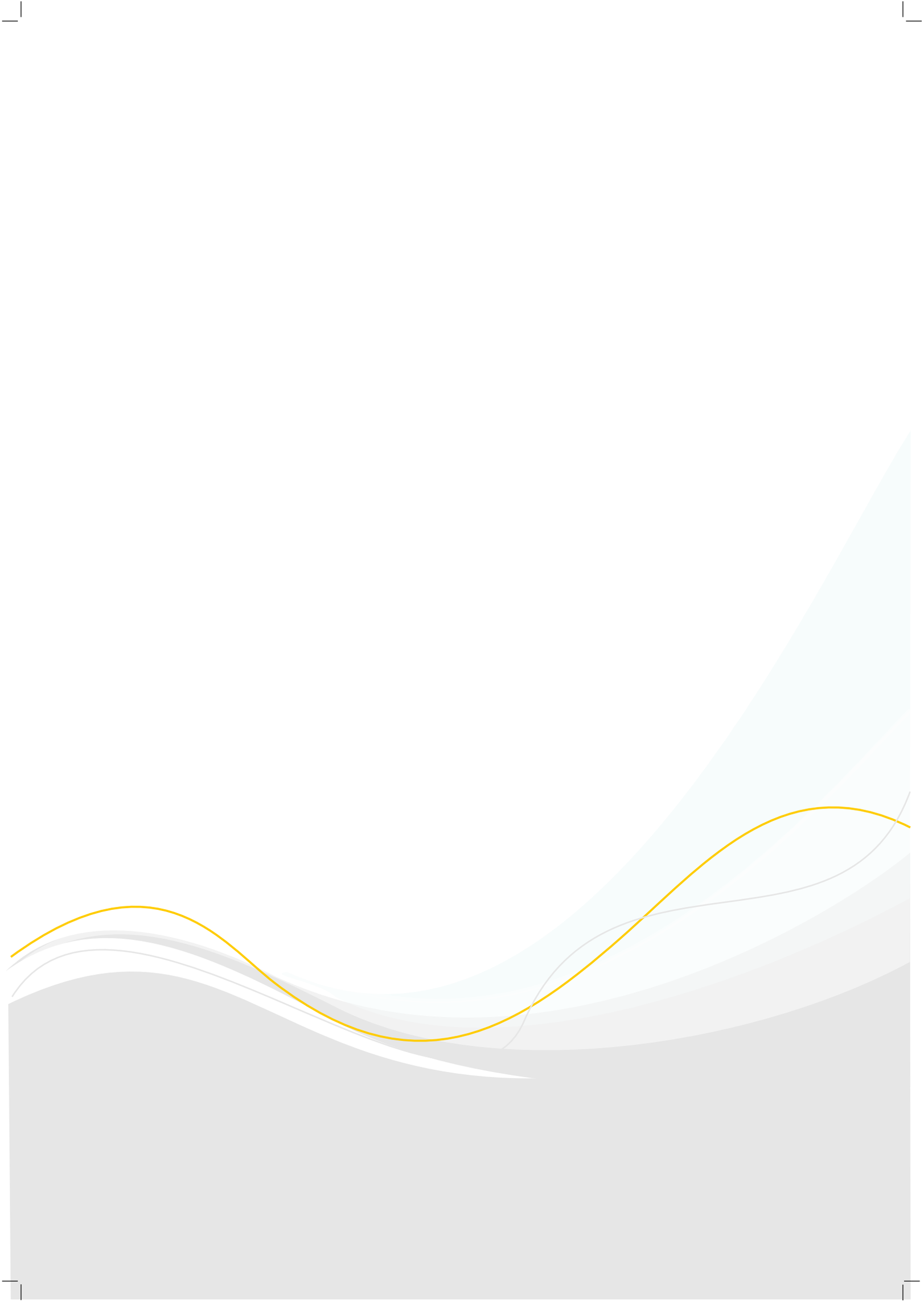
NYCY

Type	Conduct. shape	Overall diam. mm	approx. Weight Kg/km	Rated current carrying capacity (A)	
				Buried 20°C	Free air 30°C
NYCY 2x1.5/1,5	RE	12,4	241	32	22
NYCY 2x2.5/2,5	RE	13,3	290	42	30
NYCY 2x4/4	RE	15,2	396	54	40
NYCY 2x6 /6	RE	16,4	489	67	51
NYCY 2x10 /10	RE	18,4	670	90	70
NYCY 2x16/16	RM	21,2	941	116	94
NYCY 3x1.5/1,5	RE	12,8	264	26	18,5
NYCY 3x2.5/2,5	RE	13,8	323	34	25
NYCY 3x4/4	RE	15,9	446	44	34
NYCY 3x6 /6	RE	17,1	559	56	43
NYCY 3x10 /10	RE	19,2	779	74	60
NYCY 3x16/16	RM	22,3	1104	96	80
NYCY 4x1.5/1,5	RE	13,6	299	26	18,5
NYCY 4x2.5/2,5	RE	14,6	370	34	25
NYCY 4x4/4	RE	17	516	44	34
NYCY 4x6 /6	RE	18,4	651	56	43
NYCY 4x10 /10	RE	20,7	1308	74	60
NYCY 4x16/16	RM	24,0	916	96	80
NYCY 5x1.5/1,5	RE	14,4	343	26	18,5
NYCY 5x2.5/2,5	RE	15,6	428	34	25
NYCY 5x4/4	RE	18,2	604	44	34
NYCY 5x6 /6	RE	19,7	766	56	43
NYCY 5x10 /10	RE	22,3	1085	74	60
NYCY 5x16/16	RM	26,0	1556	96	80
NYCY 7x1.5/2,5	RE	15,3	407	26	18,5
NYCY 7x2.5/2,5	RE	16,6	504	34	25,0
NYCY 8x1.5/2,5	RE	15,8	434	26	18,5
NYCY 8x2.5/4	RE	17,1	560	34	25,0
NYCY 10x1.5/2,5	RE	18,4	539	26	18,5
NYCY 10x2.5/4	RE	20,4	600	34	25,0
NYCY 12x1.5/2,5	RE	18,9	594	26	18,5
NYCY 12x2.5/4	RE	20,6	772	34	25,0
NYCY 14x1.5/2,5	RE	19,6	652	26	18,5
NYCY 14x2.5/6	RE	21,7	873	34	25,0

NYCY

Type	Conduct. shape	Overall diam. mm	approx. Weight Kg/km	Rated current carrying capacity (A)	
				Buried 20°C	Free air 30°C
NYCY 16x1.5/4	RE	20,7	728	26	18,5
NYCY 16x2.5/6	RE	22,6	955	34	25,0
NYCY 19x1.5/4	RE	21,6	811	26	18,5
NYCY 19x2.5/4	RE	23,6	1072	34	25,0
NYCY 21x1.5/6	RE	23,5	906	26	18,5
NYCY 21x2.5/10	RE	26,0	1213	34	25,0
NYCY 24x1.5/6	RE	24,7	994	26	18,5
NYCY 24x2.5/10	RE	27,3	1334	34	25,0
NYCY 30x1.5/6	RE	25,9	1151	26	18,5
NYCY 30x2.5/10	RE	28,6	1557	34	25,0
NYCY 40x1.5/10	RE	30,9	1499	26	18,5
NYCY 40x2.5/10	RE	33,9	1976	34	25,0
NYCY 52x1.5/10	RE	32,1	1795	26	18,5
NYCY 52x2.5/10	RE	35,3	2399	34	25,0
NYCY 61x1.5/10	RE	33,9	2030	26	18,5
NYCY 61x2.5/10	RE	37,2	2730	34	25,0

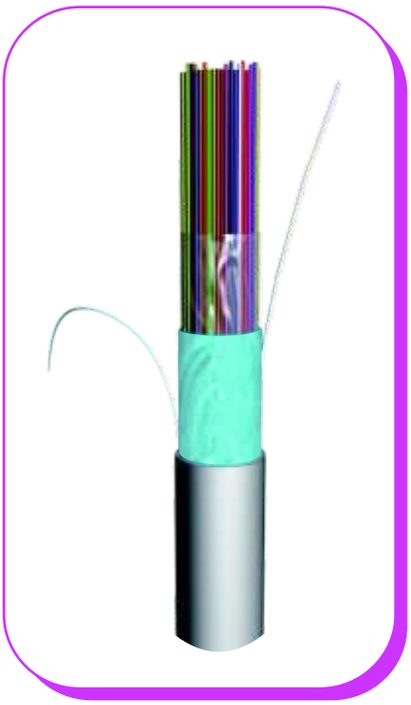
(1) Maximum intensities valid for: 1 cable with 3, 4,5 used for three-phase circuit or 1 cable with two conductors used in a single-phase circuit and for cables set up in underground conduits at 20° C or set up on cable shelves in the open air at 30° C.



Indoor cables

Presentation

Cables of series 278 are used for indoor telephone installations.



Reference standards

UTE C 93-526 and UTE C 93-527 and FRANCE TELECOM specifications

Cable structure

1- Conductors:

Conductors consist of a solid copper with a nominal diameter of 0.4; 0.5 or 0.6 mm.

2- Insulation of conductors:

Conductors are insulated by a colored solid polyethylene layer.

3- Standing:

· Units:
- Pairs elements for cables 1 and 2 pairs.
- Quad elements for all other cables.

· Units stranding:
- Cables with 4 pairs, 8 pairs, 14 pairs, 28 pairs: concentric Stranding of quads.
- Cables with 56 pairs: Stranding of units of 7 quads.
- Cables higher than 56 pairs: Stranding of units of 14 quads.

4- Core wrapping:

A dielectric polyester tape is applied over the cable core.

5- Screen:

Over the wrapped core cable is applied a plastic coated aluminum foil.

6- Drain wire:

It consists of tinned copper wire with a nominal diameter of 0,5 mm.

7- Outer sheath:

The outer sheath consists of flame retarding and unleaded PVC.

ELECTRICAL CHARACTERISTICS

Maximum Conductor resistance Ø 0,4mm	144 ? /km
Maximum Conductor resistance Ø 0,5mm	90 ? /km
Maximum Conductor resistance Ø 0,6mm	63,9 ? /km
Test voltage Cond /Cond Ø 0,4mm	0,6KV (1 min)
Test voltage Cond /Cond Ø 0,5mm& Ø 0,6mm	1,15KV (1 min)
Test voltage Cond /screen	1,5 KV (1 min)
Minimum Insulation resistance	5000M? .km
Maximum Mutual capacitance	57,5 nF/km(1)

(1) The value is 62 nF/km for cables with 2 to 14 pairs.

DIMENSIONS

Number of pairs	Conductor diameter mm	Sheath Thickness (mm)	External diameter mm	Number of pairs	Conductor diameter mm	Sheath Thickness (mm)	External diameter mm
1	0,5	0,80	2,9	28	0,4	1,40	11,3
1	0,6	0,80	3,0	28	0,5	1,50	12,0
2	0,5	0,50	3,9	28	0,6	1,50	14,0
2	0,6	0,50	5,2	56	0,4	1,60	13,5
4	0,5	0,50	4,1	56	0,5	1,60	16,0
4	0,6	0,50	5,0	56	0,6	1,60	19,0
8	0,4	1,30	7,1	112	0,4	1,60	19,8
8	0,5	1,30	7,4	112	0,5	1,80	21,5
8	0,6	1,30	7,5	112	0,6	1,80	24,6
14	0,4	1,40	8,4	224	0,4	1,80	24,7
14	0,5	1,40	9,1	224	0,5	2,00	29,0
14	0,6	1,40	9,8	224	0,6	2,00	33,0

PRESENTATION

These cables are used for internal installations. They are particularly used for telephony distribution and ADSL.
These cables could be supplied without armor (SYT1+) or with armor (SYT2+)
where mechanical damages could be expected.

REFERENCE STANDARDS

UTE C 93-529-2

CABLE STRUCTURE

1- Conductors

Conductors consist of solid copper having a diameter of 0.5(AWG24)
and 0.8 (AWG 20).

2- Insulation of conductors

Foam-skin polyethylene.

3- Stranding

. Units:
two insulated conductors are assembled in pairs
. Units stranding:
- pairs are assembled in concentric cables having a capacity lower than 21 pairs
- Cables having a capacity of 21 pairs or more are assembled in bundles of 7 or 14 pairs

4- Core wrapping

A dielectric polyester tape is applied over the cable core

5- Screen

Over the wrapped cable is applied a plastic coated aluminum foil.

6- Drain wire

It consists of tinned copper wire with a 0.45 mm diameter.

7- Inner sheath

The Inner Sheath (SYT2 +) / Outer sheath(SYT+) consist of unleaded PVC.
It may be thermoplastic without halogens (LSOH).

8- Armor (for SYT2)

Over the inner sheath are applied two steel tapes with a thikness of 0,2 mm.

9- Outer sheath (for SYT2)

The sheath consist of unleaded PVC. or halogen free compound

DIMENSIONS

Designation	diameter of inner shealth SYT1 + (mm)		diameter of outer shealth SYT2 + (mm)	
	AWG 20	AWG 24	AWG 20	AWG 24
1 paire	4,3	3,6	--	--
2 paires	6,0	4,6	8,6	--
3 paires	6,8	5,1	9,5	--
5 paires	7,9	6,3	10,5	8,9
7 paires	8,9	6,7	11,9	10,1
10 paires	10,3	7,7	13	11
15 paires	11,5	8,5	15,8	12,8
21 paires	13,6	10,3	17,8	14,2
30 paires	16,1	11,8	20,2	15,8
42 paires	18,3	13,4	22,8	18,2
56 paires	20,7	15,00	26,6	21,3
112 paires	28,0	20,6	30	25

ELECTRICAL CHARACTERISTICS

Maximum electric resistance of the conductor:

0.5 mm (AWG 24): 96 ? /km

0.8 mm (AWG 20): 37 ? /km

Test voltage in direct current (1mm): 1.5 kV

Minimum Insulation resistance (200VDC): > 1500 M ? /km

Nominal mutual capacity: 60 nF/km

TRANSMISSION CHARACTERISTICS

Frequency (kHz)	Typical linear attenuation. (db / 100m)	Minimum near end crosstalk (NEXT)attenuation. (db)
1	2	70
40	3,5	70
150	6,5	67
300	13	63
1000	25	55
2000	35	50

ENVIRONMENT CHARACTERISTICS

- Flame resistance — Category C2 according to NFC 32070 2.1 or IEC 60332-1
- Temperature of function — - 10° C ÷ +70° C
- RoHS conformity — European Parlement N: 2002/95/EC

PACKAGING

- Packaging in coils or drums of 500m and 1000m.

PRESENTATION

Cable for phone equipment connection such as distributors and centrals.

REFERENCE STANDARDS

UTE 93-533 and UTE 93-534-2

CABLE STRUCTURE

1- Conductors

Conductors consist of red or tinned copper having a diameter of 0.5 mm.

2- Insulation of conductors

Each conductor is insulated by a hard and resistant PVC layer. The nominal thickness of the insulation is of 0.3 mm

3- Stranding

The insulated wires are assembled in pairs, fours, fives, and sixes according to the customer's requirements.

MECHANICAL CHARACTERISTICS

Elongation at break of conductors: ≥15%

Elongation at break of insulation: ≥125%

ELECTRICAL CHARACTERISTICS

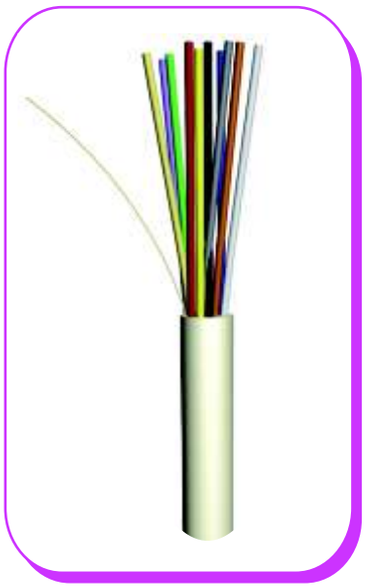
Maximum Conductor resistance Ø 0,5mm 97,8 ? /km
Test voltage 3,750 KV (1 min)
Minimum Insulation resistance1000M? .km

PRESENTATION

They are suitable for indoors telecommunication fixed installation.

REFERENCE STANDARDS

DIN VDE 0815



CABLE STRUCTURE

1- Conductors

Conductors consist of solid copper having a diameter of 0.6 mm and 0.8 mm.

2- Insulation

Conductors are insulated with PVC according to VDE 0207.

3- Stranding

Pairs are stranded together in concentic layers .
The color identification of the wires is in compliance with the VDE 0815.

4- Core wrapping

A polyester tape is applied over the cable core

5- Screen

Over the wrapped core is applied a plastic coated aluminum foil.

6- Drain wire

The Drain wire consists of red copper that has a diameter of 0.4 mm for cables having a maximum capacity of 10 pairs and 0.6 mm diameter for cables with more than 10 pairs.

7- Outer sheath

Outer sheath consist of unleaded and flame retardant PVC.
The sheath color is grey RAL 7035. (For fire alarm cables, the sheath color is red)

ELECTRICAL CHARACTERISTICS

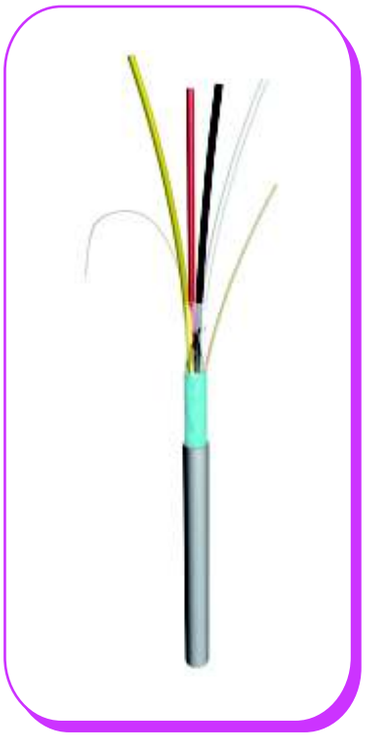
1- Capacitance (800 Hz)	Max.100 nF/km
2- Insulation resistance	Min.100M? .km
3- Electrical resistance	
0,6 mm conductors	Max.130? /km
0,8 mm conductors	Max.73,2? /km
4- Capacity unbalance at (800 Hz)	Max.300pF/100ml
5- Test voltage	800 V DC
6- Operating voltage	300V

PACKAGING

Coils : 100m; 250m
Drums : 500 or 1000m

PRESENTATION

These cables are suitable for indoors telecommunication fixed installation.
These cables are halogen free and flame retardant. They are used in locations with fire hazard to reduce damage in case of fire.



STANDARDS

VDE 0815 standard.

CABLE MANUFACTURE

1- Conductors:

Each conductor consists of a solid wire of annealed, grade A copper, having a diameter of 0,6 mm or 0,8 mm.

2- Insulation:

Each conductor is insulated with a FRNC compound

3- Stranding:

- Four conductors to form a star quad.
- Five quads to form a bundle.
- Bundles assembled in layers.

4- Wrapping:

A polyester wrapping tape is applied over the cable core.

5- Screen:

Over the wrapped core is applied a plastic coated aluminum foil.

6- Drain wire:

The drain wire is an annealed copper having a diameter 0,6 mm for cables with conductor diameter 0,6 mm and 0,8 mm for cables with conductor diameter 0,8 mm.

7- sheath:

The sheath is an FRNC compound.

ELECTRICAL CHARACTERISTICS

1- Capacity (800 Hz)	Max.120 nF/km
2- Insulation resistance	Min.100M? .km
3- Electrical resistance	
0,6 mm conductors	Max.130? /km
0,8 mm conductors	Max.73,2? /km
4- Capacity unbalance at (800 Hz)	Max.300pF/100ml
5- Test voltage	800 V
6- Operating voltage	300V

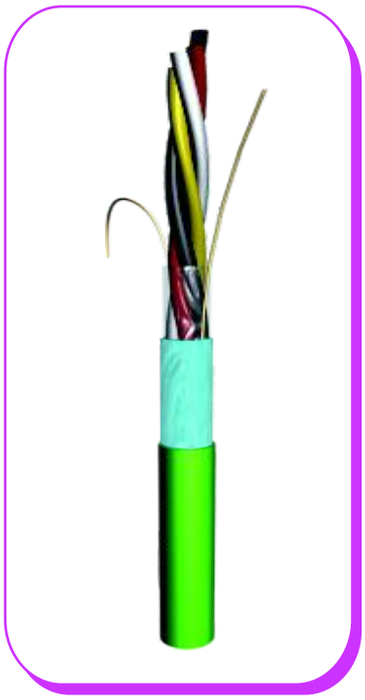
ENVIRONMENTAL PROPERTIES

- Operating temperature (-30 : ±70° C)
- Halogen free
- Fire retardancy according to EN 50266-2-4 IEC 60332-3-24
- Low smoke generation
- No emission of corrosive gases

INSTALLATION CABLE

PRESENTATION

This cable is used for BUS (EIB) system applications, transmission of measured values and for being used in automated and adjustment fields.



REFERENCE STANDARDS

According to the example DIN VDE 08 15

Cable structure

1- Conductors

Conductors consist of a solid annealed copper with a nominal diameter of 0.8 mm.

2- Insulation of conductors

Conductors are insulated with :

- PVC for EIB J-Y(St)Y cables.
- Halogen free compound for EIB-J-H(St)H

3- Stranding

The 4 wires are assembled in a Quad and identified with colors as follows: Red, Black, White and Yellow

4- Core wrapping

A dielectric polyester tape is applied over the cable core

5- Screen

Over the wrapped core cable is applied a plastic coated aluminum foil.

6- Drain wire

The Drain wire consists of tinned copper with 0.4 mm diameter.

7- Outer sheath

PVC green for EIB-J-Y(St)Y cables.
HFFR green compound for EIB-JH(St)H cables

DIMENSIONS

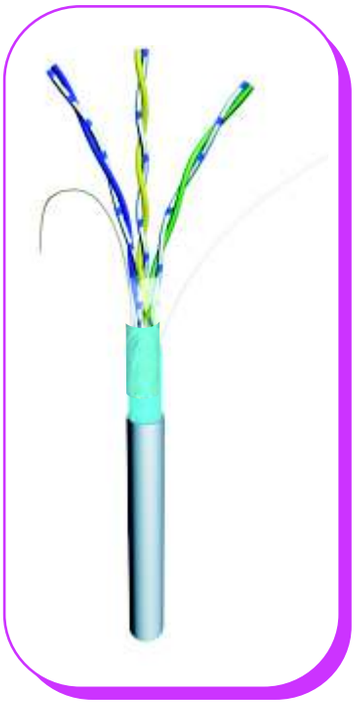
Thickness of the sheath: 1 mm.
Outer diameter: 6,0mm

ELECTRICAL CHARACTERISTICS

1- Capacity (800 Hz)	Max.100 nF/km
2- Insulation resistance	Min.100M? .km
3- Electrical resistance	Max.73,2? /km
4- Capacity unbalance at (800 Hz)	Max.200pF/100ml
5- Voltage test Core/Core	800 V
6- Test voltage Core/Screen	4000V
7- Operating voltage	250V

PRESENTATION

These are transmission cables made for the exchange of equivalent and digital signals in static networks in Austria. They are used as connection cables in telephone, fax, telex and modem systems as well as security system, fire alarm, internal announcement and entry checking systems.
They are also used for signs, sound frequency and data transfer where there is electronic information exchange which requires rays of short curvatures and short distances.
They bring about an easy use for tight places thanks to their good flexibility.



REFERENCE STANDARDS

K35 OVE (Austria)

CABLE STRUCTURE

1- Conductors

Conductors consist of a solid copper with a nominal diameter of 0.6 mm or 0.8 mm.

2- Insulation of conductors

Conductors are insulated with PVC.

3- Stranding

Assembled pairs.
The wires are identified according to OVE K35-1997

4- Core wrapping

A dielectric polyester tape is applied over the cable core

5- Screen

Over the wrapped core cable is applied a plastic coated aluminum foil.

6- Drain wire

The Drain wire consists of tinned copper with a diameter of 0.5 mm.

7- Outer sheath

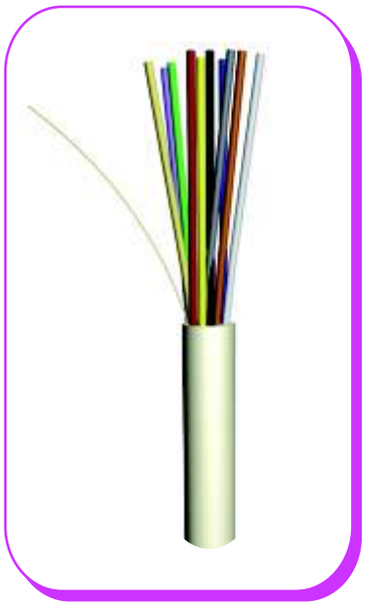
Outer sheath consist of PVC.
The sheath color may be grey RAL 7035. (For fire alarm system, the sheath color is red)

ELECTRICAL CHARACTERISTICS

1- Capacity (800 Hz)	Max.100 nF/km
2- Insulation resistance	Min.100M? .km
3- Electrical resistance	
0,6 mm conductors	Max.130? /km
0,8 mm conductors	Max.73,2? /km
4- Capacity unbalance at (800 Hz)	Max.300pF/100ml
5- Test voltage	800 V
6- Operating voltage	300V

PRESENTATION

These are used in intercommunication cables.



REFERENCE STANDARDS

K50 OVE (Austria)

CABLE STRUCTURE

1- Conductors

Conductors consist of solid copper having a diameter of 0.6 mm for YYSCH cables and 0.8 mm for YR cables.

2- Insulation of conductors

Conductors are insulated by PVC insulating layer covered complying with the Austrian standards OVE K50. The thickness of insulation is such as the electrical requirements are met.

3- Stranding

Stranding is concentric for combinations having more than 5 cores.
Wires are assembled in parallel for small combinations.

4- Outer sheath

Outer sheath consists of unleaded PVC.
It may be grey RAL 7035 or ivory RAL 1013 for YYSCH cables and white RAL 9016 for YR cables.

DIMENSIONS

Cable	thickness of the sheath (mm)	Diameter of the outer sheath (mm)
YYSCH		
2x 0,6	0,60	3,10
3x 0,6	0,60	3,50
4x 0,6	0,60	3,80
5x 0,6	0,60	4,10
6x 0,6	0,60	4,50
10x 0,6	0,80	5,70
16x 0,6	0,80	6,80
26x 0,6	0,90	8,50
YR		
2x 0,8	0,80	4,60
3x 0,8	0,80	5,20
4x 0,8	0,80	5,70
5x 0,8	0,80	6,10
6x 0,8	0,80	6,50
8x 0,8	0,80	7,20
10x 0,8	0,90	8,00

ELECTRICAL CHARACTERISTICS

1- Insulation resistance	Min.50M? .km
2- Electrical resistance	
0,6 mm conductors	Max.130? /km
0,8 mm conductors	Max.73,2? /km
3- Test voltage	1000V
4- Operating voltage	100V

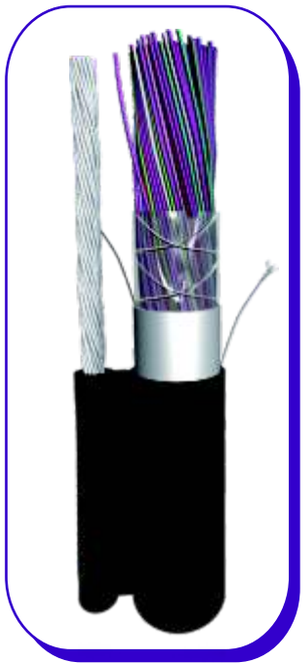
Outdoor network cables

PRESENTATION

Aerial self supporting cables for local distribution telecommunication network.

REFERENCE STANDARDS

UTE C 93-526 and UTE C 93-527-3



CABLE STRUCTURE

1- Conductors

Each conductor consists of solid copper having a diameter of 0.4, 0.6 or 0.8 mm.

2- Insulation of conductors

Conductors are insulated by a colored solid polyethylene layer.
The thickness of insulation is such as the electrical requirements are met.

3- Stranding

- Element of cabling: insulated conductors are assembled in star quads.
- Cabling elements:
  - Quads are assembled in concentric bundles with a capacity of 8 pairs, 14 pairs and 28 pairs.
  - Cables with 56 pairs are assembled in basic bundles of 14 pairs
  - Cables having a capacity higher than 56 pairs are assembled in basic bundles of 28 pairs.

4- Core wrapping

A dielectric polyester tape is applied over the cable core.

5- Screen

On the cable core cover is applied an aluminum tape.

6- Drain wire

The Drain wire consists of tinned copper with 0.5 mm diameter.

7- Outer sheath

The sheath consists of low density polyethylene. It is black and contains 2.5 ± 0.5 mm of carbon black in compliance with the European standards requirements EN 50290-2-24

8- Suspension wire

The suspension strand is made up of assembled galvanized steel wires.

DIMENSIONS

Cable type	Cable sheath		Web		Sheathed suspension strand		
	Thickness	Diameter	Height	Width	Diameter	Thickness	Diameter
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
99-4-8		8,5					
98-8-4	1,5	7,9	1,8	2,0	2,4	0,9	5,0 ± 0,3
98-14-4		8,5					
98-8-6	1,6	8,7					
99-8-8	1,6	10,5					
98-14-6	1,7	10,8					
99-14-8	1,7	13,0	1,8	2,5	3,0	1,0	6,0 ± 0,3
98-28-4	1,6	10,6					
98-28-6	1,8	13,5					
98-56-4	1,8	13,0					
99-28-8	1,8	17,5					
98-56-6	1,9	18,3	1,8	3,5	4,0	1,4	7,8 ± 0,5
98-112-4	1,9	16,5					
99-56-8	2,0	22,6	3,3	3,5	5,5	1,4	9,7 ± 0,5
98-112-6	2,2	23,8					
99-112-8	2,2	29,9	4	4	5,5	1,6	9,7 ± 0,5

ELECTRICAL CHARACTERISTICS

Test	0,4 mm diameter	0,6 mm diameter	0,8 mm diameter
Electrical resistance max.? /km	150	66,6	36,8
Voltage test Conductor/Conductor Kv	0,6	1,15	1,5
Voltage test Conductor/SCREEN Kv	1,5	1,5	2,25
Insulation resistance M? .Km	5000		
Mutual capacitance max. nF/Km	57,5		

PRESENTATION

Aerial self supporting cables for local distribution telecommunication network.

REFERENCE STANDARDS

International Electro-technical Commission, Publication 708- 4 and 708 - 1

STRUCTURE

1- Conductors

Conductors consist of solid copper having a diameter of 0.4, 0.6 or 0.8 mm

2- Insulation of conductors

Conductors are insulated by a colored solid polyethylene layer.
The insulation thickness is such as the electrical requirements are met.

3- Stranding

- Element of cabling:

Cables having a capacity Equal to or lower than 5 pairs are assembled in pairs.

- Cabling elements:
  - Five Quads are assembled to make up a sub-bindle. Quads are identified by the insulated conductor color.
  - Cables having a capacity lower than or equal to 100 pairs are assembles in concentric layers of sub-bundles of 5 Quads (10 pairs).
  - Cables having a capacity equal to or higher than 100 pairs are made up of bundles of 50 pairs.
  - Sub-bundles and bundles are identified with colored ropes.

4- Core wrapping

A dielectric polyester tape is applied over the cable core

5- Screen

On the cable core cover is applied an aluminum tape.

6- Drain wire

It consists of tinned copper with 0.5 mm diameter.

7- External sheath

The sheath consists of low density polyethylene. It is black and contains 2.5 ± 0.5 % of carbon black in compliance with the European standards requirements EN 50290-2-24.

8- Suspension wire

Steel wires assembled galvanized.

Number of pairs	Conductor diameter	Suspension strand diameter	Sheath thickness	Diameter on sheath	Web		Diameter over the suspension strand
					height	width	
5	0,6	2,4	1,30	8,5	2,0	2,0	5,6
10	0,4	2,4	1,30	8,1	2,0	2,0	5,2
	0,6	3,0	1,30	9,8	2,0	2,5	6,2
	0,8	3,0	1,40	11,5	2,0	2,5	6,2
20	0,4	2,4	1,40	9,7	2,0	2,5	6,2
	0,6	3,0	1,40	12,1	2,0	2,5	6,2
	0,8	3,0	1,50	15,6	2,0	2,5	6,2
30	0,4	3,0	1,50	10,9	2,0	2,5	6,2
	0,6	3,0	1,50	14,0	2,0	2,5	6,2
	0,8	4,0	1,50	17,9	2,0	3,5	8,0
50	0,4	3,0	1,50	12,7	2,0	2,5	6,2
	0,6	4,0	1,60	18,2	2,0	3,5	8,0
	0,8	5,5	1,60	22,1	4,0	3,5	9,9
70	0,4	4,0	1,60	15,5	2,0	3,5	8,0
	0,8	4,0	1,60	20,5	4,0	3,5	8,0
	0,6	7,5	1,70	25,3	4,0	4,5	12,3
100	0,4	4,0	1,60	17,5	2,0	3,5	8,0
	0,6	5,5	1,70	22,8	4,0	3,5	9,9
	0,8	7,5	1,80	29,9	4,0	4,5	12,3

ELECTRICAL CHARACTERISTICS

Test	0,4 mm diameter	0,6 mm diameter	0,8 mm diameter
Electrical resistance max.? /km	150	66,6	36,8
Voltage test Conductor/Conductor Kv	0,6	1,15	1,5
Voltage test Conductor/SCREEN Kv	1,5	1,5	2,25
Insulation resistance M? .Km	5000		
Mutual capacitance max. nF/Km	57,5		

PRESENTATION

Petroleum jelly filled cables for local distribution telecommunication networks, suitable for drawing into ducts or directly burried.

REFERENCE STANDARDS

UTE C 93-526 and UTE C 93-527-1

CABLE STRUCTURE

1- Conductors

Conductors consist of solid copper having a diameter of 0.4, 0.6 and 0.8 mm

2- Insulation of conductors

Conductors are insulated by a solid polyethylene layer.
Conductors having a diameter of 0.6 and 0.8 mm are insulated by a cellular polyethylene covered by a solid polyethylene layer (double insulated layer or foam skin). The thickness is such as the electrical requirements are met.

3- Stranding

- Element of cabling: insulated conductors are assembled in Star Quads
- Cabling elements:
  - Quads are assembled in concentric bundles having a capacity of 8 pairs, 14 pairs and 28 pairs.
  - Cables with 56 pairs are assembled in basic bundles of 14 pairs
  - Cables having a capacity higher than 56 pairs are assembled in basic bundles of 28 pairs

4- Core wrapping

The cable core is covered with a:

- A polyester tape
- A water blocking tape

5- Screen

On the cable core is applied a corrugated aluminum tape.

6- Drain wire

The Drain wire consists of tinned copper and has a diameter of 0.5 mm. It is set longitudinally under the metal tape and ensures the screen connection.

7- Outer sheath

The sheath consists of high density polyethylene. It is black and contains 2.5 ± 0.5 mm of carbon black. It is complying with the European standards requirements EN 50290-2-24

8- Cable filling

The cable are fully filled with a high grade, high drop point, petroluem based jelly compound.

DIMENSIONS

TYPE	Sheath thickness (mm)	Max. diameter on sheath (mm)	TYPE	Sheath thickness (mm)	Max. diameter on sheath (mm)
74 - 8 - 4	1.5	12	74 - 112 - 4	2.0	24
74 - 8 - 6	1.6	13.5	74 - 112 - 6	2.2	29
74 - 14 - 4	1.6	13.5	74 - 112 - 8	2.2	35.5
74 - 14 - 6	1.7	15.0	74 - 224 - 4	2.2	30.8
74 - 14 - 8	1.6	17.5	74 - 224 - 6	2.4	37.4
74 - 28 - 4	1.7	16.0	74 - 224 - 8	2.4	46.5
74 - 28 - 6	1.8	17.5	74 - 448 - 4	2.4	41
74 - 28 - 8	1.8	21	74 - 448 - 6	2.6	49
74 - 56 - 4	1.8	19	74 - 896 - 4	2.6	53.3
74 - 56 - 6	2.0	22.5	74 - 896 - 6	2.8	64
74 - 56 - 8	2.0	28	74 - 1792 - 4	2.8	71

ELECTRICAL CHARACTERISTICS

1- Conductor electrical resistance

Conductor diameter (mm)	Individual value (? /km)	Average (? /km)
0,4	150	144
0,6	66,6	63,9
0,8	36,8	35,3

2- Voltage test

The cable Insulation of conductors resists without failure to a direct voltage for one minute.
This is provided in the table below according to the conductor diameter:

Conductors diameter (mm)	Applied voltage (kV)	
	Between conductors	Between conductor and screen
0,4	0,6	1,5
0,6	1,15	1,5
0,8	1,5	2,25

3- Insulation resistance

The values, measured at about 20°C and at 200 V, are higher than 5000 M ? .km;

4- Mutual capacitance

Number of pairs	Average value (nF/km)	Individual value (nF/km)
4	60,0	62,0
Between 8 and 14 pairs	55,0	57,5
28 pairs	55,0	57,5
Beyond 2_ pairs	52,5	57,5

5- Capacitance unbalance

At about 20°C and a frequency of 800Hz , do not exceed the following individual limits:

Individual value (pF/km)	Cable length (m)	Average value (pF/km)
300	70	175
600	100	300
1200	150	500

6- Attenuation (approximately)

The values, measured at about 20°C and a frequency of 800MHz, do not exceed the following maximum limits:

Diameter conductor (mm)	Individual value (dB/km)
0,4	1,79
0,6	1,19
0,8	0,90

PRESENTATION

These cables are for exterior use in local networks. They are plastic-wrapped suitable for underground installations in ducts.

REFERENCE STANDARDS

UTE C 93-526 and UTE C 93-527-2

CABLE STRUCTURE

1- Conductors

Each conductor consists of solid copper having a diameter of 0.4, 0.6 and 0.8 mm

2- Insulation of conductors

Conductors are insulated by a solid polyethylene layer.
The insulator is direct and such thick so as the electric specifications are respected.

3- Stranding

- Element of cabling: insulated conductors are assembled in Star Quads
- Cabling elements:
  - Quads are assembled in concentric cables having a capacity of 8 pairs, 14 pairs and 28 pairs.
  - Cables with 56 pairs are assembled in basic bundles of 14 pairs
  - Cables having a capacity higher than 56 pairs are assembled in basic bundles of 28 pairs

4- Core wrapping

A dielectric polyester tape is applied over the cable core.

5- Screen

Over the cables core cover is applied an aluminium tape.

6- Drain wire

The Drain wire consists of tinned copper and has a diameter of 0.5 mm.

7- Outer sheath

The sheath consists of low density polyethylene. It is black and contains 2.5 ± 0.5 mm of carbon black.
It is complying with the European standards requirements EN 50290-2-24.

DIMENSIONS

Cable	Sheath thickness (mm)	Max. diameter on sheath (mm)	Cable	Sheath thickness (mm)	Max. diameter on sheath (mm)
88 - 8 - 4	1,3	7,8	88 - 112 - 4	1,6	17,2
88 - 8 - 6	1,3	9,2	88 - 112 - 6	1.8	23,2
89 - 8 - 8	1,3	10,7	89 - 112 - 8	1.8	30,2
88 - 14 - 4	1,3	8,7	88 - 224 - 4	1.8	23,0
88 - 14 - 6	1,4	10,7	88 - 224 - 6	2.0	31,2
89 - 14 - 8	1,4	13,2	89 - 224 - 8	2.0	40,2
88 - 28 - 4	1,4	10,2	88 - 448 - 4	2.0	31,5
88 - 28 - 6	1,5	13,4	88 - 448 - 6	2.2	43,0
89 - 28 - 8	1,5	16,2	89 - 448 - 8	2.2	55,8
88 - 56 - 4	1,5	13,2	88 - 896 - 4	2,2	42,2
88 - 56 - 6	1,6	18,0	88 - 896 - 6	2,4	61,0
89 - 56 - 8	1.6	22,7	88 - 1792 - 4	2,4	57,2
			88 – 2688 - 4	2,4	66,5

ELECTRICAL CHARACTERISTICS

1- Conductor electrical resistance

The conductor electrical resistance does not exceed the following values:

Conductor diameter (mm)	Individual value (? /km)	Average (? /km)
0,4	150	144
0,6	66,6	63,9
0,8	36,8	35,3

2- Voltage test

The cable Insulation of conductors resists without failure to a direct voltage for one minute.
The voltage values are provided in the table below according to the conductor diameter:

Conductors diameter (mm)	Applied voltage (kV)	
	Between conductors	Between conductor and screen
0,4	0,6	1,5
0,6	1,15	1,5
0,8	1,5	2,25

3- Insulation resistance

The Insulation resistance values, at 200 V, are higher than 5000 M ? .km;

4- Mutual capacitance

The mutual capacity values do not exceed the following values:

Number of pairs	Average value (nF/km)	Individual value (nF/km)
4	-	62,0
8 à 14 paires	-	57,5
28 paires	55,0	57,5
> 28 paires	52,5	57,5

5- Environmental characteristics

These cables do not contain any substance referred to in the European Decree N° 2002/95/EC(RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.

PRESENTATION

Petroleum jelly filled cables for local distribution telecommunication networks, suitable for drawing into ducts. The armoured cables can be directly burried

STANDARDS

International Electro-technical Commission IEC standard, Publication 708 - 2 and 708 - 1

CABLE MANUFACTURE

1- Conductors

Each conductors consist of solid wire of annealed, grade A copper, having a diameter of 0.4 mm, 0.5 mm, 0.6 mm and 0.8 mm.

2- Insulation

Each Conductors of 0.4 mm diameter is insulated with a layer of solid polyethylene. Each conductors of 0.5mm, 0.6 mm and 0.8 mm diameter are insulated with an inner layer of cellular polyethylene and an outer skin of solid polyethylene (Foam-Skin). The radial thickness of the insulation is such that the electrical requirements are met.

3- Stranding

- Quadding:

Four appropriately coloured Insulated conductors are assembled togother to form a quad.

- Unit stranding:

· Five quads are stranded together to form a unit.
· Cables up to 100 pairs are made up by stranding together units of 5 quads (10 pairs).
· Cables of more than 100 pairs are made up by stranding together Main-units of 50, 100 or 150 pairs.
· Main-units and units are identified with an open lapping coloured polyester tape.

4- filling

The cables are fully filled with a high grade, high drop point, petroleum based, jelly compound.

5- wrapping

A wrapping tape is applied over the cable core. It consistes of:

- An outer layer of absorbing paper materiel.
- An inner layer of insulating polyester tape.

6- Screen

Over the wrapped core cable is applied an aluminum tape, coated on one side with polymer. It has a thickness of about 150 µ m

7- Continuity wire

A tinned copper conductor of 0.5 mm diameter is applied under the screen to ensure its continuity.

8- sheath

The sheath is black low density polyethylene containing 2.5 ± 0.5 % carbon black. The sheath dimensions shall be as follows:

Number of pairs	Minimum sheath thickness (mm)				Nominal Diameter of cable (mm)			
	0,4mm	0,5mm	0,6mm	0,8mm	0,4mm	0,5mm	0,6mm	0,8mm
5 paires	1,40	1,40	1,50	1,50	8,1	9,2	9,9	12,0
10 paires	1,40	1,40	1,50	1,50	9,3	10,5	10,9	13,0
20 paires	1,50	1,50	1,50	1,50	11,1	12,5	12,8	17,0
30 paires	1,50	1,50	1,50	1,50	12,8	14,0	14,7	19,0
50 paires	1,55	1,55	1,60	1,60	15,0	17,0	18,0	23,0
70 paires	1,60	1,60	1,65	1,65	17,3	20,0	20,9	26,5
100 paires	1,70	1,70	1,80	1,80	18,5	23,0	23,0	31,0
150 paires	1,70	1,80	1,90	2,00	23,7	26,9	27,6	37,0
200 paires	2,00	2,00	2,00	2,10	27,0	30,0	31,8	41,0
250 paires	2,00	2,00	2,20	2,20	30,5	32,5	35,5	47,0
300 paires	2,00	2,00	2,20	2,20	31,5	34,5	37,5	49,0
500 paires	2,20	2,30	2,40	2,40	38,8	44,5	48,2	61,0

Number of pairs	Minimum sheath thickness (mm)				Nominal Diameter of cable (mm)			
	0,4mm	0,5mm	0,6mm	0,8mm	0,4mm	0,5mm	0,6mm	0,8mm
600 paires	2,30	2,40	2,60	--	41,8	47,6	51,0	--
800 paires	2,50	2,50	2,80	--	47,1	57,0	60,8	--
900 paires	2,60	2,50	2,90	--	50,3	58,8	62,5	--
1000 paires	2,70	2,60	3,00	--	53,0	61,0	65,0	--
1200 paires	2,80	3,00	3,10	--	55,5	66,0	70,0	--
1500 paires	2,90	--	--	--	64,1	--	--	--
1800 paires	3,00	--	--	--	69,8	--	--	--
2400 paires	3,20	--	--	--	80,0	--	--	--

9- Armouring (only for armoured cables)

Over the sheath are applied two steel tapes of 0,2 mm thickness.
(A paper tape can be applied just under the armouring).

10- External sheath (only for armoured cables)

The external sheath is black low density polyethylene containing 2,5 ± 0,5% carbon black. The nominal thickness of the sheath is 2,00 mm.

ELECTRICAL CHARACTERISTICS

1- Conductor resistance

Diameter of the conductor (mm)	Maximum (? /km)
0,4	150
0,5	95,9
0,6	66,6
0,8	36,8

2- Dielectric strength

The insulation shall resists without any defect to the application of a tension for 60 seconds, according to the table below.

Conductors	Between conductors	Between screen and conductors
0,4 mm	1 kV	3 kV
0,5 mm; 0,6 mm et 0,8 mm	0,5 kV	1 kV

3- Insulation resistance

After steady electrification with 500 V DC voltage for one minute, the Insulation resistance of each conductor in the cable measured with all conductors connected together is:

Conductor diameter (mm)	Insulation Resistance (M? .km)
0,4	5000
0,5; 0,6; 0,8	1500

4- Mutual capacitance

The mutual capacitance of the pairs does not exceed the following values:

Number of pairs	Maximum average (nF / km)	Maximum for 99% of cases (nF / km)
< 20 paires	--	64
⩾ 20 paires	55	64

5- Capacity unbalance

For a 500 meter length cable the capacitance unbalance between adjacent pairs does not exceed 250 pF.

PRESENTATION

They are used as a Subscriber line cable in local distribution networks for short and medium distances.

STANDARD

VDE 816

CABLE STRUCTURE

1- Conductor

Each conductor consists of a solid wire of annealed, grade A copper, having a diameter of 0.6 mm or 0.8 mm

2- Insulation

Each conductor is insulated with a layer of solid polyethylene. The thickness shall be according to DIN VDE 0816 table 4

3- Stranding

- Quadding

Four appropriately coloured insulated conductors are assembled together to form a quad.

- Unit stranding
- Five star quads stranded to sub units; each 5 or 10 sub units stranded to main units and the sub or main units stranded to cable core.

4- Wrapping

A wrapping tape is applied over the cable core. It consist of a layer of insulating polyester tape.

5- Moisture barrier

Over the wrapping tape, is applied an aluminum tape (0.2 mm of thickness) coated on both sides with polymer.

6- Sheath

The sheath is black low density polyethylene (2YM2) containing 2,5 0.5% carbon black.

ELECTRICAL PROPERTIES

1- Electrical resistance

Conductor diameter (mm)	Resistance max. (? /km)
0,6	65
0,8	36,6

2- Dielectric strength

The insulation shall resists without any defect to the application of a tension for 60 sec, according to the table below:

Conductor	Between conductors	Between screen and conductors
0,6 mm et 0,8 mm	0,5 kV	2 kV

3- Insulation resistance

> 500 M? .km

4- Mutual capacitance

Conductor	100% of values (nF / km)	95% of values (nF / km)	80% of values (nF / km)
0.6 mm	< 52	< 50	< 48
0.8 mm	< 55	< 53	< 50

PRESENTATION

They are used as a subscriber line cable in local distribution networks for short and medium distances.
The cavities of the cable core are filled continuously with viscous compound to avoid water penetration.

STANDARD

VDE 816

CABLE STRUCTURE

1- Conductor

Each conductor consists of a solid wire of annealed, grade A copper, having a diameter of 0.6 mm or 0.8 mm.

2- Insulation

Each conductor is insulated with a layer of solid polyethylene. The thickness shall be according to DIN VDE 0816 table 4

3- Stranding

- Quadding

Four appropriately coloured insulated conductors are assembled together to form a quad.

- Unit stranding
- Five star quads stranded to sub units; each 5 or 10 sub units stranded to main units and the sub or main units stranded to cable core.

4- Filling

The cables are fully filled with a high grade, high drop point, petroleum based, jelly compound..

5- Wrapping

A wrapping tape is applied over the cable core It consists of:

- An outer layer of absorbing paper materiel.
- An inner layer of insulating polyester tape.

6- Moisture barrier

Over the wrapping tape, is applied an aluminum tape (0.2 mm of thickness) coated on both sides with polymer.

7- Sheath

The sheath is black low density polyethylene (2YM2) containing 2,5 ± 0.5% carbon black

ELECTRICAL PROPERTIES

1- Electrical resistance.

Conductor diameter (mm)	Resistance max. (? /km)
0,6	65
0,8	36,6

2- Dielectric strength

The insulation shall resists without any defect to the application of a tension for 60 sec, according to the table below:

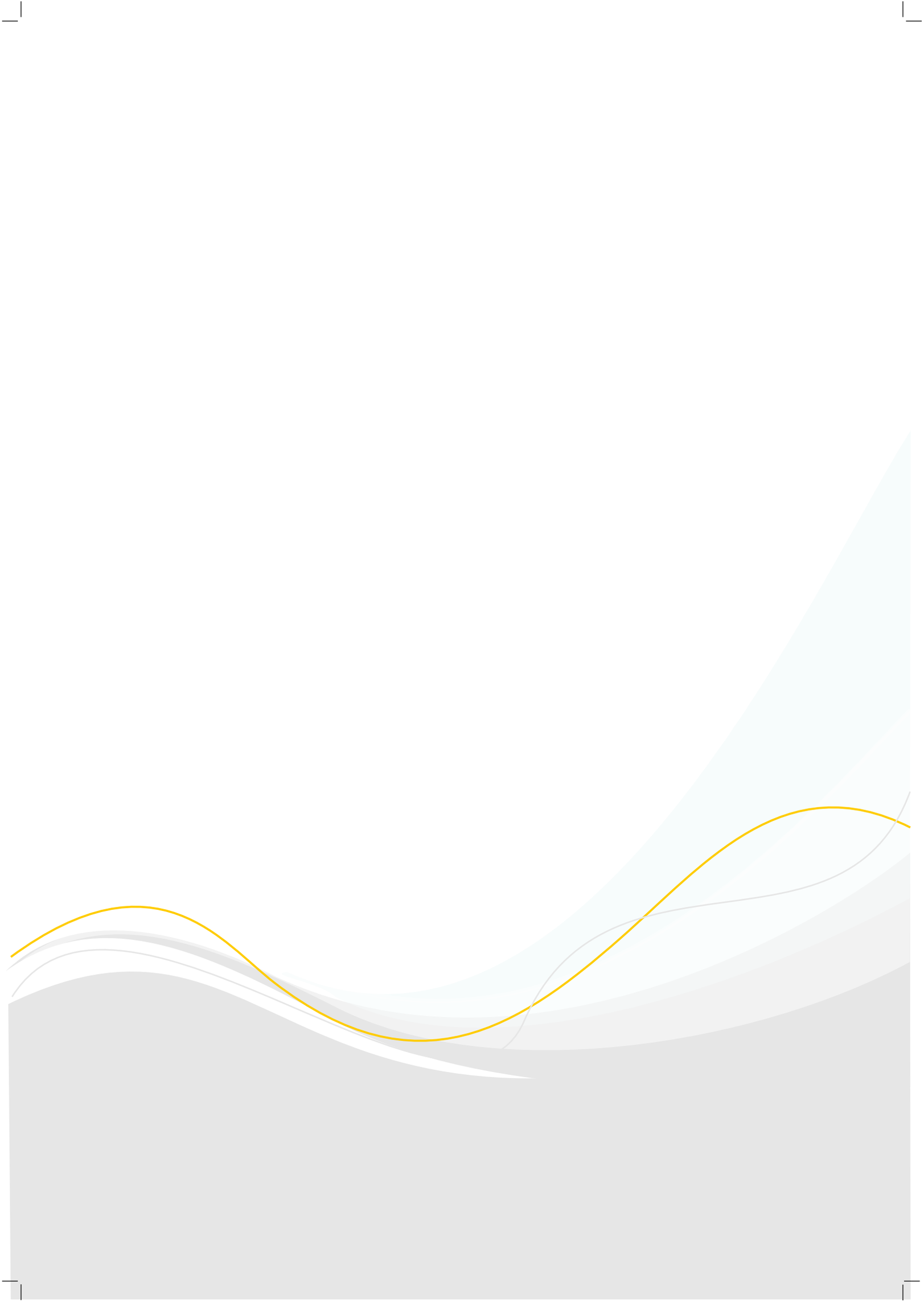
Conductor	Between conductors	Between screen and conductors
0,6 mm et 0,8 mm	0,5 kV	2 kV

3- Insulation resistance

>1500 M? .km

4- Mutual capacitance

Conductor	100% of values (nF / km)	95% of values (nF / km)	80% of values (nF / km)
0.6 mm	< 52	< 50	< 48
0.8 mm	< 55	< 53	< 50



Consumers' connection cables

PRESENTATION

The cable, belonging to 5-10 series, is a filled cable with a quad used for consumers' overhead connection.

REFERENCE STANDARDS

UTE C 93-526 and UTE C 93-527-2

CABLE STRUCTURE

1- Conductors

Conductors are made of annealed copper having a diameter of 0.8 mm.

2- Insulation

Conductors having a diameter of 0,8 mm are insulated by high density colored polyethylene.
The thickness of the insulation is such that the electrical requirements are met.

3- Assembling

Insulated conductors are assembled to form a quad.

4-The protection sheath

Black low density polyethylene complying with UTE 32 - 060

5- Suspension wire

It is made up of assembled galvanized steel wires.

6- Cable filling

The cable cavities are filled with a material commonly called “Petro-jelly” in accordance with technical specifications NFC 93-526.

DIMENSIONS

Diameter on cable core sheath : 7,4 mm ± 20
Web thickness : 1,2 mm ± 2,5 mm
Web height : 1,0 mm ± 2,5 mm
Minimum thickness of cable sheath : 1,7 mm

ELECTRICAL CHARACTERISTCS

Conductor resistance	? /km	35,3	
Insulation resistance	M? .km	⩾1 500	
Dielectric strength	VCC	1 500 for 1 mn	
Mutual capacitance	nF/km	individuel value :⩽ 57,5	
Real-real unblance capacitance in the quad	pF/1800m	90% of value ⩽ 800	100% of value ⩽1200

ENVIRONMENTAL CHARACTERISTICS

These cables do not contain any substance referred to in the European Decree N° 2002/95/EC(RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.

PRESENTATION

It's a filled quad used for consumers' connection. It may be set up underground or in pipes.

REFERENCE STANDARDS

UTE C 93-526 and UTE C 93-527-9

CABLE STRUCTURE

1- Conductors

Annealed copper having a diameter of 0.6 mm or 0.8 mm.

2- Insulation

Conductors are insulated by a high density polyethylene.

3- Assembling

Insulated conductors are assembled in one Star Quad.

4- Cable filling

The cable cavities are filled with a material commonly called "Petro-jelly" in accordance with technical specifications NFC 93-526.

5- Sheath

Black high density polyethylene. It is complying with European standards requirements EN 50290-2-24

DIMENSION

Nominal thickness of cable sheath : 1.1 mm
Minimum thickness on one point of the sheath : 0.84 mm
Diameter on sheath
- 2-pair cables 0.6 mm: 5.2 mm
- 2-pair cables 0.8 mm: 6.00 mm

ELECTRICAL CHARACTERISTCS

Conductor resistance Conductor 0.6 mm Conductor 0.8 mm	**? /**km	**63,9** **35,3**	
Insulation resistance	M**?** .km	⩾ 1 500	
Dielectric strength	VCC	1 500 for 1 mn	
Mutual capacitance	nF/km	individuel value : ⩽ 57,5	
Unbalance capacitance in the quad	pF/1800m	90% of value ⩽ 1300	100% of value ⩽ 2000

ENVIRONMENTAL CHARACTERISTICS

These cables do not contain any substance referred to in the European Decree N° 2002/95/EC(RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.

PRESENTATION

Aerial connecting cable of subscribers in the local area networks of telecommunication.

REFERENCE STANDARDS

UTE C 93-526 and UTE C 93-527-12

CABLE STRUCTURE

1- Conductors

Conductors are made up of annealed copper having a diameter of 0.74 ± 0.02 mm.

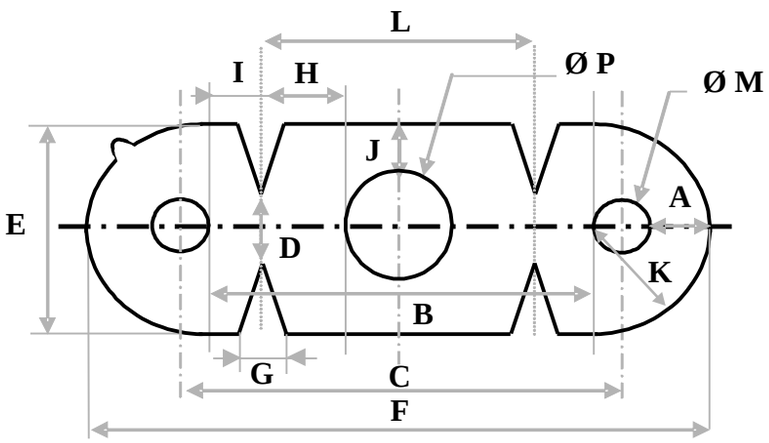
2- Sheath

The sheath is made up of high density polyethylene. It is black and contains 2.5 % of carbon. It is complying with the European standards requirements EN 50290-2-24

3- Suspension wire

It has a diameter of 1.5 mm. It is made up of inert strand out of 7 galvanized steel wires having a diameter of 0.5 mm complying with NFA 47-151.

DIMENSIONAL CHARACTERISTICS



The measurements provided below are in mm

A	B	C	D*	E	F	G	H	I	J*	K	L	M	P
0,80	4,30	5,10	0,40	3,1	7,4	1,0	0,7	0,7		1,5	2,9	0,74	1,5
+0,15 -0,10	± 0,3	± 0,3	+0,25 -0,05	± 0,2	± 0,4				⩽ 0,6			± 0,02	

· J and D satisfy in addition the relation : D < J - 0,15 mm

MECHANICAL CHARACTERISTICS

Minimum tensile strength of conductor : > 20 daN
Elongation at break of conductor : ≥ 15 %
Adherence between conductors insulation : > 20 daN
Tensile strength of the sheath : > 18 MPa
Elongation at break of the sheath : ≥ 300%
Stress breaking of the suspension wire : ≥ 195 daN
Minimum value of adherence of the suspension wire : ≥ 25 daN

ELECTRICAL CHARACTERITICS

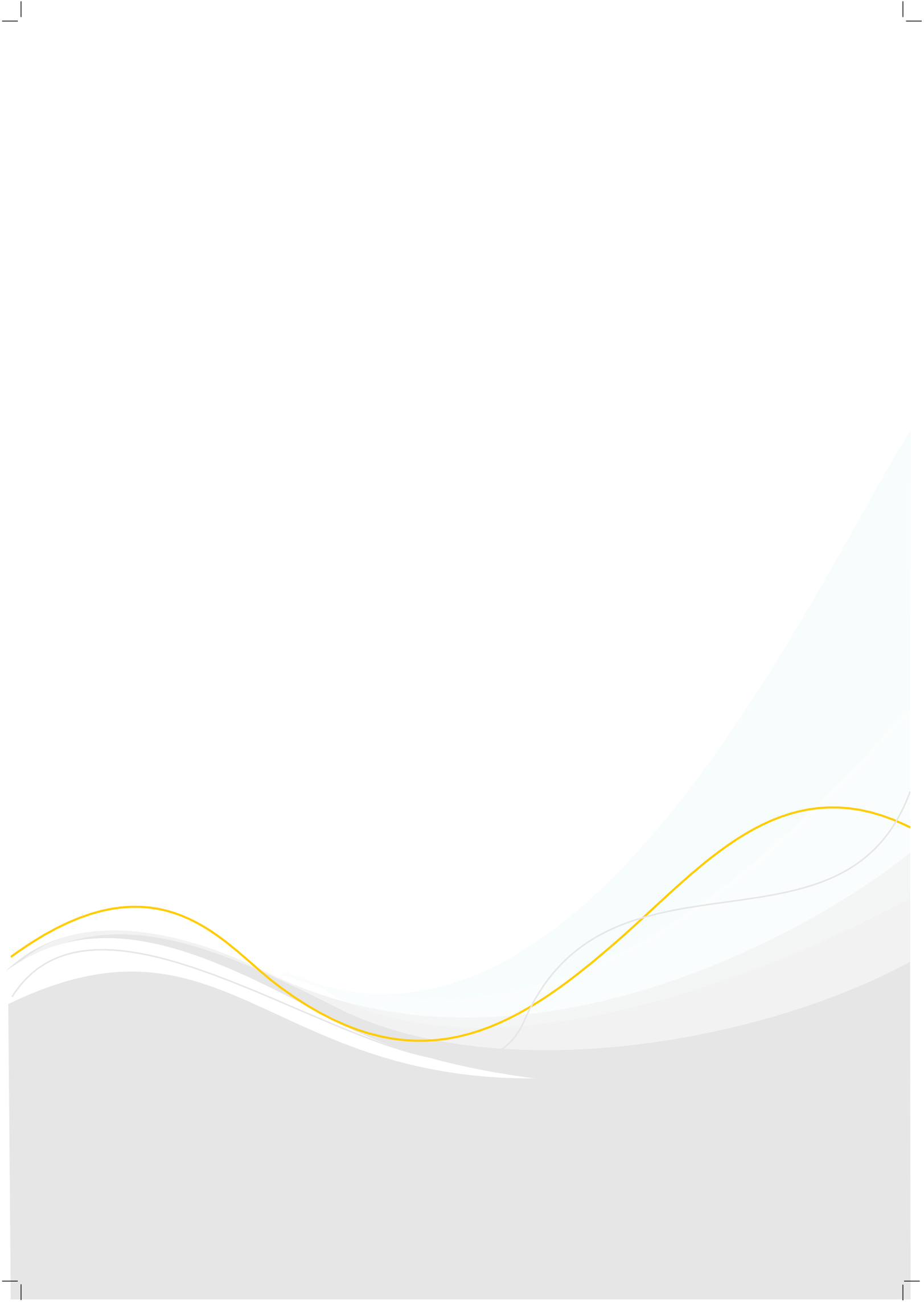
CHARACTERISTCS	LIMITS
Conductor resistance	⩽ 42,89 ? /km
Insulation resistance under direct voltage of 200 V after one-minute	> 5000 ? M.
Dielectric strength	2250 Vcc For one minute
Effective capacitance in water at 800 Hz	< 75 nF/km

STANDARD DELIVERY LENGTHS

- 1200-meter XBN drums.
- 300-meter coils

ENVIRONMENTAL CHARACTERISTICS

These cables do not contain any substance referred to in the European Decree N° 2002/95/EC(RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.



Data cables

SCREEN CABLE FOR DATA TRANSMISSION

Series 298 (Unscreened) & Series 299 (Screened) CATEGORY 5

PRESENTATION

A data cable for high flow transmission in local computer networks.
Its transmission capacity may reach 130 Mbits/s.
It is particulary suitable for the transmission of images, voice and data.

REFERENCE STANDARDS

UTE C 93-531-12 and NF EN C 50288-2-1

CABLE STRUCTURE

1- Conductors

Annealed copper with diameter of 0.5 mm.

2- Insulation

Conductors are insulated by a high density polyethylene layer.
The thickness of insulation is such that the electrical and transmission characteristics are net.

3- Stranding

- Cabling element: Insulated conductors are assembled in pairs.
- Cabling of elements: four pairs are assembled together.

4- Wrapping

The cable core is covered with a polyester tape making a mechanic and electric protection barrier.

5- Screen (only for serie 299 cables)

Over the cable wrapping is applied an aluminiun / polyester tape.

6- Drain Wire (only for serie 299 cables)

A solid tinned copper conductor of 0,5 mm diameter.

7- Sheath

The protection sheath consists of PVC in accordance with NF EN C 50290-2-22, which resists to UV rays complying with NF EN C 50290-2-27. It is unleaded and flame retardant. (Category C2 according to NFC 32070 2.1 or EN 50265-2-2).
The sheath color is selected by the customer.

ELECTRICAL CHARACTERISTICS

Conductor maximum electric resistance	90 ? /km
Test voltage (DC, 1mn)	1 kV
Minimum Insulation resistance (200VCC)	> 5000 M? .km
Nominal mutual capacitance at 800 Hz	55 nF/km
Imput impedance	100 ± 20 ?
Nominal velocity of propagation	> 65 % de C.

TRANSMISSION CHARACTERISTICS

Frequency (MHZ)	Attenuation (dB/100m)	NEXT	ACR (dB)
1	2,1	62	59,9
4	4,3	53	48,7
10	6,6	47	40,4
16	8,2	44	35,8
20	9,2	42,5	33,3
31,25	11,8	39,5	27,7
62,5	17,1	35	17,9
100	22,0	32	10

ENVIRONMENTAL CHARACTERISTICS

- Flame retardant, does not spread flames - Category C2 NFC 32070 2.1
- Operating temperature -10° C +70° C
- Maximum voltage use 180V to 50hz
- These cables do not contain any substance referred to in the European Decree N° 2002/95/EC (RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.

DATA +® F/UTP CAT 5E 4P
DATA +® F/UTP CAT 5E 2x4P

PRESENTATION

FTP cable is used commonly in computer networking. It is suitable for transmission until 130Mbits/s of digital and analogue voice, data and video signals with a low attenuation due to its shielding.

STANDARDS

Our cable is produced according to the ANSI / TIA / EIA 568; ISO / IEC 11801 and EN 50288 standards.

CABLE MANUFACTURE

1- Conductors:

Conductors are solid copper with a nominal diameter of 0,51 mm (AWG 24).

2- Insulation:

Each conductor is insulated with a layer of solid polyethylene.
The radial thickness of the insulation is such that the electrical requirements are met.

3- Stranding:

- Two wires are twisted together in pair.
- Four pairs are stranded together to form the core.

4-Wrapping:

A polyester wrapping tape is applied over the core.

5- Screen:

Over the wrapped core cable is applied an aluminium tape, coated on one side with polyester.

6- Drain and continuity wire:

A solid tinned copper conductor of 0.5 mm diameter is applied under the screen in contact with the aluminium face to ensure its continuity.

7- Rip cord:

A polyester thread is applied under the outer sheath.

8- sheath:

PVC or halogen-free compound (FRNC)

DIMENSIONS

Type	Sheath thickness (mm)	Diameter (mm)	Width (mm)
F / UTP 4 P Cat 5E	0,5	6,2	
F / UTP 2x4 P Cat 5E	0,6	6,4	13,3

ELECTRICAL CHARACTERISTICS

Maximum Resistance at 20° C	: 96 /km
Dielectric strength (1 mn, Vac)	: 1,0 kV
Insulation resistance (min.) at 200 Vdc	: >5000 M.km
Mutual capacitance (nom.)	: 55 nF/km
Characteristic Impedance	: 100 ± 15 ?
Velocity of propagation (f>1 MHz)	: 66 % of C.

TRANSMISSION CHARACTERISTICS

Frequency (Mhz)	Linear Attenuation max. (dB/100m)	Near End Crosstalk (NEXT) min. (dB)	ACR min. (dB)
0,064	0,8	--	--
0,256	1,1	--	--
0,512	1,5	--	--
0,772	1,8	77,7	--
1	2.1	65,3	63,2
4	4.3	56,3	52
10	6.6	50,3	43,7
16	8.2	47,3	39,1
20	9.2	45,8	36,6
31.25	11.8	42,9	31,1
62.5	17.1	38,4	21,3
100	22	35,3	13,3

ENVIRONMENTAL CHARACTERISTICS

- Flame resistance	Category C2 according to NFC 32070 2.1. (IEC 60332-1)
- Temperature of use	-10° C ÷ +70° C
- Voltage max. of use	180 V at 50 Hz
- RoHS conformity	European Parlement N: 2002/95/EC.

PRESENTATION

This is an unshielded data cable for high flow transmission in local computer networks (LAN).
Its transmission capacity may reach 130 Mbits/s.
It's suitable for the transmission of images, voice and data.

REFERENCE STANDARDS

ANSI / EIA-B-2; ISO / IEC 11801 and EN 50288

CABLE STRUCTURE

1- Conductors

Conductors consists of a solid copper with a nominal diameter of 0.51 mm (AWG24)

2- Insulation

Conductors are insulated by a solid polyethylene layer.
The thickness of insulation is such that the electrical and transmission characteristics are net.

3- Stranding

- Cabling element: Insulated conductors are assembled in pairs.
- Cabling of elements: four pairs are assembled together.

4- Outer Sheath

Outer sheath consists of PVC in accordance with NF EN C 50290-2-22.
It is unleaded and flame retardant. (Category C2 according to NFC 32070 2.1 or EN 50265-2-2). It may be thermoplastic without halogens (LSZH).
The color of the sheath is selected by the customer.
A polyester rope is placed under the sheath to help split the sheath while cabling.

ELECTRICAL CHARACTERISTICS

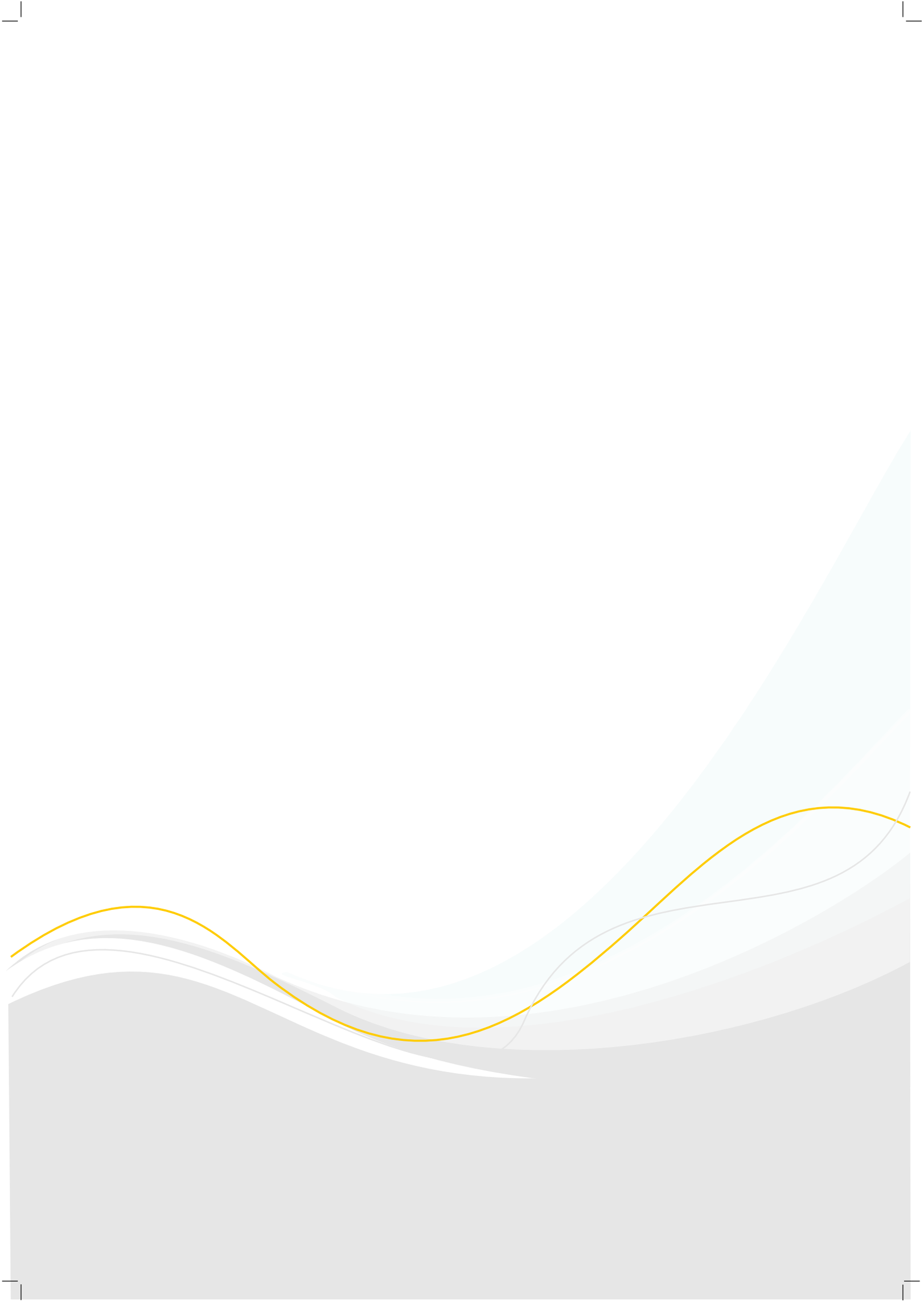
Conductor maximum electric resistance	90 ? /km
Test voltage (1mn)	1 kV
Insulation resistance (200VCC)	> 5000 M? .km
Nominal mutual capacitance at 800 Hz	55 nF/km
Imput impedance	100± 20 ?
Nominal velocity of propagation	66 % de C.

TRANSMISSION CHARACTERISTICS

Frequency (Mhz)	Attenuation (dB/100m)	Minimum Near End CrossTalk NEXT (db)	ACR (dB)
1	2,1	65,3	63,2
4	4,3	56,3	52
10	6,6	50,3	43,7
16	8,2	47,3	39,1
20	9,2	45,8	36,6
31,25	11,8	42,9	31,1
62,5	17,1	38,4	21,3
100	22,0	35,3	13,3

ENVIRONMENTAL CHARACTERISTICS

- Flame retardant - Category C2 NFC 32070 2.1
- Operating temperature -10° C 70° C
- Maximum voltage use 180V
- These cables do not contain any substance referred to in the European Decree N° 2002/95/EC (RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.



DATA +® F/UTP CAT6 350 4P
DATA +® F/UTP CAT6 350 2x4P

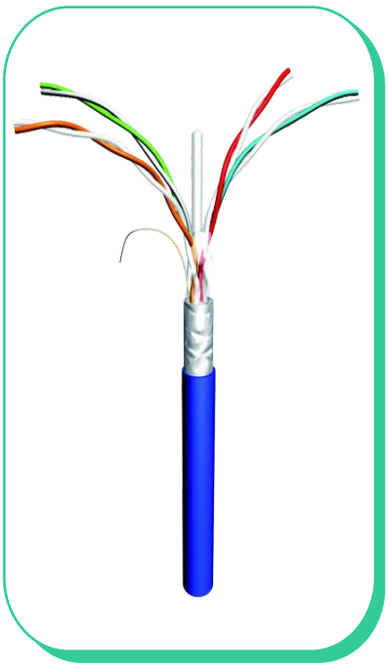
PRESENTATION

Shielded twisted pairs cable F/UTP which is used in a horizontal or vertical configuration.
This cable is used for transmission of digital and analogue voice, Data and video signals.

STANDARDS

ANSI/TIA/EIA-568-B-2-1 ; ISO/IEC 11801 and EN 50288

CONSTRUCTION



1- Conductor

Solid annealed copper having a nominal diameter of 0,55 mm (AWG23)

2- Insulation

Each conductor is insulated with a layer of solid polyethylene.
The radial thickness of the insulation is such that the electrical requirements are met.

3- Stranding:

- Two wires are twisted together in pair.
- Four pairs are stranded together to form the core.
- The pairs are separated with a plastic cross.

4- Wrapping:

A polyester wrapping tape is applied over the core.

5- Screen:

Over the wrapped core cable is applied an aluminium tape, coated on one side with polyester.

6- Drain wire:

A solid tinned copper conductor of 0.5 mm diameter is applied under the screen in contact with the aluminium face to ensure its continuity.

7- Rip cord:

A polyester thread is applied under the outer sheath.

8- sheath:

The sheath is of PVC or halogen-free compounds. (LSZH), flame retardant according to IEC 60332-1.
The colour depends to the customer.
A black ink marking is applied over the sheath every meter.

ELECTRICAL CHARACTERISTICS

Maximum Resistance at 20° C	: 89 /km
Dielectric strength (1 mn, Vac)	: 1,0 kV
Insulation resistance (min.) at 200 Vcc	: >5000 M.km
Mutual capacitance (nom.)	: 52 nF/km
Characteristic Impedance	: (From 1 to 100 Mhz) :100 ± 15 ? (From 100 to 250 Mhz): 100 ± 20 ?
Velocity of propagation (f>1 MHz)	: 66 % of C.

TRANSMISSION CHARACTERISTICS

F(MHz)	Attenuation (dB/100m)	NEXT (dB/100m)	PSNEXT (dB)	ELFEXT (dB/100)	PSELFEXT (dB/100)	Return Loss min. (dB)
1	2.0	74.3	72.3	67.8	64.8	20.0
4	3.8	65.3	63.3	55.8	52.8	23.0
10	6.0	59.3	57.3	47.8	44.8	25.0
16	7.6	56.2	54.2	43.7	40.7	25.0
20	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
100	19.8	44.3	42.3	27.8	24.8	20.1
200	29.0	39.8	37.8	21.8	18.8	18.0
250	32.8	38.3	36.3	19.8	16.8	17.3
350	37,5	36	34	17	14	16,3

ENVIRONMENTAL CHARACTERISTICS

- Flame resistance — Category C2 according to NFC 32070 2.1. (IEC 60332-1)
- Temperature of function — -10° C ÷ +70° C
- Voltage max. of use — 180 V at 50 Hz
- RoHS conformity — European Parlement N: 2002/95/EC.

DATA +® F/UTP CAT6A 500 4P
DATA +® F/UTP CAT6A 500 2x4P

PRESENTATION

Shielded twisted pairs cable F/UTP which is used in a horizontal or vertical configuration.
It is made up of a central element PE cross facilitating the holding of the twisted pairs.
Its shielding with a very high coverage allows him a use in a disturbed environment and in a correct operation up to 500 MHZ.
This cable is used for transmission of digital and analogue voice, Data and video signals.

STANDARDS

ANSI/TIA/EIA-568-B-2-1 ; ISO/IEC 11801 and EN 50288

CONSTRUCTION

1- Conductor

Solid annealed copper having a diameter of 0,570 mm (AWG23).

2- Insulation

Each conductor is insulated with a layer of solid polyethylene.
The radial thickness of the insulation is such that the electrical requirements are met.

3- Stranding

- Two wires are twisted together in pair.
- Four pairs are stranded together to form the core.
- The pairs are separated with a plastic cross.

4- Wrapping

A polyester wrapping tape is applied over the core.

5- Screen:

Over the wrapped core cable is applied an aluminium tape, coated on one side with polyester.

6- Drain and continuity wire:

A solid tinned copper conductor of 0.5 mm diameter is applied under the screen in contact with the aluminium face to ensure its continuity.

7- Rip cord:

A polyester thread is applied under the outer sheath.

8- sheath:

The sheath is of PVC or halogen-free compounds. (LSZH), flame retardant according to IEC 60332-1.
The colour depends to the customer.
A black ink marking is applied over the sheath every meter.

ELECTRICAL CHARACTERISTICS

Resistance at 20° C (max.)	: 89 /km
Dielectric strength (1 mn, Vac)	: 1,0 kV
Insulation resistance (min.) at 200 Vcc	: >5000 M.km
Mutual capacitance (nom.)	: 52 nF/km
Characteristic Impedance	: (From 1 to 100 Mhz) :100 ± 15 ? (From 100 to 250 Mhz): 100 ± 20 ?
Velocity of propagation (f>1 MHz)	: 66 % of C.

TRANSMISSION CHARACTERISTICS

F(MHz)	Attenuation (dB/100m)	NEXT (dB/100m)	PSNEXT (dB)	ELFEXT (dB/100)	PSELFEXT (dB/100)	Return Loss min. (dB)
1	2.0	74.3	72.3	67.8	64.8	20.0
4	3.8	65.3	63.3	55.8	52.8	23.0
10	6.0	59.3	57.3	47.8	44.8	25.0
16	7.6	56.2	54.2	43.7	40.7	25.0
20	9.5	53.3	51.3	39.8	36.8	24.3
31.25	10.7	51.9	49.9	37.9	34.9	23.6
100	19.8	44.3	42.3	27.8	24.8	20.1
200	29.0	39.8	37.8	21.8	18.8	18.0
250	32.8	38.3	36.3	19.8	16.8	17.3
300	34.2	37.1	35.1	18.3	15.3	16.8
350	37.1	36.0	34.0	17.1	14.1	16.4
400	40.0	35.3	33.3	15.8	12.8	15.9
500	45.2	33.8	31.8	13.8	10.8	15.2

ENVIRONMENT CHARACTERISTICS

- Flame resistance — Category C2 according to NFC 32070 2.1. (IEC 60332-1)
- Temperature of function — -10° C ÷ +70° C
- Voltage max. of use — 180 V at 50 Hz
- RoHS conformity — European Parlement N: 2002/95/EC.

DATA +® U/UTP 4P CAT6-250MHZ
DATA +® U/UTP 2x4P CAT6-250MHZ

PRESENTATION

Unshielded twisted pairs cable UTP which is used in a horizontal or vertical configuration.
It is made up of a central element PE cross facilitating the holding of the twisted pairs.
This cable is used for transmission of digital and analogue voice, Data and video signals.

STANDARDS

ANSI/TIA/EIA-568-B-2-1 ; ISO/IEC 11801 and EN 50288

CONSTRUCTION

1- Conductor

Solid annealed copper AWG23.

2- Insulation

Each conductor is insulated with a layer of solid polyethylene.
The radial thickness of the insulation is such that the electrical requirements are met.

3- Stranding

- Two wires are twisted together in pair.
- Four pairs are stranded together to form the core.
- The pairs are separated with a cross.

4- Drain and continuity wire:

A solid tinned copper conductor of 0.5 mm diameter is applied under the screen in contact with the aluminium face to ensure its continuity.

5- Rip cord:

A polyester thread is applied under the outer sheath.

8- sheath:

The sheath is of lead free PVC according to NF EN 50290-2-22, flame retardant according to IEC 60332-1.
It can be of halogen-free compunds. (LSZH)
A black ink marking is applied over the sheath every meter.

ELECTRICAL CHARACTERISTICS

Resistance at 20° C (max.)	: 89 ? /km
Dielectric strength (1 mn, Vac)	: 1,0 kV
Insulation resistance (min.) at 200 Vcc	: >5000 M? .km
Mutual capacitance (nom.)	: 50 nF/km
Characteristic Impedance	: (From 1 to 100 Mhz) :100 ± 15 ?
Velocity of propagation (f>1 MHz)	: 72 % of C.

TRANSMISSION CHARACTERISTICS

F(MHz)	Attenuation (dB/100m)	NEXT (dB/100m)	PSNEXT (dB)	ELFEXT (dB/100)	PSELFEXT (dB/100)
1	2.0	74.3	72.3	67.8	64.8
4	3.8	65.3	63.3	55.8	52.8
10	6.0	59.3	57.3	47.8	44.8
16	7.6	56.2	54.2	43.7	40.7
20	9.5	53.3	51.3	39.8	36.8
31.25	10.7	51.9	49.9	37.9	34.9
100	19.8	44.3	42.3	27.8	24.8
200	29.0	39.8	37.8	21.8	18.8
250	32.8	38.3	36.3	19.8	16.8

ENVIRONMENT CHARACTERISTICS

- Flame resistance — Category C2 according to NFC 32070 2.1. (IEC 60332-1)
- Temperature of function — -10° C ÷ +70° C
- Voltage max. of use — 180 V at 50 Hz
- RoHS conformity — European Parlement N: 2002/95/EC.

DATA +® F/FTP CAT 6A

APPLICATION

Shielded twisted pairs cable F/FTP which is used in a horizontal or vertical configuration. Its shielding with a very high coverage allows him a use in a disturbed environment and a correct operation up to 555 MHZ.
This cable is used for transmission of digital and analogue voice,Data and video signals.

STANDARDS

NF EN 50173-1 ;ISO/IEC 11801 ; CEI 61156-5

CONSTRUCTION

1- Conductor

Solid annealed copper AWG23.

2- Insulation

Each conductor is insulated with 3 layers of polyethylene compound skin foam skin..

3- Stranding

- Two wires are twisted together in a pair..
- Each pair is screened with an overlapped laminated aluminium foil.
- The screened pairs are stranded together.

4- Overall screen

Aluminium polyester foil

5- Drain and continuity wire

A solid tinned copper conductor applied under the screen in contact with the aluminium face to ensure its continuity.

6- Rip cord

A polyester thread is applied under the outer sheath.

7- sheath

LSZH compound.

ELECTRICAL CHARACTERISTICS

Resistance at 20° C (max.)	: 95 ? /km
Dielectric strength (1 mn, Vac)	: 1,0 kV
Insulation resistance (min.) at 200 Vcc	: >5000 M? .km
Mutual capacitance (nom.)	: 44 nF/km
Characteristic Impedance	: (From 1 to 100 Mhz) :100 ± 15 ?
Velocity of propagation (f>1 MHz)	: 65 % of C.

Frequency (MHz)	Attenuation max. (dB/100m)	NEXT	PSNEXT (dB)	ELFEXT (dB/100)	PSELFEXT (dB/100)	Return loss dB
4	3.8	66.3	63.3	55.8	52.8	23
10	6.0	60.3	57.3	47.8	44.8	25
16	7.6	57.2	54.2	43.7	40.7	25
20	9.5	55.8	51.3	39.8	36.8	25
31.25	10.7	52.9	49.9	37.9	34.9	23.6
100	19.8	45.3	42.3	27.8	24.8	20.1
200	29.0	40.8	37.8	21.8	18.8	18
300	34.2	38.1	35.1	18.3	15.3	16.8
500	45.2	34.8	31.8	13.8	10.8	15.2

ENVIRONMENTAL CHARACTERISTICS

- Fire behaviour (IEC 60332-1); IEC 60754; IEC 61034
- Temperature of function -20° C ÷ +60° C
- Operating voltage 100V max
- Bending radius Static: 4xd Dynamic: 8xd

DATA +® S/FTP CAT 7 4P -600 MHZ
DATA +® S/FTP CAT 7 2X4P -600 MHZ

APPLICATION

For connection of IT system units in the desktop area, between workstations and as riser cable up to 600 Mbit/s (category 7+). It fully complies with the requirements to electromagnetic compatibilty (EMC) of the European Standard EN 55022. Additional, the copper braiding ensures perfect matching with screened connectors.

STANDARDS

NF EN 50173-1 ;ISO/IEC 11801 ; CEI 61156-5

CONSTRUCTION

1- Conductor

Solid annealed copper AWG23.

2- Insulation

Each conductor is insulated with 3 layers of polyethylene compound skin foam skin..

3- Stranding

- Two wires are twisted together in a pair..
- Each pair is screened with an overlapped laminated aluminium foil.
- The screened pairs are stranded together.

4- Overall screen

Braiding of tinned copper wire

5- Drain and continuity wire

A solid tinned copper conductor applied under the screen in contact with the aluminium face to ensure its continuity.

6- Rip cord

A polyester thread is applied under the outer sheath.

7- sheath

LSZH compound

DIMENSIONS

Type of table	Sheath thickness (mm)	Diameter (mm)	Width (mm)
S/FTP CAT 7 4P	0.5 – 0.6	7.5 – 8	--
S/FTP CAT 7 2x4P	0.5 – 0.6	7.5 – 8	17 –18

ELECTRICAL CHARACTERISTICS

Resistance at 20° C (max.) : 75 ? /km
Dielectric strength (1 mn, Vac) : 1,0 kV
Insulation resistance (min.) at 200 Vcc : >5000 M? .km
Mutual capacitance (nom.) : 44 nF/km
Characteristic Impedance : (From 1 to 100 Mhz) :100 ± 15 ?
(From 100 to 250 Mhz) :100 ± 20 ?
Velocity of propagation (f>1 MHz) : 79 % of C.

F(MHz)	Attenuation (dB/100m)	NEXT (dB/100m)	PSNEXT (dB)	ELFEXT (dB/100)	PSELFEXT (dB/100)	Return loss (dB/100)
1	2,0	78,0	75,0	78	75,0	20,0
10	5,9	78,0	75,0	74	71	25
16	7,4	78,0	75,0	69.9	66.9	25
31,25	10,4	78,0	75,0	64.1	61.1	23,6
62,5	14,9	75,5	72,5	58.1	55.1	21,5
100	19,0	72,4	69,4	54	51	20,1
200	27,5	67,9	64,9	48	45	18,0
300	34,2	65,2	62,2	44.5	41.5	17,3
600	50,1	60,7	57,7	38.4	35.4	17,3

ENVIRONMENTAL CHARACTERISTICS

- Fire behaviour (IEC 60332-1); IEC 60754; IEC 61034
- Temperature of function -20° C ÷ +60° C
- Operating voltage 100V max
- Bending radius Static: 4xd Dynamic: 8xd

DATA +® S/FTP CAT 7 4P -1000 MHZ
DATA +® S/FTP CAT 7 2X4P -1000 MHZ

APPLICATION

For connection of IT system units in the desktop area, between workstations and as riser cable up to 1000 Mbit/s (category 7+). It fully complies with the requirements to electromagnetic compatibilty (EMC) of the European Standard EN 55022. Additional, the copper braiding ensures perfect matching with screened connectors.

STANDARDS

NF EN 50173-1 ;ISO/IEC 11801 ; CEI 61156-5

CONSTRUCTION

1- Conductor

Solid annealed copper AWG23.

2- Insulation

Each conductor is insulated with 3 layers of polyethylene compound skin foam skin..

3- Stranding

- Two wires are twisted together in pair..
- Each pair is screened with an overlapped laminated aluminium foil.
- The screened pairs are stranded together.

4- Overall screen

Braiding of tinned copper wire

5- Drain and continuity wire

A solid tinned copper conductor applied under the screen in contact with the aluminium face to ensure its continuity.

6- Rip cord

A polyester thread is applied under the outer sheath.

7- sheath

LSZH compound

DIMENSIONS

Type	Sheath thickness (mm)	Diameter (mm)	Width (mm)
S/FTP CAT 7A 4P	0.5 – 0.6	7.5 – 8	--
S/FTP CAT 7A 2x4P	0.5 – 0.6	7.5 – 8	17 –18

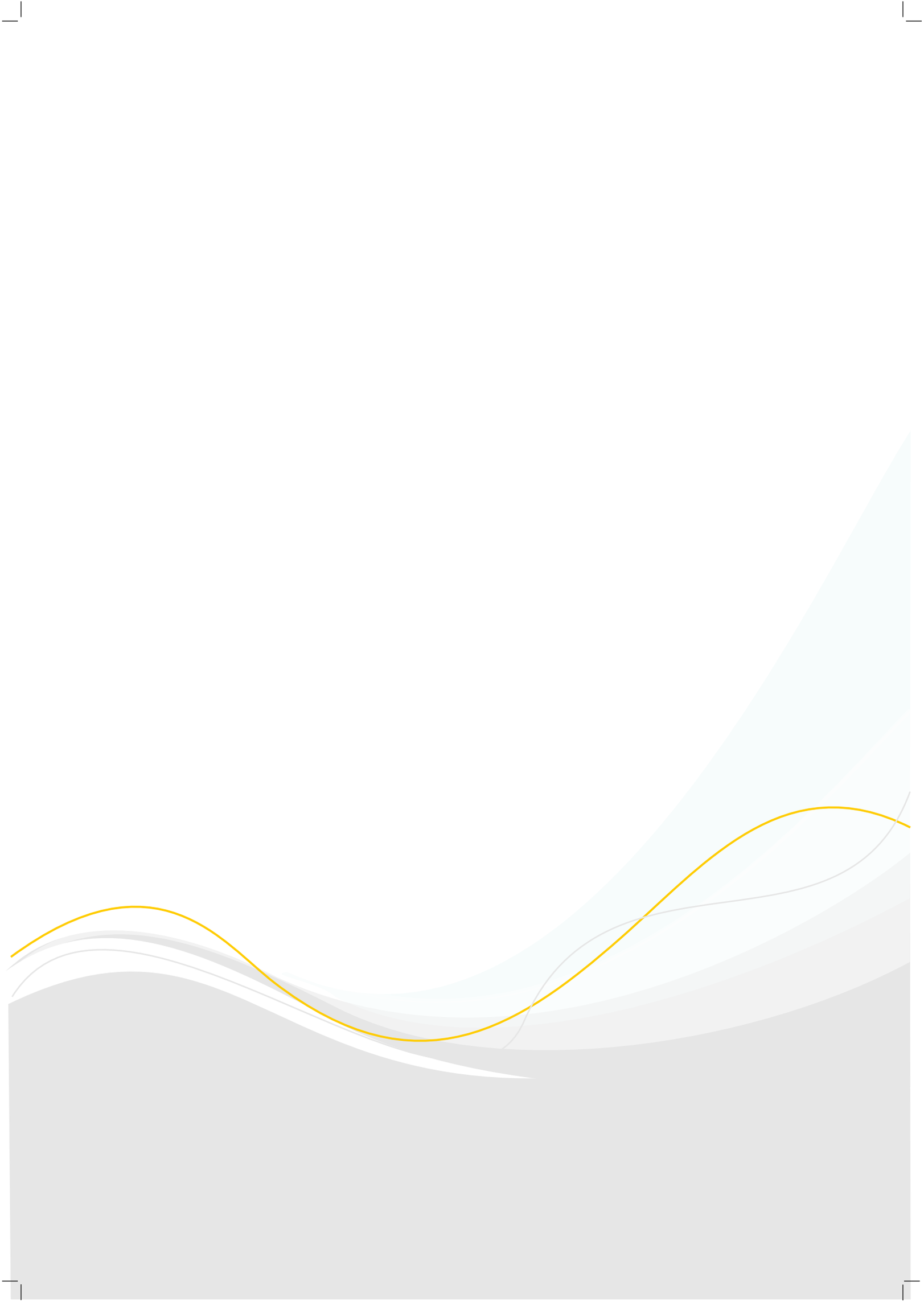
ELECTRICAL CHARACTERISTICS

Resistance at 20° C (max.)	: 75 ? /km
Dielectric strength (1 mn, Vac)	: 1,0 kV
Insulation resistance (min.) at 200 Vcc	: >5000 M? .km
Mutual capacitance (nom.)	: 44 nF/km
Characteristic Impedance	: (From 1 to 100 Mhz) :100 ± 15 ? (From 100 to 250 Mhz) :100 ± 20 ?
Velocity of propagation (f>1 MHz)	: 78 % of C.

F(MHz)	Attenuation (dB/100m)	NEXT (dB/100m)	PSNEXT (dB)	ELFEXT (dB/100)	PSELFEXT (dB/100)	Return loss (dB/100)
1	2,0	78,0	75,0	78	75,0	20,0
10	5,9	78,0	75,0	74	71	25
16	7,4	78,0	75,0	69.9	66.9	25
31,25	10,4	78,0	75,0	64.1	61.1	23,6
62,5	14,9	75,5	72,5	58.1	55.1	21,5
100	19,0	72,4	69,4	54	51	20,1
200	27,5	67,9	64,9	48	45	18,0
300	34,2	65,2	62,2	44.5	41.5	17,3
600	50,1	60,7	57,7	38.4	35.4	17,3
1000	61.9	57	54	34	35.4	17.3

ENVIRONMENTAL CHARACTERISTICS

- Fire behaviour (IEC 60332-1); IEC 60754; IEC 61034
- Temperature of function -20° C ÷ +60° C
- Operating voltage 100V max
- Bending radius Static: 4xd Dynamic: 8xd



Instrumentation cables

PRESENTATION

These cables are used with very low voltage (250 VDC / 150 VAC) to transmit analogue signals in the petroleum industry; or in zones where hydrocarbons may be present. Their outside sheath is realized with PVC resisting to aliphatic hydrocarbons.

STANDARDS

NF M 87-202

EGSF

CABLE MANUFACTURE

1- Conductors

- For the model " 05 " (section 0,5 mm2): the conductor consists of a solid wire of annealed, grade A copper, having a diameter 0,8 mm.
- For the model " 09 " (section 0,88 mm2): the conductor consists of a stranded 7 wires of annealed, grade A copper, having a diameter of 0,4 mm each one.

2- Insulation

PVC.

3- Pairing

· Element of cabling: the wires are assembled in pairs; triples or quads.

4- Construction

EGSF - EGFA	EISF - EIFA
Pairs, tierces or quads are assembled and wrapped with polyester tape Over the core wrapping an aluminium tape coated with a protective plastic is applied. Over the core wrapping an aluminium tape coated with a protective plastic is applied as a moisture barrier. The continuity wire is a strand of 7x0,20 mm copper tinned wires applied longitudinally under the metal screen to assure its continuity.	Each pairs, tierces or quads is wrapped individually with polyester tape Then screened with an aluminium polyester tape. A continuity wire is applied under the metal screen. Each pairs, tierces or quads screened is covered with a PVC sheath The individual cables are assembled together and screened with a polyester tape, continuity wire and overall aluminium polyester tape.

7- sheath:

The sheath is in polyvinyl chloride resisting to hydrocarbons of clear blue colour corresponding to the standard NFM 87-202, unleaded and not propagator of flames (category C2 following the NFC 32070 2.1 standard).

8- Armouring (for cables EGFA, EIFA)

Above the internal sheath is applied helically two steel tapes; each with a thickness of 0,20 mm.

9- Outside sheath (for cables EGFA, EIFA)

The outer sheath is in polyvinyl chloride resisting to hydrocarbons of clear blue colour corresponding to the standard NFM 87-202, unleaded and not propagator of flames (category C2 following the NFC 32070 2.1 standard) and without dangerous substances according to the European directive 2002 / 95 / EC.

10 /Marking of the sheath

Over the outer sheath is applied the ink marking to identify the cable and its length every meter with the following message:

ELECTRICAL CHARACTERISTICS

Max electrical resistance of the conductor :
0,5 mm² (model " 05 ") : 37,5 Ω/ km 0,88 (Model " 09 ") : 21,4 Ω/ km

Max. Unbalance resistance between the wire of the same pair or third :
0,5 mm² (model “05”) : 1,12 ? /km
0,88 mm² (model “09”) : 1,07 ? /km
Test voltage in direct current (1mn) : 2,0 Kv
Insulation resistance min. after 2 minutes (200VCC) > 500 M? /km
Maximum mutual capacitance (in nF/km) :

model	Between conductors	Between conductors and Screens
« 05 »	145	210
« 09 »	160	230

ENVIRONMENTAL CHARACTERISTICS

- Fire reaction not propagator of flames - Category C2, NFC 32070 2.1.
- The Resistance to hydrocarbons in compliance with the standard NFM 87-202.
- Temperature of function - 30° C to 90° C ·
- Max tension of use 150 V to 50 Hz
- These cables don't contain a substance mentioned by the European parliament N:2002 / 95 / EC (RoHS) of January 27th, 2003, relative to the limitation of use of certain dangerous substances in the electric and electronic equipments

PACKAGING AND LENGTHS OF DELIVERY

- Coils of 100m and 500m or 1000m on wooden reels.
- Minimal bending ratio: 8 x diameter of the cable.

PRESENTATION

Telereport cables armoured or non armoured are for Data transmission between power or fluid counters and the property's interface box They are suitable for installation inside buildings, on walls or in duct.

STANDARDS

Our cables are produced according to the NFC33-400 French standard.

CABLE MANUFACTURE

1- Conductors:

Each conductor consists of a solid wire of annealed copper, having a diameter 0,6 mm.

2- Insulation:

Each conductor is insulated with a layer of PVC material category TI51.
The radial thickness of the insulation is such that the electrical requirements are met.

3- Stranding

- Quadding
  Four appropriately coloured insulated conductors are assembled together to form a quad.

4- Wrapping:

A polyester wrapping tape is applied over the core.

5- Screen:

Over the wrapped core cable is applied an aluminium tape, coated on one side with polyester. It has a total minimum thickness of about 30 microns.

6- Drain and continuity wire:

A solid tinned copper conductor of 0.5 mm diameter is applied under the screen in contact with the aluminium face to ensure its continuity.

7- Rip cord:

A polyester thread is applied under the inner sheath.

8- sheath:

The inner sheath is lead free and other heavy metal free PVC, Ivory colour RAL1013, UV resistant and flame retardant (category C2 according to NFC32070 2.1).
The sheath dimensions shall be as follows:

Nominal sheath thickness (mm)	Nominal diameter of cable (mm)
1,0	5,20

9- Armouring:

Over the inner sheath can be applied helically two black steel tapes of 0,2 mm thickness or one corrugated steel tape applied over a bedding consisting of a polyester tape .

10- Outer sheath:

Only for the armoured cable ,the outer sheath is lead free and other heavy metal free PVC, Black colour and flame retardant (category C2 according to NFC32070 2.1).
The sheath dimensions shall be as follows:

Nominal sheath thickness (mm)	Nominal diameter of cable (mm)
1,2	10,50

11- Marking :

Over the outer sheath an ink marking is applied every meter:

ELECTRICAL CHARACTERISTICS

Resistance at 20° C (max.)	: 133,2 /km
Dielectric strength (1 mn, Vac)	: 1,5 kV
Insulation resistance (min.) at 200 Vcc	: >500 M.km
Mutual capacitance (nom.)	: 80 ÷130 nF/km
Characteristic Impedance	: 75 ÷115 Ohms

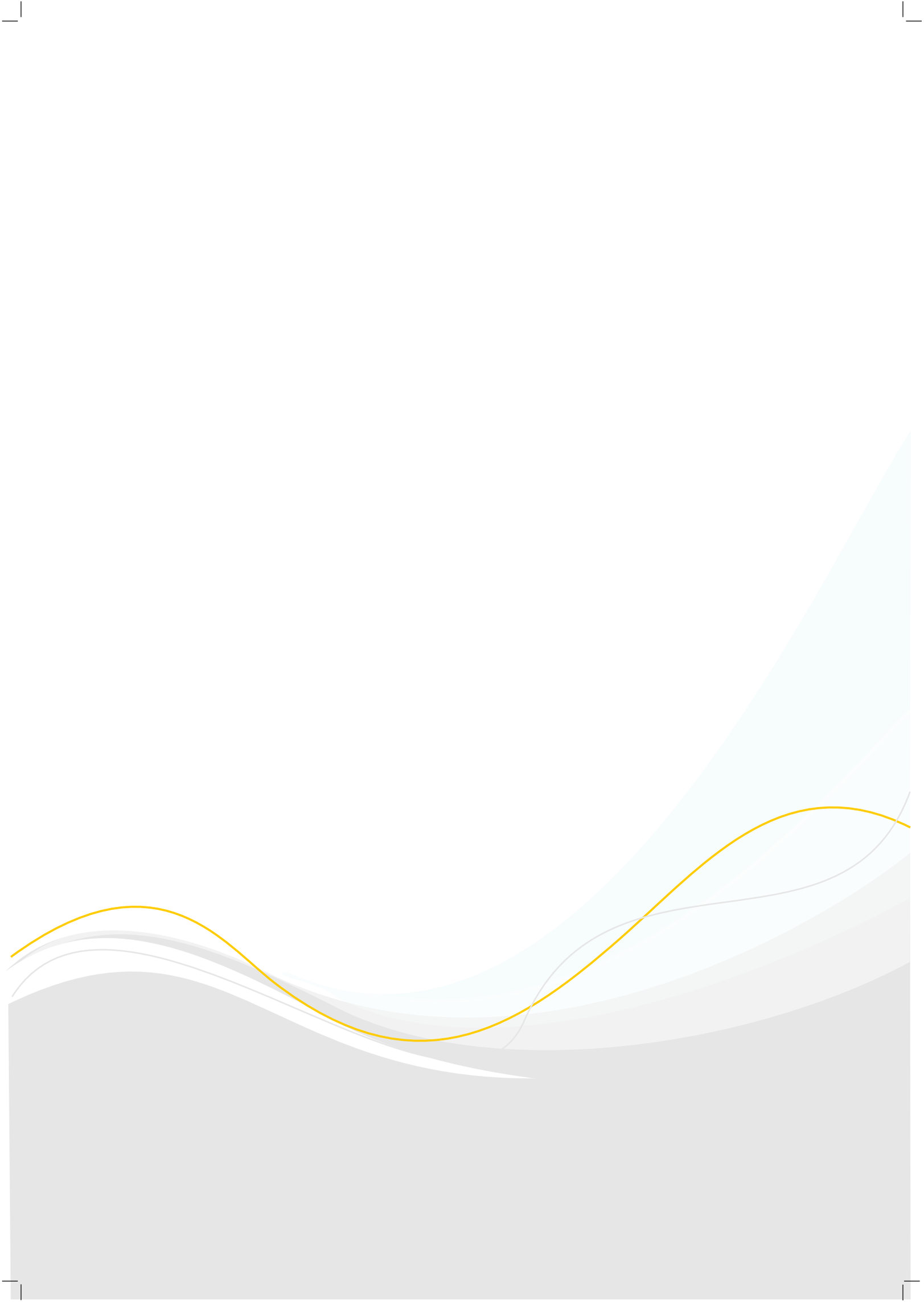
ENVIRONMENTAL CHARACTERISTICS

- Flame resistanceCategory C2 according to NFC 32070 2.1.
- Temperature of function-10° C ÷ +70° C
- Voltage max. of use 180 V at 50 Hz

PACKAGING

- Packaging in 100m coils or in drums of 500m and 1000m.
- Minimum bending radius is :

	Dynamic (when installing)	Static (after installation)
Unarmoured	70 mm	30 mm
Armoured	220 mm	110 mm



Coaxial cables

PRESENTATION

VATC cables are used for wave-broadcasting radios as well as analogical and numerical televisions for frequencies from 5 to 3000 MHz

REFERENCE STANDARDS

UTE C 90-130

CABLE STRUCTURE

1- Conductors

Conductors consist of solid copper.

2- Dielectric:

Conductors are insulated by a physical cellular polyethylene layer.
The thickness of insulation is such that the elctrical requirements are net.

3- Screen

On the cable core cover there is aluminum tape covered on one side by a polyethylene layer and a tinned copper braid.

4- Outer sheath

The sheath, consists of PVC, is complying with NF EN50290-2-22 standards. . It is unleaded and flame retardant and not spread flames (Category C2 according to NFC 32070 2.1) and resists to UV rays. It may be without halogens.

5- Marking on the sheath

Each meter the sheath has on a generator the following message:

TUNISIE-CABLES 17 VATC ss/aa + metric marking (000001.m)

17: type representing Attenuation in dB/100m (example: 23; 17;19)
ss: week number
aa: year in 2 figures
Metric marking: xxxxxx m (6 characters followed by “m” for meters)

ELECTRICAL CHARACTERISTICS

Minimum Insulation resistance (200VDC) > 5000 M ? Km
Maximum line capacity: 60 nF/km

Cable	Impedance at 200 MHz (?)	capacity Nf/km	Velocity (% C)	copper core (mm)	Dielectric diameter (mm)	Sheath diameter (mm)
12 VATC	75	50	88	1x1,70	6,90	6,10
17 VATC	75	50	84	1x1,13	4,85	6,80
19 VATC	75	50	82	1x1,02	4,60	6,80
21 VATC	75	50	80	1x1,02	4,60	6,80
23 VATC	75	50	70	1x 0,85	4,10	6,10

ENVIRONMENTAL CHARACTERISTICS

- Flame retardant - Category C2 NFC 32070 2.1
- Operating temperature -10° C +70° C
- These cables do not contain any substance referred to in the European Decree N° 2002/95/EC(RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.

PRESENTATION

KX cables, according to 93-550, are used in professional electronic field or in electronic surveillance. They are used in applications requiring high cable flexibility and an indicator undergoing a minimum distortion and reduction.

REFERENCE STANDARDS

NFC 93-550

CABLE STRUCTURE

1- Conductors

Conductors consist of multi-strand solid copper.

2- Dielectric:

Conductors are insulated by a solid polyethylene layer having a natural color.
The thickness of insulation is such that the electrical requirements braiding are net.
It is made up of red copper brad.

3- Outer sheath

The sheath consists of PVC complying with NF EN50290-2-22 standards.
It is unleaded, flame retardant and does not spread flames (Category C2 according to NFC 32070 2.1) and resists to UV rays. It may be without halogens.

4- Marking on the sheath

Each meter the sheath has on a generator the following massage:

TUNISIE-CABLES KX106 ss/aa + metric marking (000001.m)

With:
ss: week number
aa: year in 2 figures
Metric marking: xxxxxx m (6 characters followed by “m” for meters)

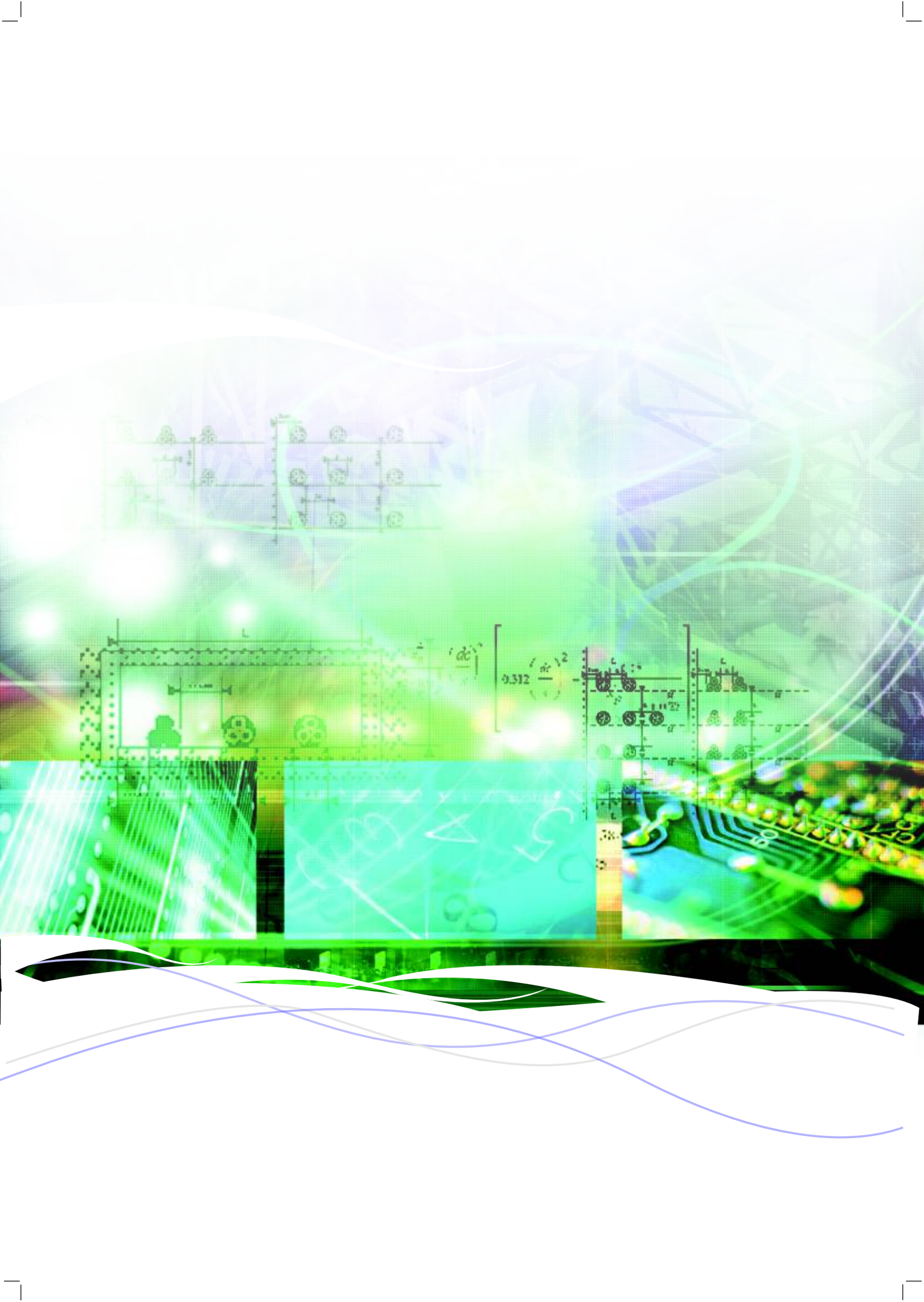
ELECTRICAL CHARACTERISTICS

Minimum Insulation resistance (200VDC) > 5000
Line capacity: 67 nF/km

Cable	Impedance at 200 MHz (?)	Attenuation at 200 MHz (dB/100m)	Copper core	Sheath diameter (mm)	Sheath color
KX 106 (RG 59 B/U)	75	20	7 x 0,20 mm	6,10	Green
KX 8 (RG 11 A/U)	75	12	7 x 0,40 mm	10,20	Green
KX 104 (RG 213/U)	50	13	7 x 0,75 mm	10,20	Black

ENVIRONMENTAL CHARACTERISTICS

1- Anti-fire , does not spread flames - Category C2 NFC 32070 2.1
2- Operating temperature -10°C +70°C
3- These cables do not contain any substance referred to in the European Decree N° 2002/95/EC(RoHS) of January 27, 2003, relating to limiting the use of certain dangerous substances in electric and electronic equipment.



SUMMARY

Transmission cables practices are fairly similar in many countries. For wiring type cables, many individual countries have preferences for particular designs or materials, but the difference is not fundamental.
The present catalog covers essentially low and medium voltage cables up to 33 KV, manufactured according to European and international specifications which are largely used in Europe and the majority of countries throughout the world .

Power cables are distinguished in the following categories
Overhead (Aerial) lines with bare conductors.
Overhead (Aerial) lines with insulated conductors.
Low voltage (LV) power cables for indoor installations.
Low voltage (LV) power cables for outdoor installations.
Low voltage (LV) special cables destined to special uses.
Medium Voltage (MV) power cables.

OVERHEAD POWER LINES

Overhead lines are generally divided from the point of view of their use, into 3 main categories , as follows :
- Overhead lines for low voltage power distribution in rural areas, as well as in small villages
- Overhead lines used for medium voltage power transportation and distribution
- Overhead lines used for High Voltage power transportation from generating stations to big power consumers

Aerial lines with bare conductors
- Bare soft drawn stranded copper conductors
- Bare hard drawn stranded copper conductors.
- Bare hard drawn stranded all aluminium conductors (AAC).
- Bare hard drawn stranded all aliminium alloy conductors (AAAC).
- Aluminium conductors steel reinforced (ACSR).

Aerial lines with insulated conductors
- Weather proof service drop copper cables 0,6/1KV , XLPE insulated for over head power lines.
- Weather proof service drop aluminium cables 0,6/1KV, XLPE insulated for over head power lines.

LOW VOLTAGE INDOOR CABLES

Indoor cables are destined for permanent (fixed) as well as for movable installations inside covered areas, protected from direct rain falls, as well as from moisture presence.
These cables are mainly composed of solid or stranded or flexible copper conductors, insulated with PVC
Wherever fire retardant qualities, reduced fumes, toxic and corrosive gases emission in case of fire are required, they should be insulated and sheathed with LSZH* material.
The most common types of indoor cables, used in internal fixed or movable installations are the following:
- Single core cables with solid or stranded copper conductors, PVC insulated.
- Single core cables with flexible copper conductors, PVC insulated.
- Multicore cables , with solid or stranded copper conductors, PVC insulated and PVC sheathed.
- Multicore cables, with flexible copper conductors, PVC insulated and PVC sheathed.
- Flt-twin or flat-three core cables, with solid or stranded copper conductors, PC insulated and PVC sheathed.
- Multicore cables , with solid or stranded copper conductors, LSZH* insulated and LSZH* sheathed.

*LSZH : Low Smoke Zero Halogen material

LOW VOLTAGE OUTDOOR CABLES

Outdoor low voltage cables are usually exposed to serious weather influences, high mechanical stresses and dangerous chemical attacks,
For these reasons, they are characterized by increased thickness in the insulation and in the protecting outer sheath, as well as by special insulating and sheathing in case of presence of various dangerous chemicals in the ground, where the cables are to be placed and whenever fire retardant qualities are required in case of fire.
When the cables are destined to be buried direct in ground, they are normally protected with steel tape, when limited tensile stress are present during installation and only protection against mechanical damages are requested.
When the contrary, cables subjected to higher tensile stress during their installation, due to high pulling forces or to the presence of not stable or sandy ground, as well as when exposed to exaggerate mechanical pressures, they must be provided with an armour of round or flat galvanized steel wires
The most common types of outdoor cables, used in external permanent (fixed) installations, are the following:
- Single core and multicore cables with solid or stranded copper or aluminium conductors , PVC insulated and PVC sheathed.
- Multicore cables with solid or stranded copper or aluminium conductors , PVC or XLPE insulated and PVC sheathed.
- Multicore cables with solid or stranded copper conductors, PVC or XLPE insulated, steel tape or steel wires armoured and PVC sheathed.
- Multicore cables with stranded sector-shape copper or aluminium conductors, PVC or XLPE insulated and

PVC sheathed.

- Multicore cables with stranded sector-shape copper or aluminium conductors, PVC or XLPE insulated, Steel tape or steel wire armoured and PVC sheathed.

- Multicore cables with solid or stranded copper conductors, PVC or XLPE insulated, steel tape or steel wires armoured and PVC sheathed

- Multicore cables with solid or stranded copper or aluminium conductors, LSZH* insulated and LSZH* sheathed.

*LSZH : Low Smoke Zero Halogen material

CONTROL CABLES FOR INDOOR AND OUTDOOR INSTALLATIONS

Control cables are composed of soft drawn solid, stranded, flexible and super flexible copper conductors, PVC or XLPE insulated, assembled into a cable core, filled with plastic or rubber materials, eventually screened with copper tapes or wires, double steel tape or steel wire armoured and finally PVC sheathed.

Wherever fire retardant qualities, reduced fumes, toxic and corrosive gases emission in case of fire are required, they should be insulated and sheathed with HFFR* material.

Control cable can be used either for indoor installations as well for outdoor installations.

The distinction of the insulated conductors is mainly realized by numbering the insulation with white numbers printed on black insulation. The induction of any undesirable signal, can be decreased or totally avoided, by applying special screening material, such as coppertapes or wires application, helped by special armour etc., in order to reduce the level of the disturbing signals so much, as to minimize the risk of the primary signal alteration.

*HFFR : Halogen free flame retardant

SPECIAL CABLES

There is a very big variety of special cables, appropriately manufactured to make front to special requests like welding, airport lighting and ship wiring.

COXIAL AND TV ANTENNA SATELLITE CABLE

Coaxial cables are commonly used for central installations in civil buildings, where a central antenna positioned on the highest point of the building, is connected to all apartments TV receivers, through vertical distributing lines of coaxial cables, which feeds the TV plugs.

MEDIUM VOLTAGE CABLES

Medium voltage (MV) cables are normally used for transporting electric power at medium distances and for safety reasons; they are installed underground directly to the soil or into ducts or in air over steel racks anchored against the wall. The MV cables covered by IEC 60502 are ranging from 3KV up to 33 KV.

1- CONDUCTORS (usually copper, aluminium , aluminium alloy)

2- INSULATION (usually PVC, PE, XLPE , RUBBER, LSZH).

3- SHEATH (usually PVC, RUBBER, HFFR)

4- ARMOUR (usually steel tapes, steel round or flat wires, aluminium tapes and wires).

5- OUTER PROTECTION OF CABLES (protection against chemicals, as well as against heat , flame, rodents, termites etc.).

CONDUCTORS

Cable conductors are designed to conform to a certain range of nominal areas in graduated steps according to IEC 60228. The value of ohmic resistance at 20° C of each area, is also given by IEC 60228.

Conductors are distinguished into following classes:

Class1 : Solid copper and aluminum conductors

Class 2 : Stranded copper and aluminium conductors

Class 5 : Stranded flexible copper conductors

Class 6 : Stranded super flexible copper conductors

INSULATION AND SHEATHING MATERIAL

The insulating materials used in power cables are essentially the following :

Thermoplastic materials (PVC and PE)

Thermosetting materials (XLPE)

Electrometric materials as :

Natural rubber

Synthetic rubber

Special insulating and sheathing materials (EPR or EPDM, EVA, PCP, CSPE and CPE).

CABLE ARMOUR

All underground cables especially those laid direct to ground are armoured with steel tapes or wires in order to protect them against mechanical stressed and damages.

Standard specifications caters for a wide range of choice for armour :

- Plain or galvanized steel tape
- Plain or galvanized flat steel wires
- Galvanized round steel wires
- Aluminium flat wires or strips

The final choice of the type of armour depends on the specifications.

Galvanized steel tapes are preferred by users where the cables are supposed to be laid in aggressive environments Where the armour is also used as an earth conductor, steel wire armour is preferred.

Steel round or flat wires are usually

applied as an armour in all cases, in which the cables are subjected to higher mechanical stresses, especially longitudinal tensile stress during cable laying or in case of sandy soils and soils with very weak compaction.

Single-core cables for AC and three-phase operation system, are not armoured as a rule, in order to avoid excessive additional losses. However in the cases where the armour is necessary, an armour of non-magnetic material (copper or aluminium) has to be provided.

OUTER PROTECTION OF CABLE

Metal sheathed cables , as well as armoured power cables must be protected against corrosion, only cables having an outer sheath of PVC do not practically need any protection against corrosion, as this sheath is by itself corrosion resistant against nearly all chemicals eventually present in the soil.

Protection against rodents and termites

There are additives to the sheathing material which by their repellent or rat-killing properties repel or kill termites or rodents, especially rats.

Protection again Hydrocarbons

The cable used in oil and petrochemical units is subject to various chemical products and hydrocarbons.

It is thus particularly important to protect them against the attacks of the following hydrocarbons groups :

Aliphatic hydrocarbons

Aromatic hydrocarbons

To resist to the aliphatic hydrocarbons, cables are protected by PVC nitrate sheath.

Protection against fire

Particularly in public and industrial setting, when fire retardant qualities are required in case of fire, filling and sheathing materials should be flame or fire retardant. Moreover, the educed fumes, toxic and gases remissions of HFFR filling and sheathing materials in case of fire, achieve to the cable the propriety that to be used in areas when strict safety standards have to be respected

Water proof cables

To secure longitudinal water tightness throughout the cable length, a suitable swelling tape is helically applied under the sheath. This tape is made up of a matter that swells-up moisture and stop water tightness.

Solid copper and aluminum conductors Class 1

TYPE	Approximate diameter (mm)		Maximum electrical resistance at 20° C	
	Copper mm	Aluminium mm	copper	Aluminum
1,5	1,38	-	12,10	-
2,5	1,78	-	7,41	-
4	2,25	-	4,61	-
6	2,76	-	3,08	-
10	3,57	3,55	1,83	3,08
16	4,50	4,50	1,15	1,91
25	5,65	5,55	0,727	1,20
35	6,60	6,45	0,524	0,868
50	7,70	7,60	0,387	0,641
70	9,30	9,10	0,268	0,443
95	10,90	10,70	0,193	0,320
120	12,30	12,00	0,153	0,253
150	13,60	13,30	0,124	0,206
185	-	15,00	-	0,164
240	-	17,10	-	0,125
300	-	19,10	-	0,100

Stranded conductors class 2

TYPE	Stranded circular copper and aluminium conductors		Stranded compacted copper and aluminium conductors						Maximum electrial resistance at 20° C (Ω /km)	
	Minimum number of wires	Approximate conductor diameter mm	Minimum number of wires				Approximate conductor diameter mm		copper	Aluminium
			circular shape		Sector shape					
			copper	Alu	copper	Alu	copper	Alu		
1,5	7	1,5	-	-	-	-	1,70	-	12,10	-
2,5	7	2,1	-	-	-	-	2,10	-	7,41	-
4	7	2,5	-	-	-	-	2,55	-	4,61	-
6	7	3,1	-	-	-	-	2,90	-	3,08	-
10	7	4,05	-	-	-	-	3,80	-	1,83	3,08
16	7	5,1	6	6	-	-	4,80	4,65	1,15	1,91
25	7	6,4	6	6	6	6	6,00	5,90	0,727	1,20
35	7	7,6	6	6	6	6	7,10	6,80	0,524	0,868
50	19	8,9	6	6	6	6	8,40	7,90	0,387	0,641
70	19	10,7	12	12	12	12	10,00	9,75	0,268	0,443
95	19	12,6	15	15	15	15	11,20	11,40	0,193	0,320
120	37	14,2	18	15	18	15	12,90	12,60	0,153	0,253
150	37	15,7	18	15	18	15	14,20	14,10	0,124	0,206
185	37	17,6	30	30	30	30	16	15,60	0,0991	0,164
240	61	20,2	34	30	34	30	18,30	17,90	0,0754	0,125
300	61	22,7	34	30	34	30	20,20	20,10	0,0601	0,100
400	61	25,6	53	53	53	53	-	23,20	0,0470	0,0778
500	61	28,8	53	53	53	53	26,60	27,40	0,0366	0,0605
630	91	32,8	53	53	53	53	32,40	29,60	0,0283	0,0469
800	91	37,0	53	53	-	-	36,30	36,30	0,0221	0,0367
1000	91	41,6	53	53	-	-	-	-	0,0176	0,0291

Stranded and flexible conductors class 5

TYPE	Maximum diameter of wire mm	Approximate diameter of conductor mm	Maximum electrical resistance at 20° C (Ω /km)	
			copper	Tinned copper
0.5	0.21	0.9	39	40.1
0.75	0.21	1.1	26	26.7
1	0.21	1.3	19.5	20
1.5	0.26	1.5	13.3	13.7
2.5	0.26	1.8	7.98	8.21
4	0.31	2.4	4.95	5.09
6	0.31	3.0	3.30	3.39
10	0.41	4.0	1.91	1.95
16	0.41	5.1	1.21	1.24
25	0.41	6.6	0.780	0.795
35	0.41	7.8	0.554	0.565
50	0.41	9.3	0.386	0.393
70	0.51	11.5	0.272	0.277
95	0.51	13.1	0.206	0.210
120	0.51	14.7	0.161	0.164
150	0.51	16.7	0.129	0.132
185	0.51	18.6	0.106	0.108
240	0.51	21.0	0.0801	0.0817
300	0.51	23.6	0.0641	0.0654
400	0.51	27.5	0.0486	0.0495
500	0.61	31.3	0.0384	0.0391

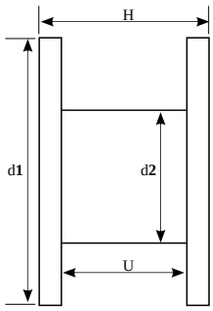
Stranded and super flexible conductors class 6

TYPE	Maximum diameter of wire mm	Approximate diameter of conductormm	Maximum electrical resistance at 20° C (Ω /km)	
			Plain copper	Tinned copper
0,5	0,16	0,9	39	40,1
0,75	0,16	1,1	26	26,7
1	0,16	1,3	19,5	20
1,5	0,16	1,6	13,3	13,7
2,5	0,16	2,3	7,98	8,21
4	0,16	2,9	4,95	5,09
6	0,21	3,4	3,30	3,39
10	0,21	4,5	1,91	1,95
16	0,21	5,1	1,21	1,24
25	0,21	6,6	0,780	0,795
35	0,21	8,6	0,554	0,565
50	0,31	10,2	0,386	0,393
70	0,31	12,3	0,272	0,277
95	0,31	14,2	0,206	0,210
120	0,31	15,0	0,161	0,164
150	0,31	17,0	0,129	0,132
185	0,41	18,7	0,106	0,108
240	0,41	21,4	0,081	0,0817
300	0,41	23,9	0,0641	0,0654

Insulating material characteristics

Characteristics	Insulating materials			
	PVC (Y)	PE (2Y)	XLPE (2X)	Halogen free(H)
Density	1.35-1.5	0.94-0.98	0.92	1.4-1.6
Break down voltage Kv/mm(20° C)	25	70	50	25
Dielectric constant	3.6-6	2.3	4-6	3.4-5
Working temperature (° C)	-30 to +70	-50 to +70	-35 to 90	-30 to +70
Flame resistance	Self extinguishing	flammable	flammable	Self extinguishing
Oxygen index (% O2)	23-42	<22	<22	<40
Heating value(Mj.kg)	17-25	42-44	42-44	17-22
Thermal conductivity ($w.k^{-1}.m^{-1}$)	0.17	0.3	0.3	0.17
Corrosive gases in case of fire	Hydrogen chloride	no	no	no
Tensile strength N/mm^2	10-25	10-20	12.5-20	8-13
Elongation at break %	130-350	Medium	300-400	150-250
Shore hardness	70-95 A	43-50 D	40-45 D	65-95 A
Abrasion resistance	Medium	400-600	Medium	Medium
Water absorption %	0.4	0.1	0.1	0.2-1.5
Halogen free	no	yes	yes	yes

Designation		XBN	ABN	BBN	CBN	DBN	EBN	FBN	GBN	HBN
d1 : flange diameter	mm	600	750	900	1050	1200	1400	1650	1900	2200
d2 : barrel diameter	mm	350	350	450	550	650	800	960	1200	1400
u : traverse diameter	mm	300	350	450	450	600	600	600	950	1000
H : overall width	mm	385	435	555	555	705	720	735	1150	1220
d3 : bare diameter	mm	42	82	82	82	82	82	82	82	82
Maximum load	Kg	200	500	700	800	1200	1500	2500	4000	5000
net weight	Kg	25	35	73	85	125	190	290	475	690



Capacity of drums

Type	600	750	900	1050	1200	1400	1650	1900	2200
	X	A	B	C	D	E	F	G	H
Distance to floor	50	50	50	50	50	50	50	50	50
D mm	Maximum cable lengths (m)								
8	425	1170	2240	3235					
10	267	800	1455	2070	3545				
12	190	520	980	1340	2395	3200			
14	131	365	720	1015	1800	2270	3390		
16	88	279	515	755	1380	1760	2540		
18	79	223	415	620	1040	1350	2005		
20		172	320	490	870	1135	1580	3250	
22		127	250	400	710	935	1320	2545	
24		121	230	315	585	780	1125	2130	3050
26		90	185	257	470	640	945	1795	2625
28			175	248	435	510	775	1485	2225
30			130	191	355	490	660	1410	1910
32				180	325	380	595	1175	1620
34				135	257	365	495	960	1530
36				125	244	287	470	930	1265
38				116	184	271	375	770	1230
40				114	184	271	375	715	1030
42				80	174	206	355	685	955
44					163	191	275	550	785
46					125	191	275	525	755
48					115	178	257	500	725
50					115	178	209	500	725
52					107	126	190	385	575
54					107	126	190	365	550
56					98	115	174	345	520
58						115	174	345	520
60						115	135	325	400
64							121	237	375
68							108	221	350
72							108	221	254
80									212
84									197
88									197
90									197

The maximum cable length

is calculated by the formula:

$$L_m = \underbrace{\left(\frac{u}{D}\right)}_{N1} \underbrace{\left(\frac{d_1 - d_2 - G}{D}\right)}_{N2} \left(d_2 + N_2 D\right) \frac{11}{1000}$$

(G = Distance to floor)
N1 and N2 should be round down

Rigid copper and aluminium cables unarmoured 1 KV

TYPE	RESISTANCE (Ω /km)			Reactance (Ω / km)	IMPEDANCE (Ω /km) at 50 Hz and 90° C for cosφ			
	Continuous current		alternative current at 90° C	at 50 Hz - Lω	1	0.8	0.5	0.3
	Rc 20° C	Rc 90° C						
Multi-pole copper cables								
1,5	12,10	15,43	15,43	0,107	15,43	12.41	7,81	4,73
2,5	7,41	9,45	9,45	0,100	9,45	7,62	4,81	2,93
4	4,61	5,88	5,88	0,094	5,88	4,76	3,02	1,85
6	3,08	3,93	3,93	0,088	3,93	3,19	2,04	1,26
10	1,83	2,33	2,33	0,0785	2,33	1,91	1,23	0,77
16	1,15	1,47	1,47	0,0754	1,47	1,22	0,80	0,51
25	0,727	0,927	0,927	0,0754	0,930	0,787	0,529	0,350
35	0,524	0,668	0,668	0,0754	0,672	0,580	0,399	0,272
50	0,387	0,493	0,494	0,0754	0,500	0,441	0,313	0,220
70	0,268	0,342	0,343	0,0722	0,350	0,318	0,234	0,172
95	0,193	0,246	0,247	0,0722	0,257	0,241	0,186	0,143
120	0,153	0,195	0,197	0,0722	0,210	0,201	0,161	0,128
150	0,124	0,158	0,16	0,0722	0,176	0,171	0,143	0,117
185	0,0991	0,1264	0,1291	0,0722	0,1479	0,1466	0,1271	0,1076
240	0,0754	0,0961	0,0997	0,0722	0,1232	0,1232	0,1124	0,0988
300	0,0601	0,0766	0,0812	0,0691	0,1066	0,1064	0,1004	0,0903
Single core copper cables								
50	0,387	0,493	0,493	0,0880	0,501	0,448	0,323	0,232
70	0,268	0,342	0,343	0,0848	0,353	0,325	0,245	0,184
95	0,193	0,246	0,247	0,0848	0,261	0,249	0,197	0,155
120	0,153	0,195	0,196	0,0816	0,212	0,206	0,169	0,137
150	0,124	0,158	0,160	0,0816	0,180	0,177	0,151	0,126
185	0,0991	0,1264	0,1285	0,0816	0,1522	0,1518	0,1349	0,1164
240	0,0754	0,0961	0,0991	0,0785	0,1264	0,1264	0,1175	0,1046
300	0,0601	0,0766	0,0803	0,0785	0,1123	0,1113	0,1081	0,0990
400	0,0470	0,0599	0,0646	0,0785	0,1017	0,0988	0,1003	0,0943
Multi core aluminum cables								
35	0,868	1,113	1,113	0,0754	1,115	0,936	0,622	0,406
50	0,641	0,822	0,822	0,0754	0,825	0,703	0,476	0,318
70	0,443	0,568	0,569	0,0722	0,574	0,499	0,347	0,240
95	0,320	0,410	0,411	0,0722	0,418	0,372	0,268	0,192
120	0,253	0,324	0,325	0,0722	0,333	0,304	0,225	0,166
150	0,206	0,264	0,265	0,0722	0,275	0,255	0,195	0,148
185	0,164	0,210	0,212	0,0722	0,224	0,213	0,168	0,132
240	0,125	0,160	0,162	0,0691	0,177	0,171	0,141	0,115
300	0,100	0,128	0,131	0,0691	0,148	0,146	0,125	0,105
Single core aluminum cables								
50	0,641	0,822	0,822	0,0880	0,827	0,710	0,487	0,330
70	0,443	0,568	0,568	0,0848	0,574	0,505	0,357	0,251
95	0,320	0,410	0,411	0,0848	0,420	0,380	0,279	0,204
120	0,253	0,324	0,325	0,0816	0,335	0,309	0,233	0,175
150	0,206	0,264	0,265	0,0816	0,277	0,261	0,203	0,157
185	0,164	0,210	0,212	0,0816	0,227	0,218	0,176	0,141
240	0,125	0,160	0,162	0,0785	0,180	0,177	0,149	0,124
300	0,1000	0,1282	0,1304	0,0785	0,1522	0,1515	0,1332	0,1140
400	0,0778	0,0997	0,1027	0,0785	0,1293	0,1293	0,1193	0,1057

Rigid copper and aluminium cables 1 KV armoured

TYPE	RESISTANCE (Ω /km)			REACTANCE (Ω / km) at 50 Hz - Lω	IMPEDANCE (Ω /km) at 50 Hz and 90° C for cosφ			
	Continuous current		alternative current		1	0.8	0.5	0.3
	Rc 20° C	Rc 90° C						
Multi core copper cables								
1,5	12,10	15,43	15,43	0,122	15,43	12,42	7,82	4,74
2.,5	7,41	9,45	9,45	0,116	9,45	7,63	4,82	2,95
4	4,61	5,88	5,88	0,110	5,88	4,77	3,03	1,87
6	3,08	3.93	3,93	0,100	3,93	3,20	2,05	1,27
10	1,83	2,33	2,33	0,094	2,34	1,92	1,25	0,790
16	1,15	1,47	1,47	0,0911	1,47	1,23	0,81	0,53
25	0,727	0,927	0,927	0,0911	0,931	0,796	0,542	0,365
35	0,524	0,668	0,668	0,0911	0,674	0,589	0,413	0,287
50	0,387	0,493	0,494	0,0879	0,502	0,448	0,323	0,232
70	0,268	0,342	0,343	0,0879	0,354	0,327	0,247	0,187
95	0,193	0,246	0,247	0,0879	0,262	0,250	0,200	0,158
120	0,153	0,195	0,197	0,0879	0,216	0,210	0,175	0,143
150	0,124	0,158	0,16	0,0879	0,183	0,181	0,156	0,132
185	0,0991	0,1264	0,1291	0,0879	0,1562	0,1560	0,1407	0,1226
240	0,0754	0,0961	0,0997	0,0879	0,1330	0,1326	0,1260	0,1138
300	0,0601	0,0766	0,0812	0,0848	0,1174	0,1158	0,1140	0,1053
Multi core aluminium cables								
35	0,868	1,113	1,113	0,0911	1,117	0,945	0,635	0,421
50	0,641	0,822	0,822	0,0879	0,827	0,710	0,487	0,330
70	0,443	0,568	0,569	0,0879	0,576	0,508	0,361	0,255
95	0,320	0,410	0,411	0,0879	0,421	0,382	0,282	0,207
120	0,253	0,324	0,325	0,0879	0,337	0,313	0,239	0,181
150	0,206	0,264	0,265	0,0879	0,279	0,265	0,209	0,163
185	0,164	0,210	0,212	0,0879	0,229	0,222	0,182	0,147
240	0,125	0,160	0,162	0,0879	0,185	0,183	0,157	0,133
300	0,100	0,128	0,131	0,0848	0,156	0,156	0,139	0,120

Flexible cables 450/750 V

TYPE	RESISTANCE (Ω /km)			REACTANCE (Ω / km) at 50 Hz - Lω	IMPEDANCE (Ω /km) at 50 Hz and 90° C for cosφ			
	Continuous current		alternative current		1	0.8	0.5	0.3
	Rc 20° C	Rc 90° C						
Multi core copper cables								
1	19,5	24,9	24,9	0,110	24,9	20	12,5	7,6
1,5	13,3	17,0	17,0	0,104	17,0	13,6	8,6	5,2
2,5	7,98	10,18	10,18	0,100	10,18	8,2	5,17	3,15
4	4,95	6,31	6,31	0,094	6,31	5,11	3,24	1,98
6	3,30	4,21	4,21	0,091	4,21	3,42	2,18	1,35
10	1,91	2,44	2,44	0,0879	2,44	2,00	1,29	0,81
16	1,21	1,54	1,54	0,0816	1,55	1,28	0,84	0,54
25	0,780	0,995	0,995	0,0816	0,998	0,845	0,568	0,376
35	0,554	0,706	0,706	0,0785	0,711	0,612	0,421	0,287
50	0,386	0,492	0,493	0,0785	0,499	0,442	0,315	0,223
70	0,272	0,347	0,347	0,0785	0,356	0,325	0,242	0,179
95	0,206	0,263	0,264	0,0785	0,275	0,258	0,200	0,154
Multi core aluminium cables								
50	0,386	0,492	0,492	0,0973	0,502	0,452	0,330	0,240
70	0,272	0,347	0,348	0,0973	0,361	0,337	0,258	0,197
95	0,206	0,263	0,264	0,0973	0,281	0,269	0,216	0,172
120	0,161	0,205	0,206	0,0942	0,227	0,222	0,185	0,152
150	0,129	0,164	0,166	0,0911	0,189	0,187	0,162	0,137
185	0,106	0,135	0,137	0,0911	0,165	0,164	0,147	0,128
240	0,0801	0,1021	0,1044	0,0911	0,1385	0,1382	0,1311	0,1182
300	0,0641	0,0817	0,0846	0,0879	0,122	0,1204	0,1184	0,1092

Introduction

Cable sizing methods do differ across international standards (e.g. IEC, NEC, BS, etc) and some standards emphasise certain things over others. However the general principles underlying any cable sizing calculation do not change. In this article, a general methodology for sizing cables is first presented and then the specific international standards are introduced.

Why do the calculation?

The proper sizing of an electrical (load bearing) cable is important to ensure that the cable can:

- Operate continuously under full load without being damaged.
- Withstand the worst short circuits currents flowing through the cable.
- Provide the load with a suitable voltage (and avoid excessive voltage drops).
- (optional) Ensure operation of protective devices during an earth fault.

When to do the calculation?

This calculation can be done individually for each power cable that needs to be sized, or alternatively, it can be used to produce cable sizing waterfall charts for groups of cables with similar characteristics (e.g. cables installed on ladder feeding induction motors).

General Methodology

All cable sizing methods more or less follow the same basic six step process:

1- Gathering data about the cable, its installation conditions, the load that it will carry, etc

2- Determine the minimum cable size based on continuous current carrying capacity.

3- Determine the minimum cable size based on voltage drop considerations.

4- Determine the minimum cable size based on short circuit temperature rise.

5- Determine the minimum cable size based on earth fault loop impedance.

6- Select the cable based on the highest of the sizes calculated in step 2, 3, 4 and 5.

Step 1: Data Gathering

The first step is to collate the relevant information that is required to perform the sizing calculation. Typically, you will need to obtain the following data:
Load Details

The characteristics of the load that the cable will supply, which includes: Load type: motor or feeder.

Three phase, single phase or DC System / source voltage

Full load current (A) - or calculate this if the load is defined in terms of power (kW)

Full load power factor (pu) Locked rotor or load starting current (A).

Starting power factor (pu)

Distance / length of cable run from source to load - this length should be as close as possible to the actual route of the cable and include enough contingency for vertical drops / rises and termination of the cable tails.

Cable Construction

The basic characteristics of the cable's physical construction, which includes:

- Conductor material - normally copper or aluminium
- Conductor shape - e.g. circular or shaped.
- Conductor type - e.g. stranded or solid.
- Conductor surface coating - e.g. plain (no coating), tinned, silver or nickel.
- Insulation type - e.g. PVC, XLPE, EPR.
- Number of cores - single core or multicore (e.g. 2C, 3C or 4C).

Installation Conditions

How the cable will be installed, which includes:

- Above ground or underground.
- Installation / arrangement - e.g. for underground cables, is it directly buried or buried in conduit? for above ground cables, is it installed on cable tray / ladder, against a wall, in air, etc.
- Ambient or soil temperature of the installation site.
- Cable bunching, i.e. the number of cables that are bunched together.
- Cable spacing, i.e. whether cables are installed touching or spaced
- Soil thermal resistivity (for underground cables)
- Depth of laying (for underground cables)
- For single core three-phase cables, are the cables installed in trefoil or laid flat?

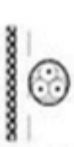
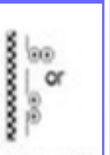
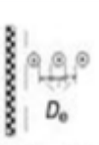
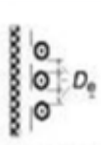
Step 2: Cable Selection Based on Current Rating

Current flowing through a cable generates heat through the resistive losses in the conductors, dielectric losses through the insulation and resistive losses from current flowing through any cable screens / shields and armouring.

The component parts that make up the cable (e.g. conductors, insulation, bedding, sheath, armour, etc) must be capable of withstanding the temperature rise and heat emanating from the cable. The current carrying capacity of a cable is the maximum current that can flow continuously through a cable without damaging the cable's insulation and other components (e.g. bedding, sheath, etc). It is sometimes also referred to as the continuous current rating or ampacity of a cable.

Cables with larger conductor cross-sectional areas (i.e. more copper or aluminium) have lower resistive losses and are able to dissipate the heat better than smaller cables. Therefore a 16 mm2 cable will have a higher current carrying capacity than a 4 mm² cable.

Table A.52-10 (52-C9) - Current-carrying capacities in amperes for installation methods E, F and G of table A.52-1 (52-B1) - PVC insulation/Copper conductors
Conductor temperature: 70 °C/Reference ambient temperature: 30 °C

Nominal cross-selectional area of conductor mm²	Installation methods of table A.52-1						
	Multi-core cables		Single-core cables				
	Two loaded conductors	Three loaded conductors	Two loaded conductors touching	Three loaded conductors trefoil	Three loaded conductors, flat		
					Touching	Spaced	
						Horizontal	Vertical
							
	Method E	Method E	Method F	Method F	Method F	Method G	Method G
1	2	3	4	5	6	7	8
1,5	22	18,5	-	-	-	-	-
2,5	30	25	-	-	-	-	-
4	40	34	-	-	-	-	-
6	51	43	-	-	-	-	-
10	70	60	-	-	-	-	-
16	94	80	-	-	-	-	-
25	119	101	131	110	114	146	130
35	148	126	162	137	143	181	162
50	180	153	196	167	174	219	197
70	232	196	251	216	225	281	254
95	282	238	304	264	275	341	311
120	328	276	352	308	321	396	362
150	379	319	406	356	372	456	419
185	434	364	463	409	427	521	480
240	514	430	546	485	507	615	569
300	593	497	629	561	587	709	659
400	-	-	754	656	689	852	795
500	-	-	868	749	789	982	920
630	-	-	1 005	855	905	1 138	1 070

NOTE: Circular conductors are assumed for sizes up to and including 16 mm². Values for larger sizes relate to shaped conductors and may safely be applied to circular conductors.

Table 1. Example of base current rating table (Excerpt from IEC 60364-5-52)

International standards and manufacturers of cables will quote base current ratings of different types of cables in tables such as the one shown on the right. Each of these tables pertain to a specific type of cable construction (e.g. copper conductor, PVC insulated, 0.6/1kV voltage grade, etc) and a base set of installation conditions (e.g. ambient temperature, installation method, etc). It is important to note that the current ratings are only valid for the quoted types of cables and base installation conditions.
In the absence of any guidance, the following reference based current ratings may be used.

Installed Current Ratings

When the proposed installation conditions differ from the base conditions, derating (or correction) factors can be applied to the base current ratings to obtain the actual installed current ratings.

International standards and cable manufacturers will provide derating factors for a range of installation conditions, for example ambient / soil temperature, grouping or bunching of cables, soil thermal resistivity, etc. The installed current rating is calculated by multiplying the base current rating with each of the derating factors, i.e.

$$I_c = I_b.k_d$$

where

I_c is the installed current rating (A)

I_b is the base current rating (A)

k_d are the product of all the derating factors

For example, suppose a cable had an ambient temperature derating factor of k_{amb} = 0.94 and a grouping derating factor of k_g = 0.85, then the overall derating factor k_d = 0.94x0.85 = 0.799. For a cable with a base current rating of 42A, the installed current rating would be I_c = 0.799x42 = 33.6A.

In the absence of any guidance, the following reference derating factors may be used.

Cable Selection and Coordinaton with Protective Devices

Feeders

When sizing cables for non-motor loads, the upstream protective device (fuse or circuit breaker) is typically selected to also protect the cable against damage from thermal overload. The protective device must therefore be selected to exceed the full load current, but not exceed the cable's installed current rating, i.e. this inequality must be met:

$$I_l \leq I_p \leq k_c$$

Where

I_l is the full load current (A)

I_p is the protective device rating (A)

k_c is the installed cable current rating (A)

Motors

Motors are normally protected by a separate thermal overload (TOL) relay and therefore the upstream protective device (e.g. fuse or circuit breaker) is not required to protect the cable against overloads. As a result, cables need only to be sized to cater for the full load current of the motor, i.e.

$$I_l \leq I_c$$

Where

I_l is the full load current (A)

I_c is the installed cable current rating (A)

Of course, if there is no separate thermal overload protection on the motor, then the protective device needs to be taken into account as per the case for feeders above.

Step 3: Voltage Drop

A cable's conductor can be seen as an impedance and therefore whenever current flows through a cable, there will be a voltage drop across it, which can be derived by Ohm's Law (i.e. V = IZ). The voltage drop will depend on two things:

- Current flow through the cable – the higher the current flow, the higher the voltage drop.

- Impedance of the conductor – the larger the impedance, the higher the voltage drop.

Cable Impedances

The impedance of the cable is a function of the cable size (cross-sectional area) and the length of the cable. Most cable manufacturers will quote a cable's resistance and reactance in Ω/km. The following typical cable impedances for low voltage AC and DC single core and multicore cables can be used in the absence of any other data.

Calculating Voltage Drop

For AC systems, the method of calculating voltage drops based on load power factor is commonly used. Full load currents are normally used, but if the load has high startup currents (e.g. motors), then voltage drops based on starting current (and power factor if applicable) should also be calculated.

For a three phase system:

$$V_{3\phi} = \frac{\sqrt{3} I \, (R_c \cos\phi + X_c \sin\phi) \, L}{1000}$$

Where

$V_{3\phi}$ is the three phase voltage drop (V)

I is the nominal full load or starting current as applicable (A)

R_c is the ac resistance of the cable (Ω/km)

X_c is the ac reactance of the cable (Ω/km)

$\cos\phi$ is the load power factor (pu)

L is the length of the cable (m)

For a single phase system:

$$V_{1\phi} = \frac{2I\,(R_c\cos\phi + X_c\sin\phi)\,L}{1000}$$

Where

$V_{1\phi}$ is the single phase voltage drop (V)

I is the nominal full load or starting current as applicable (A)

R_c is the ac resistance of the cable (Ω/km)

X_c is the ac reactance of the cable (Ω/km)

$\cos\phi$ is the load power factor (pu)

L is the length of the cable (m)

For a DC system: $V_{dc} = \frac{2I\,R_c\,L}{1000}$

Where

V_{dc} is the dc voltage drop (V)

I is the nominal full load or starting current as applicable (A)

R_c is the dc resistance of the cable (Ω/km)

L is the length of the cable (m)

Maximum Permissible Voltage Drop

It is customary for standards (or clients) to specify maximum permissible voltage drops, which is the highest voltage drop that is allowed across a cable. Should your cable exceed this voltage drop, then a larger cable size should be selected.

Maximum voltage drops across a cable are specified because load consumers (e.g. appliances) will have an input voltage tolerance range. This means that if the voltage at the appliance is lower than its rated minimum voltage, then the appliance may not operate correctly.

In general, most electrical equipment will operate normally at a voltage as low as 80% nominal voltage. For example, if the nominal voltage is 230VAC, then most appliances will run at >184VAC. Cables are typically sized for a more conservative maximum voltage drop, in the range of 5 – 10% at full load.

Calculating Maximum Cable Length due to Voltage Drop

It may be more convenient to calculate the maximum length of a cable for a particular conductor size given a maximum permissible voltage drop (e.g. 5% of nominal voltage at full load) rather than the voltage drop itself. For example, by doing this it is possible to construct tables showing the maximum lengths corresponding to different cable sizes in order to speed up the selection of similar type cables.

The maximum cable length that will achieve this can be calculated by re-arranging the voltage drop equations and substituting the maximum permissible voltage drop (e.g. 5% of 415V nominal voltage = 20.75V). For a three phase system:

$$L_{max} = \frac{1000\,V_{3\phi}}{\sqrt{3}I\,(R_c\cos\phi + X_c\sin\phi)}$$

Where

L_{max} is the maximum length of the cable (m)

$V_{3\phi}$ is the maximum permissible three phase voltage drop (V)

I is the nominal full load or starting current as applicable (A)

R_c is the ac resistance of the cable (Ω/km)

X_c is the ac reactance of the cable (Ω/km)

$\cos\phi$ is the load power factor (pu)

For a single phase system:

$$L_{max} = \frac{1000\,V_{1\phi}}{2I\,(R_c\cos\phi + X_c\sin\phi)}$$

Where

L_{max} is the maximum length of the cable (m)

$V_{1\phi}$ is the maximum permissible single phase voltage drop (V)

I is the nominal full load or starting current as applicable (A)

R_c is the ac resistance of the cable (Ω/km)

X_c is the ac reactance of the cable (Ω/km)

$\cos\phi$ is the load power factor (pu)

For a DC system:

$$L_{max} = \frac{1000\ V_{dc}}{2I\ R_c}$$

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Where

L_{max} is the maximum length of the cable (m)

V_{dc} is the maximum permissible dc voltage drop (V)

I is the nominal full load or starting current as applicable (A)

R_c is the dc resistance of the cable (Ω/km)

L is the length of the cable (m)

Step 4: Short Circuit Temperature Rise

During a short circuit, a high amount of current can flow through a cable for a short time. This surge in current flow causes a temperature rise within the cable. High temperatures can trigger unwanted reactions in the cable insulation, sheath materials and other components, which can prematurely degrade the condition of the cable. As the cross-sectional area of the cable increases, it can dissipate higher fault currents for a given temperature rise. Therefore, cables should be sized to withstand the largest short circuit that it is expected to see.

Minimum Cable Size Due to Short Circuit Temperature Rise

The minimum cable size due to short circuit temperature rise is typically calculated with an equation of the form:

$$A = \frac{\sqrt{i^2 t}}{k}$$

Where

A is the minimum cross-sectional area of the cable (mm2)

i is the prospective short circuit current (A)

t is the duration of the short circuit (s)

k is a short circuit temperature rise constant

The temperature rise constant is calculated based on the material properties of the conductor and the initial and final conductor temperatures (see the derivation here). Different international standards have different treatments of the temperature rise constant, but by way of example, IEC 60364-5-54 calculates it as follows:

$$k = 226\sqrt{\ln\left(1 + \frac{\theta_f - \theta_i}{234.5 + \theta_i}\right)}$$

(for copper conductors)

$$k = 148\sqrt{\ln\left(1 + \frac{\theta_f - \theta_i}{228 + \theta_i}\right)}$$

(for copper conductors)

Where
θ_i is the initial conductor temperature (deg C)
θ_i is the final conductor temperature (deg C)

Initial and Final Conductor Temperatures

The initial conductor temperature is typically chosen to be the maximum operating temperature of the cable. The final conductor temperature is typically chosen to be the limiting temperature of the insulation. In general, the cable's insulation will determine the maximum operating temperature and limiting temperatures.

As a rough guide, the following temperatures are common for the different insulation materials:

Maximum Permissible Voltage Drop

It is customary for standards (or clients) to specify maximum permissible voltage drops, which is the highest voltage drop that is allowed across a cable. Should your cable exceed this voltage drop, then a larger cable size should be selected.

Maximum voltage drops across a cable are specified because load consumers (e.g. appliances) will have an input voltage tolerance range. This means that if the voltage at the appliance is lower than its rated minimum voltage, then the appliance may not operate correctly.

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Calculating Maximum Cable Length due to Voltage Drop

It may be more convenient to calculate the maximum length of a cable for a particular conductor size given a maximum permissible voltage drop (e.g. 5% of nominal voltage at full load) rather than the voltage drop itself. For example, by doing this it is possible to construct tables showing the maximum lengths corresponding to different cable sizes in order to speed up the selection of similar type cables. The maximum cable length that will achieve this can be calculated by re-arranging the voltage drop equations and substituting the maximum permissible voltage drop (e.g. 5% of 415V nominal voltage = 20.75V). For a three phase system:

Material	Max Operating Temp. °C	Limiting Temp. °C
PVC	75	160
EPR	90	250
XLPE	90	250

Short Circuit Energy

The short circuit energy is normally chosen as the maximum short circuit that the cable could potentially experience. However for circuits with current limiting devices (such as HRC fuses), then the short circuit energy chosen should be the maximum prospective let-through energy of the protective device, which can be found from manufacturer data.

Step 5: Earth Fault Loop Impedance

Sometimes it is desirable (or necessary) to consider the earth fault loop impedance of a circuit in the sizing of a cable. Suppose a bolted earth fault occurs between an active conductor and earth. During such an earth fault, it is desirable that the upstream protective device acts to interrupt the fault within a maximum disconnection time so as to protect against any inadvertent contact to exposed live parts.

Ideally the circuit will have earth fault protection, in which case the protection will be fast acting and well within the maximum disconnection time. The maximum disconnection time is chosen so that a dangerous touch voltage does not persist for long enough to cause injury or death. For most circuits, a maximum disconnection time of 5s is sufficient, though for portable equipment and socket outlets, a faster disconnection time is desirable (i.e. <1s and will definitely require earth fault protection).

However for circuits that do not have earth fault protection, the upstream protective device (i.e. fuse or circuit breaker) must trip within the maximum disconnection time. In order for the protective device to trip, the fault current due to a bolted short circuit must exceed the value that will cause the protective device to act within the maximum disconnection time.

For example, suppose a circuit is protected by a fuse and the maximum disconnection time is 5s, then the fault current must exceed the fuse melting current at 5s (which can be found by cross-referencing the fuse time-current curves). By simple application of Ohm's law:

$$I_A = \frac{V_o}{Z_s}$$

Where

I_A is the earth fault current required to trip the protective device within the minimum disconnection time (A)

V_o is the phase to earth voltage at the protective device (V)

Z_s is the impedance of the earth fault loop (Ω)

It can be seen from the equation above that the impedance of the earth fault loop must be sufficiently low to ensure that the earth fault current can trip the upstream protection.

The Earth Fault Loop

The earth fault loop can consist of various return paths other than the earth conductor, including the cable armour and the static earthing connection of the facility. However for practical reasons, the earth fault loop in this calculation consists only of the active conductor and the earth conductor.

The earth fault loop impedance can be found by:

$$Z_s = Z_c + Z_e$$

Where

Z_s is the earth fault loop impedance (Ω)

Z_c is the impedance of the active conductor (Ω)

Z_e is the impedance of the earth conductor (Ω)

Assuming that the active and earth conductors have identical lengths, the earth fault loop impedance can be calculated as follows:

$$Z_s = \frac{L}{1000}\sqrt{(R_c + R_e)^2 + (X_c + X_e)^2}$$

Where

L is the length of the cable (m)

R_c and R_e are the ac resistances of the active and earth conductors respectively (Ω/km)

X_c and X_e are the reactances of the active and earth conductors respectively (Ω/km)

Maximum Cable Length

The maximum earth fault loop impedance can be found by re-arranging the equation above

$$Z_{s\,max} = \frac{V_o}{I_A}$$

Where

Z_s is the maximum earth fault loop impedance (Ω)

V_o is the phase to earth voltage at the protective device (V)

I_A is the earth fault current required to trip the protective device within the disconnection time (A)

The maximum cable length can therefore be calculated by the following::

$$L_{max} = \frac{1000\,V_o}{I_A\sqrt{(R_c + R_e)^2 + (X_c + X_e)^2}}$$

Where

L_{max} is the maximum cable length (m)

V_o is the phase to earth voltage at the protective device (V)

I_A is the earth fault current required to trip the protective device within the minimum disconnection time (A)

R_c and R_e are the ac resistances of the active and earth conductors respectively (Ω/km)

X_c and X_e are the reactances of the active and earth conductors respectively (Ω/km)

Note that the voltage V_o at the protective device is not necessarily the nominal phase to earth voltage, but usually a lower value as it can be downstream of the main busbars. This voltage is commonly represented by applying some factor to the nominal voltage. A conservative value of $C = 0.8$ can be used so that:

$$V_o = CV_n = 0.8\,V_n$$

Where V_n is the nominal phase to earth voltage (V)

Worked Example

In this example, we will size a cable for a 415V, 30kW three-phase motor from the MCC to the field.

Step 1: Data Gathering

The following data was collected for the cable to be sized:

- Cable type: Cu/PVC/GSWB/PVC, 3C+E, 0.6/1kV
- Operating temperature: 75C
- Cable installation: above ground on cable ladder bunched together with 3 other cables on a single layer and at 30C ambient temperature
- Cable run: 90m (including tails)
- Motor load: 30kW, 415V three phase, full load current = 61A, power factor = 0.85
- Protection: aM fuse of rating = 80A, max prospective fault I^2t = 90 A^2s, 5s melt time = 550A

Step 2: Cable Selection Based on Current Rating

Suppose the ambient temperature derating is 0.89 and the grouping derating for 3 bunched cables on a single layer is 0.82. The overall derating factor is 0.89 X 0.82 = 0.7298. Given that a 16 mm² and 25 mm² have base current ratings of 80A and 101A respectively (based on Reference Method E), which cable should be selected based on current rating considerations?

The installed current ratings for 16 mm² and 25 mm² is 0.7298 X 80A = 58.38A and 0.7298 X 101A = 73.71A respectively. Given that the full load current of the motor is 61A, then the installed current rating of the 16 mm² cable is lower than the full load current and is not suitable for continuous use with the motor. The 25 mm² cable on the other hand has an installed current rating that exceeds the motor full load current, and is therefore the cable that should be selected.

Step 3: Voltage Drop

Suppose a 25 mm² cable is selected. If the maximum permissible voltage drop is 5%, is the cable suitable for a run length of 90m?

A 25 mm² cable has an ac resistance of 0.884 Ω/km and an ac reactance of 0.0895 Ω/km. The voltage drop across the cable is:

$$V_d = \frac{90}{1000} \times \sqrt{3} \times 61 \times \left[0.884 \times 0.85 + 0.0895 \left(\cos^{-1}(0.85)\right)\right] = 7.593V$$

A voltage drop of 7.593V is equivalent to $\frac{7.593}{415} = 1.83\%$ which is lower than the maximum permissible voltage dorp of 5%. Therefore the cable is suitable for the motor based on voltage drop considerations.

Step 4: Short Circuit Temperature Rise

The cable is operating normally at 75C and has a prospective fault capacity (I^2t) of 90,000 A2s. What is the minimum size of the cable based on short circuit temperature rise?

PVC has a limiting temperature of 160C. Using the IEC formula, the short circuit temperature rise constant is 111.329. The minimum cable size due to short circuit temperature rise is therefore:

$$A = \frac{\sqrt{90,000}}{111.329} = 2.695mm^2$$

In this example, we also use the fuse for earth fault protection and it needs to trip within 5s, which is at the upperend of the adiabatic period where the short circuit temperature rise equation is still valid. Therefore, it's a good idea to also check that the cable can withstand the short circuit temperature rise for for a 5s fault. The 80A motor fuse has a 5s melting current of 550A. The short circuit temperature rise is thus:

$$A = \frac{\sqrt{550^2 \times 5}}{111.329} = 11.047mm^2$$

Therefore, our 25 mm² cable is still suitable for this application.

Step 5: Earth Fault Loop Impedance

Suppose there is no special earth fault protection for the motor and a bolted single phase to earth fault occurs at the motor terminals. Suppose that the earth conductor for our 25 mm² cable is 10 mm². If the maximum disconnection time is 5s, is our 90m long cable suitable based on earth fault loop impedance?

The 80A motor fuse has a 5s melting current of 550A. The ac resistances of the active and earth conductors are 0.884 Ω/km and 2.33 Ω/km) respectively. The reactances of the active and earth conductors are 0.0895 Ω/km and 0.0967 Ω/km) respectively.

The maximum length of the cable allowed is calculated as:

$$L_{max} = \frac{(1000)(0.8)(240)}{550\sqrt{(0.884 + 2.33)^2 + (0.0895 + 0.0967)^2}} = 108.43m$$

The cable run is 90m and the maximum length allowed is 108m, therefore our cable is suitable based on earth fault loop impedance. In fact, our 25 mm² cable has passed all the tests and is the size that should be selected.

Waterfall Charts

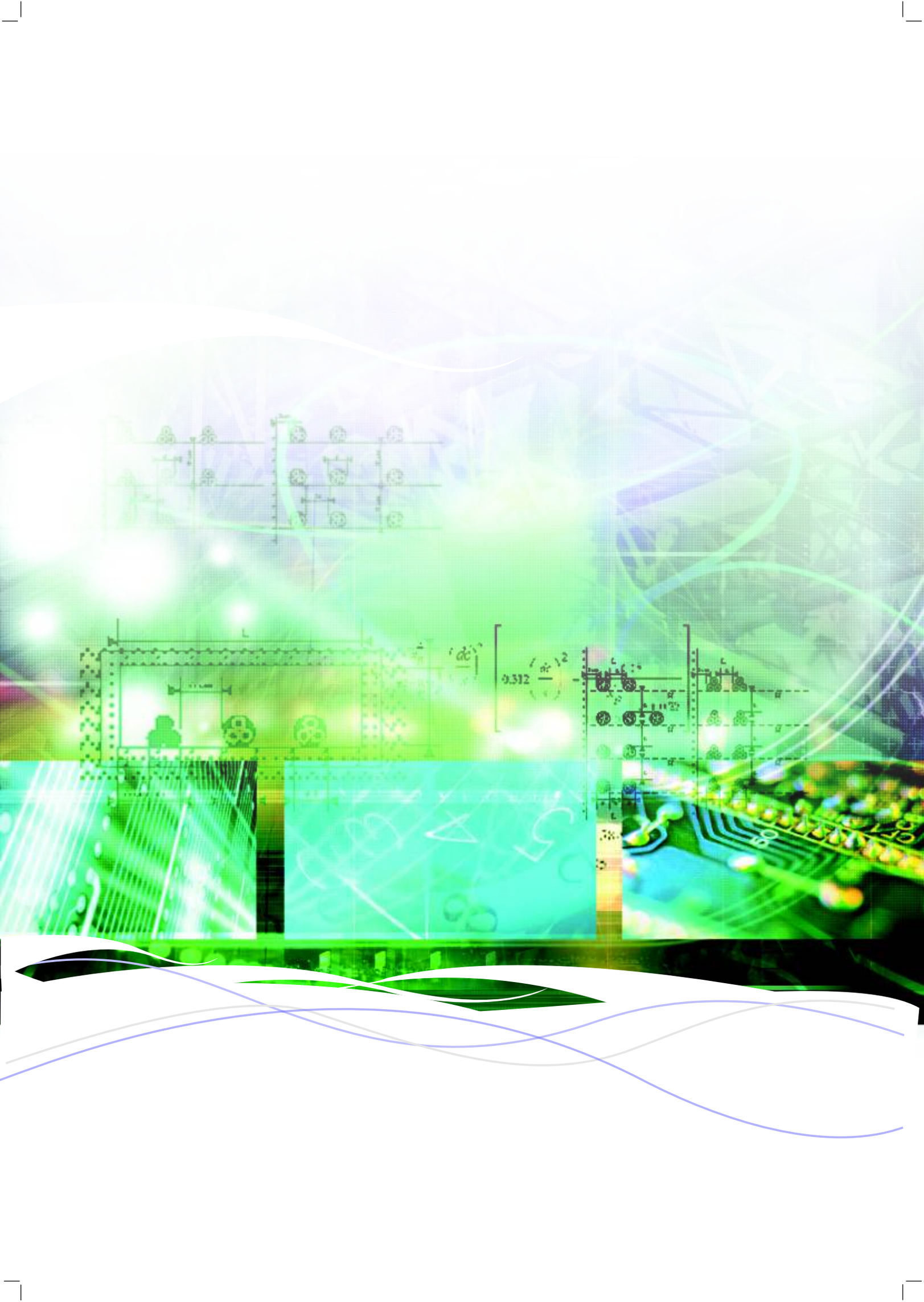
Load Rating (kw)	gMFuse Fating (A)	415V 3-Phase Motor Cable Selection Chart (15% Starting, 5% Full Load Voltage Drop)														
		2.5	4	6	10	16	25	35	50	70	95	120	150	185	2x95	Conductors Size (mm²)
		19.01	24.85	31.43	41.67	54.09	70.18	84.07	102.34	127.93	153.51	175.44	197.37	226.61	307.02	Current Rating (A)
1.1	4															
1.5	6		355	407												
2.2	10		240	275	449											
3	10		240	275	449											
4	16		130	149	243	370	411									
5.5	16		130	149	243	370	411									
7.5	20		104	119	194	296	329									
11	32		78	90	146	222	246									
15	40			129	215	335	487									
18.5	50				174	272	395									
22	63					229	332	427								
30	80						244	313	390	495						
37	100							254	316	401	480					
45	125								260	330	394	447	488			
55	160									270	323	366	399	434		
75	200										237	268	293	318	473	
90	200											224	244	265	394	
110	250													217	323	
132	355														269	
150	400														237	
160	400															
185	500															

Table 2. Example of a cable waterfall chart

Sometimes it is convenient to group together similar types of cables (for example, 415V PVC motor cables installed on cable ladder) so that instead of having to go through the laborious exercise of sizing each cable separately, one can select a cable from a pre-calculated chart.

These charts are often called "waterfall charts" and typically show a list of load ratings and the maximum of length of cable permissible for each cable size. Where a particular cable size fails to meet the requirements for current carrying capacity or short circuit temperature rise, it is blacked out on the chart (i.e. meaning that you can't choose it).

Preparing a waterfall chart is common practice when having to size many like cables and substantially cuts down the time required for cable selection.



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C/R CYBERSTONE

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