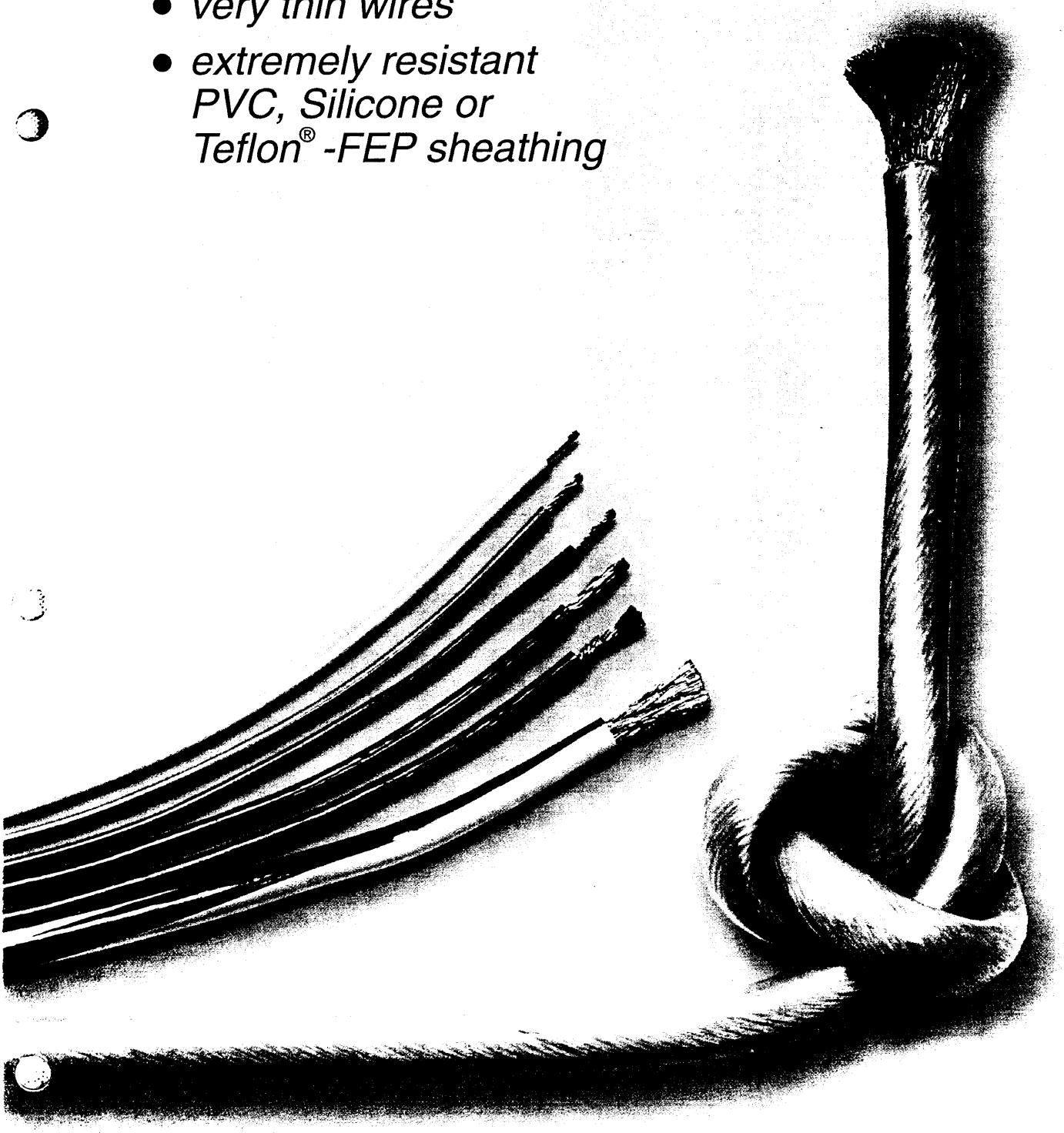
Stranded Leads

- *highly flexible*
- *very thin wires*
- *extremely resistant PVC, Silicone or Teflon® -FEP sheathing*



Quality Characteristics

The basis of HCK stranded leads are the very thin strands of soft electrolytic copper wire. With an electrical effective cross section, eg of 1.5 mm^2 for SILIVOLT® – 1V, the stranded wire consists of 770 individual wires of 0.05 mm diameter. These fine wires being stranded with very short turns (ie many coils around the longitudinal axis per unit of length), together with the very elastic insulation material, results in an extremely high flexibility of the finished leads.

HCK manufactures its stranded leads on different extrusion systems as the insulation materials PVC, Silicone and Teflon®-FEP all require different processes:

Silicone insulation is extruded when cold. The vulcanization of silicone rubber is then achieved through warming. The extrusion of PVC and Teflon®-FEP insulation occurs at temperatures of about 180 °C and 400 °C. This is followed by the leads going through a cool bath.

Rigorous quality measures govern the manufacture of HCK stranded leads. During extrusion, the insulating quality is subject to constant controls by high voltage test equipment. Also part of the continuous quality controls are the non-contact eccentricity measurements for silicone insulated leads with a dissolution of 0.012 mm and a control of the diameter of the leads over 2 axis with a tolerance of 0.03 mm. PVC and Teflon®-FEP insulated leads are also continually checked throughout production.

In addition, samples are cut from each production length and the strength of the insulation wall, diameter and mid-position of the leads are all checked.

Contents

Insulation Materials

PVC

The insulation material used for the HCK product lines FLEXIVOLT® and FLEXISTROM is Polyvinylchloride, especially designed for electrotechnical applications. This PVC compound shows good mechanical properties. It is completely flexible at temperatures of -10 °C to +60 °C and suitable for continuous use. Furthermore, this insulation material is suitable for many applications having long term reliability and a very favourable price-performance relationship.

SILICONE

For Silicone insulated stranded leads, we use an addition cross linked 2 component silicone rubber. The extruded insulation is then highly flexible and has a lasting temperature stability between -80 °C and +150 °C. It can last several hours up to a temperature of +250 °C without noticeable reduction of flexibility or of elasticity and for a short time can even cope with up to +300 °C. This is very important for leads which are used near solder work. The exceptional mechanical properties of the HCK silicone mixture, such as high notch toughness, ultimate elongation and tear propagation strength, are complemented by a good chemical resistance and long term reliability. An important safety note is shown in cases of fire by the extra insulated framework out of silicon ashes (functional support of electrical installations in industrial plants, in building conductor technology etc). The silicone rubber made by HCK is halogen free (chlorine content < 4 ppm, test method in accordance with DIN VDE 0472, Part 813) which is environmentally friendly.

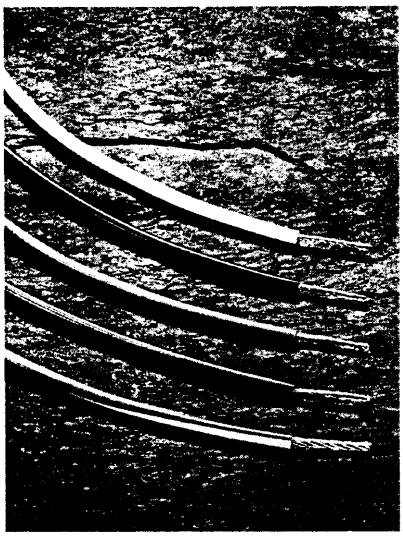
TEFLON® -FEP

In the HCK stranded leads specification, Teflon®-FEP is a weatherproof insulation material with excellent chemical resistance as well as relatively good flexibility; it is, in addition, antistatic, rejects dirt and abrasion proof. Teflon®-FEP is flame retardant, very reliable in the long term and suitable for continual use in the temperature range of -100 °C to +205 °C. Excellent dielectric features facilitate very thin insulation layers in the manufacture of the leads, which is spacesaving; an advantage with the wire of microelectronic components. With Teflon®-FEP, insulated stranded leads are recommended for many applications with special uses. For example, due to the frequency stability, the leads are very suitable in the production of voice coils. The almost universal chemical resistance (see P8) determines the leads for use in industrial plants where corrosive liquids and gases are present.

Teflon® is the trade name for a Polymerisation product of Tetrafluorethylene, an extremely durable chemical substance with excellent insulation properties.

Teflon® is a registered trademark of DUPONT de Nemours.

PVC Insulated Single Core Stranded Leads



Type FLEXIVOLT® – 1V

Special Notes highly flexible, reinforced insulation. The test voltages are designed for operating voltages in the Overvoltage category II.

Conductor very thin strands of soft drawn braided copper wire according to DIN 1787.

Insulation PVC - special mixture, 70 shore A, long term reliability.

Ultimate Elongation 280 % according to DIN 53504.

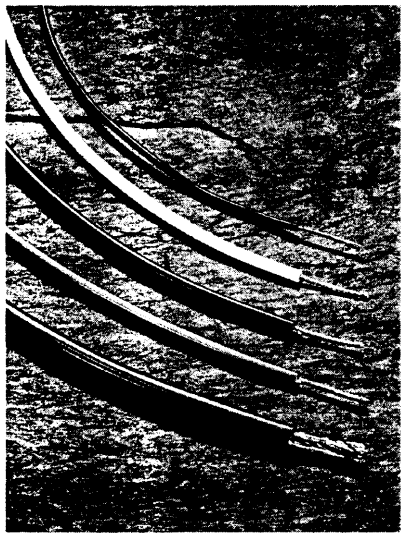
Tensile Strength 15 N/mm^2 according to DIN 53504.

Temperature Range -10 °C to +70 °C

Environmental Conditions medium to good UV and ozone resistant colour. Chemical resistance see page 8.

Typical Applications external wiring of moving elements, eg wire of components and sub assemblies in machine construction and control engineering.

nominal cross-section mm^2	(AWG)	number of strands x diameter of single strands, mm	copper weight kg/km	insulation thickness appx. mm	outer diameter appx. mm	operating voltage V	test voltage V_{AC}	rated current A	colours*	order code
0.50	20	129 x 0.07	4.7	0.65	2.3	600	4000	10	1 - 8	7085*
0.75	18	196 x 0.07	7.2	1.1	3.5	1500	8000	15	1 - 9	7086*
1.0	17	258 x 0.07	9.5	1.1	3.9	1500	8000	19	1 - 9	7087*
1.5	15	385 x 0.07	14.1	1.0	3.9	1500	8000	24	1 - 9	7088*
2.0	14	525 x 0.07	19.8	0.85	3.9	1000	6000	30	1 - 9	7089*
2.5	13	651 x 0.07	24.5	0.75	3.9	1000	6000	32	1 - 9	7125*



Type FLEXIVOLT® – 2V

Special Notes highly flexible reinforced insulation, suitable for high safety requirements through double layered construction (inner neutral, outer coloured). The test voltages are designed for operating voltages in the Overvoltage category III.

Conductor very thin strands of soft drawn braided copper wire according to DIN 1787.

Insulation PVC - special mixture, 70 shore A, long term reliability.

Ultimate Elongation 280 % according to DIN 53504.

Tensile Strength 15 N/mm^2 according to DIN 53504.

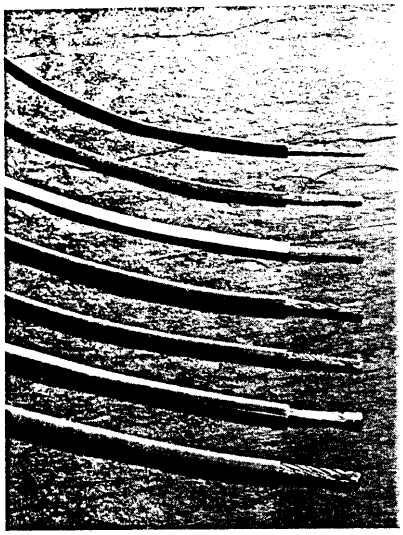
Temperature Range -10 °C to +70 °C.

Environmental Conditions medium to good UV and ozone resistant colour. Chemical resistance, see page 8.

Typical Applications test leads in research laboratories and training workshops, equipping of test rigs for the inspection and maintenance of electric installations in trade and industry.

nominal cross-section mm^2	(AWG)	number of strands x diameter of single strands, mm	copper weight kg/km	insulation thickness appx. mm	outer diameter appx. mm	operating voltage V	test voltage V_{AC}	rated current A	colours*	order code
0.25	23	65 x 0.07	2.4	0.65	2.0	600	6000	6	1 - 8	7026*
0.50	20	129 x 0.07	4.7	0.65	2.3	600	6000	10	1 - 8	7027*
0.75	18	196 x 0.07	7.2	1.1	3.5	1500	9300	15	1 - 8	7028*
1.0	17	258 x 0.07	9.5	1.2	3.9	1500	9300	19	1 - 8	7030*
1.5	15	385 x 0.07	14.1	1.0	3.9	1500	9300	24	1 - 8	7031*
2.0	14	525 x 0.07	19.8	0.9	3.9	1000	8000	30	1 - 8	7029*
2.5-S	13	651 x 0.07	24.5	0.75	3.9	1000	6000	32	1 - 6	7033*
2.5	13	651 x 0.07	24.5	1.0	4.4	1500	9300	32	1 - 6	7032*
4.0	11	1,036 x 0.07	39.6	1.5	6.0	1500	9300	42	1 - 6	7034*
6.0	9	1,575 x 0.07	59.2	1.5	7.0	1500	9300	54	1 - 6	7035*

*colours: 1=black, 2=red, 3=blue, 4=yellow, 5=green, 6=violet, 7=brown, 8=white, 9=green/yellow, 0=transparent



Type SILIVOLT® – E

Special Notes highly flexible, basic insulation.The test voltages are designed for operating voltages in the Overvoltage category II.

Conductor very thin strands of soft drawn braided copper wire.

Insulation silicone rubber, 60 shore A, halogen free outer sheath, Chlorine content <4 ppm - inspection according to DIN VDE 0472, part 813.

Rel. Dielectric Constant 2.7-2.8 according to DIN 53482 at 25 °C and 50 Hz.

Loss Factor ca 0.003 dependant on frequency according to VDE 0303 at 23 °C.

Dielectric Strength 18 - 20 kV/mm.

Ultimate Elongation 500% according to DIN 53504.

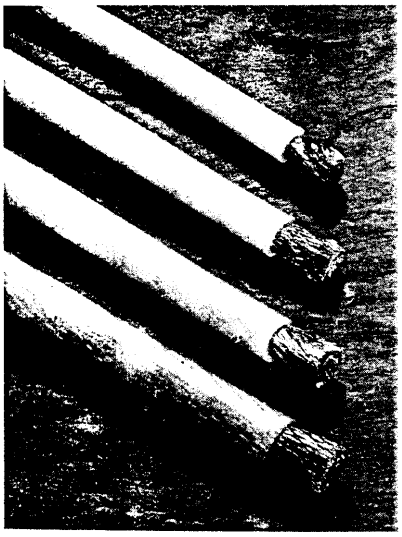
Tensile Strength ca 8.3 N/mm^2 according to DIN 53504, very high tear strength.

Temperature Range -80 °C to +150 °C continuous use, up to +250 °C for several hours, up to +300 °C short term (contact with soldering irons).

Environmental Conditions very good resistance to atmospheric conditions and radiation. Chemical resistance, see page 8.

Typical Applications flexible internal wiring of very moveable components and sub assemblies in high temperature environments.

nominal cross-section mm^2	(AWG)	number of strands x diameter of single strands	copper weight kg/km	insulation thickness appx. mm	outer diameter mm	operating voltage V	test voltage V_{AC}	rated current A	colours*	order code
0.15	25	39 x 0.07	1.4	0.25	1.0	150	2000	6	1 - 8	7550*
0.25	23	65 x 0.07	2.4	0.5	1.7	300	2000	9	1 - 8	7551*
0.50	20	129 x 0.07	4.7	0.6	2.3	300	2000	10	1 - 8	7552*
0.75	18	196 x 0.07	7.2	0.7	2.7	600	2500	15	1 - 9	7553*
1.0	17	259 x 0.07	9.5	0.7	3.0	600	2500	19	1 - 9	7554*
1.5	15	385 x 0.07	14.1	0.7	3.4	600	2500	24	1 - 9	7555*
2.5	13	651 x 0.07	24.5	0.7	3.9	600	2500	32	1 - 9	7556*



Type SILISTROM®

Special Notes highly flexible, reinforced insulation.The test voltages are designed for operating voltages in the Overvoltage category II.

Conductor very thin strands of soft drawn braided copper wire.

Insulation silicone rubber, 60 shore A, halogen free outer sheath, Chlorine content <4 ppm - inspection according to DIN VDE 0472, part 813.

Rel. Dielectric Constant 2.7-2.8 according to DIN 53482 at 25 °C and 50 Hz.

Loss Factor ca 0.003 dependant on frequency according to VDE 0303 at 23 °C.

Dielectric Strength 18 - 20 kV/mm.

Ultimate Elongation 500% according to DIN 53504.

Tensile Strength ca 8.3 N/mm^2 according to DIN 53504, very high tear strength.

Temperature Range -80 °C to +150 °C continuous use, up to +250 °C for several hours, up to +300 °C short term (contact with soldering irons).

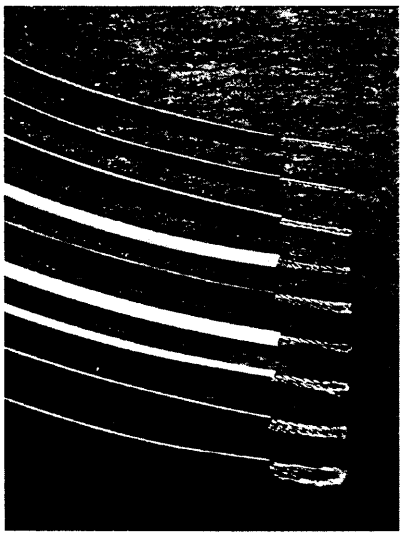
Environmental Conditions very good resistance to atmospheric conditions and radiation. Chemical resistance, see page 8.

Typical Applications flexible current feed for welding equipment and robots, heat cutting machines; as high current connection in machine construction, in conveyer systems, for highly flexible ground leads, high current test leads for relay test equipment.

nominal cross-section mm^2	(AWG) ca.	number of strands x diameter of single strands, mm	copper weight kg/km	insulation diameter appx. mm	outer diameter appx. mm	operating voltage V	test voltage V_{AC}	rated current A	colours*	order code
4.0	11	1,036 x 0.07	39.6	1.1	5.4	1500	8000	40	1-6+0	7611*
6.0	9	1,575 x 0.07	59.2	1.1	6.2	1500	8000	55	1-6+9+0	7612*
10	7	2,604 x 0.07	98	2.0	9.0	2000	9300	75	0	76130
16	5	4,116 x 0.07	156	2.0	10.5	2000	9300	100	0	76140
25	3	6,496 x 0.07	256	2.25	11.8	2000	9300	130	0	76150
35	2	9,329 x 0.07	368	2.45	13.3	2000	9300	160	0	76160
50	1/0	12,996 x 0.07	513	2.45	14.9	2000	9300	200	0	76170
70	2/0	8,967 x 0.10	720	2.45	16.4	2000	9300	245	0	76180
95	3/0	12,261 x 0.10	980	2.45	19.3	2000	9300	290	0	76190

*colours: 1=black, 2=red, 3=blue, 4=yellow, 5=green, 6=violet, 7=brown, 8=white, 9=green/yellow, 0=transparent

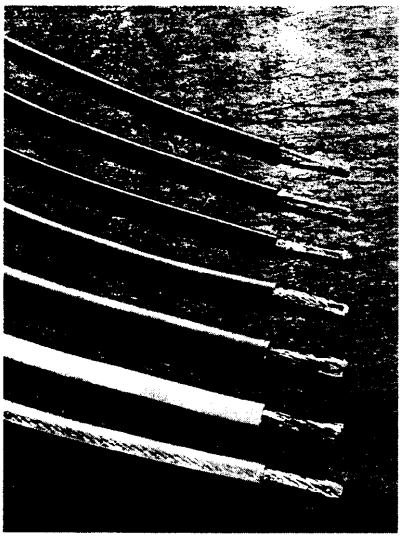
SILICONE Insulated Single Core Stranded Leads



Type SILIVOLT® – 1V

Special Notes	highly flexible, reinforced insulation.The test voltages are designed for operating voltages in the Overvoltage category II.
Conductor	very thin strands of soft drawn braided copper wire.
Insulation	silicone rubber, 60 shore A, halogen free outer sheath, Chlorine content <4 ppm - inspection according to DIN VDE 0472, part 813.
Rel. Dielectric Constant	2.7-2.8 according to DIN 53482 at 25C and 50Hz.
Loss Factor	ca 0.003 dependent on frequency according to VDE 0303 at 23 °C.
Dielectric Strength	18 - 20 kV/mm.
Ultimate Elongation	500% according to DIN 53504.
Tensile Strength	ca 8.3 N/mm^2 according to DIN 53504, very high tear strength.
Temperature Range	-80 °C to +150 °C continuous use, up to +250 °C for several hours, up to +300 °C short term (contact with soldering irons).
Environmental Conditions	very good resistance to atmospheric conditions and radiation. Chemical resistance, see page 8.
Typical Applications	handheld test and connection leads, high temperature flexible external wiring.

nominal cross-section mm^2	(AWG)	number of strands x diameter of single strands	copper weight kg/km	insulation thickness appx. mm	outer diameter appx. mm	operating voltage max. V	test voltage V_{AC}	rated current A	colours*	order code
0.15	25	39 x 0.07	1.4	0.5	1.5	300	3000	6	1 - 8	7603*
0.25	23	128 x 0.05	2.4	0.6	2.0	300	3000	9	1 - 8	7604*
0.50	20	259 x 0.05	4.8	0.8	2.7	1000	6000	12	1 - 8	7605*
0.75	18	385 x 0.05	7.3	1.1	3.5	1500	8000	15	1 - 9	7606*
1.0	17	512 x 0.05	9.8	1.1	3.9	1500	8000	19	1 - 9	7607*
1.5	15	770 x 0.05	14.4	1.1	3.9	1500	8000	24	1 - 9	7608*
2.0	14	525 x 0.07	19.8	0.9	3.9	1000	6000	30	1 - 6	7609*
2.5	13	651 x 0.07	24.5	1.1	4.6	1500	8000	34	1-6+9+0	7610*

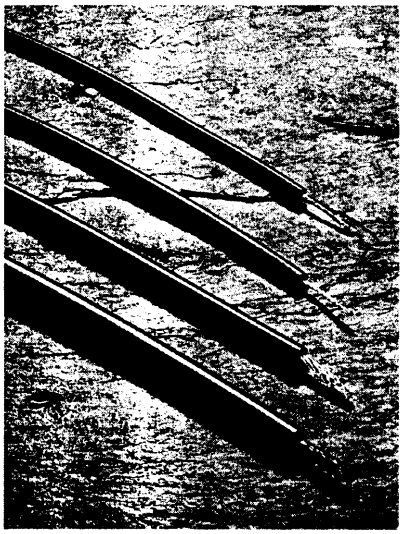


Type SILIVOLT® – UL

Special Notes	highly flexible, reinforced insulation, UL-approved for use with test leads up to 1500 V, delivery with yellow UL-card.
Conductor	very thin strands of soft drawn braided copper wire.
Insulation	silicon rubber, 60 shore A, halogen free outer sheath, Chlorine content <4 ppm - inspection according to DIN VDE 0472, part 813.
Rel. Dielectric Constant	2.7-2.8 according to DIN 53482 at 25 °C and 50 Hz.
Loss Factor	ca 0.003 dependent on frequency according to VDE 0303 at 23 °C.
Dielectric Strength	18 - 20 kV/mm.
Ultimate Elongation	500% according to DIN 53504.
Tensile Strength	ca 8.3 N/mm^2 according to DIN 53504, very high tear strength.
Temperature Range	-80 °C to +150 °C continuous use, up to +250 °C for several hours, up to +300 °C short term (contact with soldering irons).
Environmental Conditions	very good resistance to atmospheric conditions and radiation. Chemical resistance, see page 8.
Typical Applications	handheld test and connection leads up to 1500 V nominal voltage, for training workshops, test rigs and electricians.

nominal cross-section mm^2	(AWG) ca.	number of strands x diameter of single strands, mm	copper weight kg/km	insulation thickness appx. mm	outer diameter appx. mm	operating voltage max. V	test voltage V_{AC}	rated current A	colours*	order code
0.75	18	385 x 0.05	7.3	1.1	3.5	1500	8000	16	1 - 9	7560*
1.0	17	512 x 0.05	9.8	1.1	3.7	1500	8000	20	1 - 9	7561*
1.5	15	770 x 0.05	14.4	1.1	3.9	1500	8000	24	1 - 9	7562*
2.5	13	651 x 0.07	24.5	1.1	4.6	1500	8000	34	1-6+9+0	7563*
4.0	11	1.036 x 0.07	39.6	1.1	5.4	1500	8000	40	1-6+0	7564*
6.0	9	1.575 x 0.07	59.2	1.1	6.2	1500	8000	55	1-6+9+0	7565*

*colours: 1=black, 2=red, 3=blue, 4=yellow, 5=green, 6=violet, 7=brown, 8=white, 9=green/yellow, 0=transparent



Type SILIVOLT® – HV

Special Notes highly flexible, thick insulation, high voltage leads individually tested in salt water bath.The test voltages are designed for secondary operating voltages in the Overvoltage category I.

Conductor very thin strands of soft drawn braided copper wire.

Insulation silicon rubber, 60 shore A, halogen free outer sheath, Chlorine content <4 ppm - inspection according to DIN VDE 0472, part 813.

Rel. Dielectric Constant 2.7-2.8 according to DIN 53482 at 25 °C and 50 Hz.

Loss Factor ca 0.003 dependent on frequency according to VDE 0303 at 23 °C.

Dielectric Strength 18 - 20 kV/mm.

Ultimate Elongation 500% according to DIN 53504.

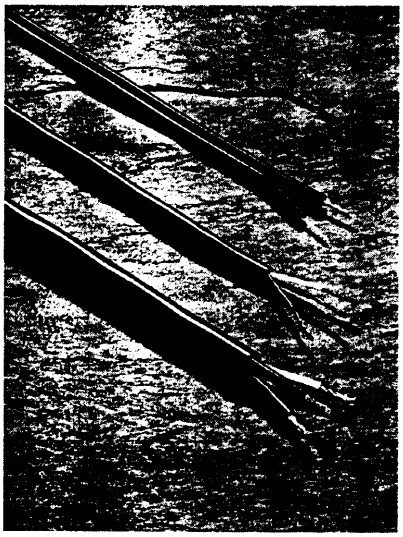
Tensile Strength ca 8.3 N/mm according to DIN 53504, very high tear strength.

Temperature Range -80 °C to +150 °C continuous use, up to +250 °C for several hours, up to +300 °C short term(contact with soldering irons).

Environmental Conditions very good resistance to atmospheric conditions and radiation. Chemical resistance, see page 8.

Typical Applications suitable for flexible high voltage wiring as the dielectric is largely independent of temperature, eg, as ignition leads in neon signs, radar and laser installations, handheld test leads for high voltage test equipment.

nominal cross-section mm^2	number of strands x diameter of single strands, mm	copper weight kg/km	insulation thickness appx. mm	outer diameter appx. mm	operating voltage max. kV	operating voltage handheld test leads max. kV	test voltage kV_{DC}	colours*	order code
0.50	129 x 0.07	4.7	1.6	4.2	5.0	2.5	11	1 - 2	7630*
0.75	196 x 0.07	7.2	1.9	5.1	7.5	3.8	15	1 - 2	7631*
1.0	259 x 0.07	9.5	2.0	5.5	10.0	5.0	20	1 - 2	7632*
2.5	651 x 0.07	24.5	2.1	6.6	12.5	6.3	25	1 - 2	7634*
6.0	1,575 x 0.07	59.2	2.5	9.0	20.0	10.0	38	1 - 2	7636*



Type SILINETZ

Special Notes highly flexible, individual silicone insulated coloured cores in a black silicone sheat.

Conductor very thin strands of soft drawn braided copper wire.

Insulation silicon rubber, 60 shore A, halogen free outer sheath, Chlorine content <4 ppm - inspection according to DIN VDE 0472, part 813.

Rel. Dielectric Constant 2.7-2.8 according to DIN 53482 at 25 °C and 50 Hz.

Loss Factor ca 0.003 dependent on frequency according to VDE 0303 at 23 °C.

Dielectric Strength 18 - 20 kV/mm.

Ultimate Elongation 500 % according to DIN 53504.

Tensile Strength ca 8.3 N/mm^2 according to DIN 53504, very high tear strength.

Temperature Range -80 °C to +150 °C continuous use, up to +250 °C for several hours, up to +300 °C short term (contact with soldering irons).

Environmental Conditions very good resistance to atmospheric conditions and radiation. Chemical resistance, see page 8.

Typical Applications as power lines under strong thermal and mechanical loads, eg supply current feeds for soldering irons.

design	nominal cross-section mm^2	wire structure	copper weight kg/km	insulation thickness/ core diameter	jacket insulation thickness appx. mm	outer diameter appx. mm	operating/ test voltage max. V	rated current A	colours*	order code
twin	2 x 0.50	129 x 0.07	9.4	0.7/2.5	0.3	3.4 x 6.9	300/3 kV	10	1 + 3/1	77301
twin	2 x 0.75	196 x 0.07	14.4	0.7/2.7	0.3	3.4 x 6.9	300/3 kV	12	1 + 3/1	77311

*colours: 1=black, 2=red, 3=blue, 4=yellow, 5=green, 6=violet, 7=brown, 8=white, 9=green/yellow, 0=transparent

Test Medium	PVC			SILICONE®			TEFLON®–FEP		
	bad	medium	good	bad	medium	good	bad	medium	good
acetamide			6%/20° C			X			X
acetic acid anhydride	X					X			X
acetic acid concentrate		X				X			X
acetic acid ester	X					X			X
acetone	X					X			X
ammonia concentrate			15 %			X			10 %
benzole	X				X			200° C	
benzyl alcohol	X					X			X
brake fluid		X				X			X
butanol	X				X				X
butyl acetate	X				X				X
calcium chloride		X							X
calcium hydroxide		X				X			X
carbon disulphide	X					X			X
caustic potash solution	X	20 %	6 %	X					X
chloroform	X			X					X
dibutylether	X				X				X
diesel oil		X			X				X
dimethylformamide	X					X			X
1.4 dioxan	X				X				X
engine oil SAE 20	60° C	40° C			X				X
engine oil SAE 30	60° C	40° C			X				X
ethanol	X					X			X
fat, vegetable	X					X			X
formic acid concentrate	X					X			X
gear oil SAE 90	60° C	40° C				X			X
glycol		X				X			X
hexane	X				X				X
hydrochloric acid 10%			X		X				X
hydrochloric acid 30%			X		X				X
hydrofluorid acid 5%	X			X					~20°C
hydrogen peroxide 10%			X			X			X
linseed oil	X					X			X
methanol	X				X				X
methyl methacrylate	X				X				X
mineral oil ASTM 1	60° C	40° C				X			X
mineral oil ASTM 2	60° C	40° C			X				X
mineral oil ASTM 3	60° C	40° C			X				X
nitric acid 5%			X		X				X

Test Medium	PVC			SILICONE®			TEFLON®–FEP		
	bad	medium	good	bad	medium	good	bad	medium	good
nitric acid 10%		X			X				X
nitric acid 65%	40° C	20° C		X					40° C
olive oil	X					X			X
petrol	X				X				X
potassium bichromate 20%			X			X			95° C
paraffin oil	X			X					X
petroleum ether	X			X					X
phenol	X					X			X
phosphoric acid 30%		X				X			X
phosphoric acid 50%		X				X			X
phosphoric acid 85%		X				X			X
phthalic acid anhydride	X					X			X
silicone oil AK 100	X				X				X
silicone oil AK 350	X				X				X
silicone oil AK 500	X				X				X
silicone oil AK 12500	X					X			X
silicone oil AP 100	X				X				X
silcone oil AP 500	X					X			X
silicone oil AR 20	X				X				X
silicone oil AR 200	X				X				X
sodium carbonate	X					X			X
sodium chlorate 20%	X					X			X
sodium chloride solution 10%			X			X			X
sodium hydroxide 10%			4 %			X			X
sodium hydroxide 30%		X				X			X
sodium hydroxide 50%		X			X				X
sodium hypochlorite		X							X
sodium perchlorate 20%	X					X			X
sulfuric acid 10%		X				X			X
sulfuric acid 60%		X		X					X
tetrachloroethylene					X				X
tetrachloromethane	X				X				X
tetrahydrofuran	X								X
toluene	X				X				X
transformer oil	60° C	40° C				X			X
trichloroethylene	X					X			X
Vaseline	X					X			X
washing powder solution 1%		60° C	X			X			X
xylene	X				X			X	