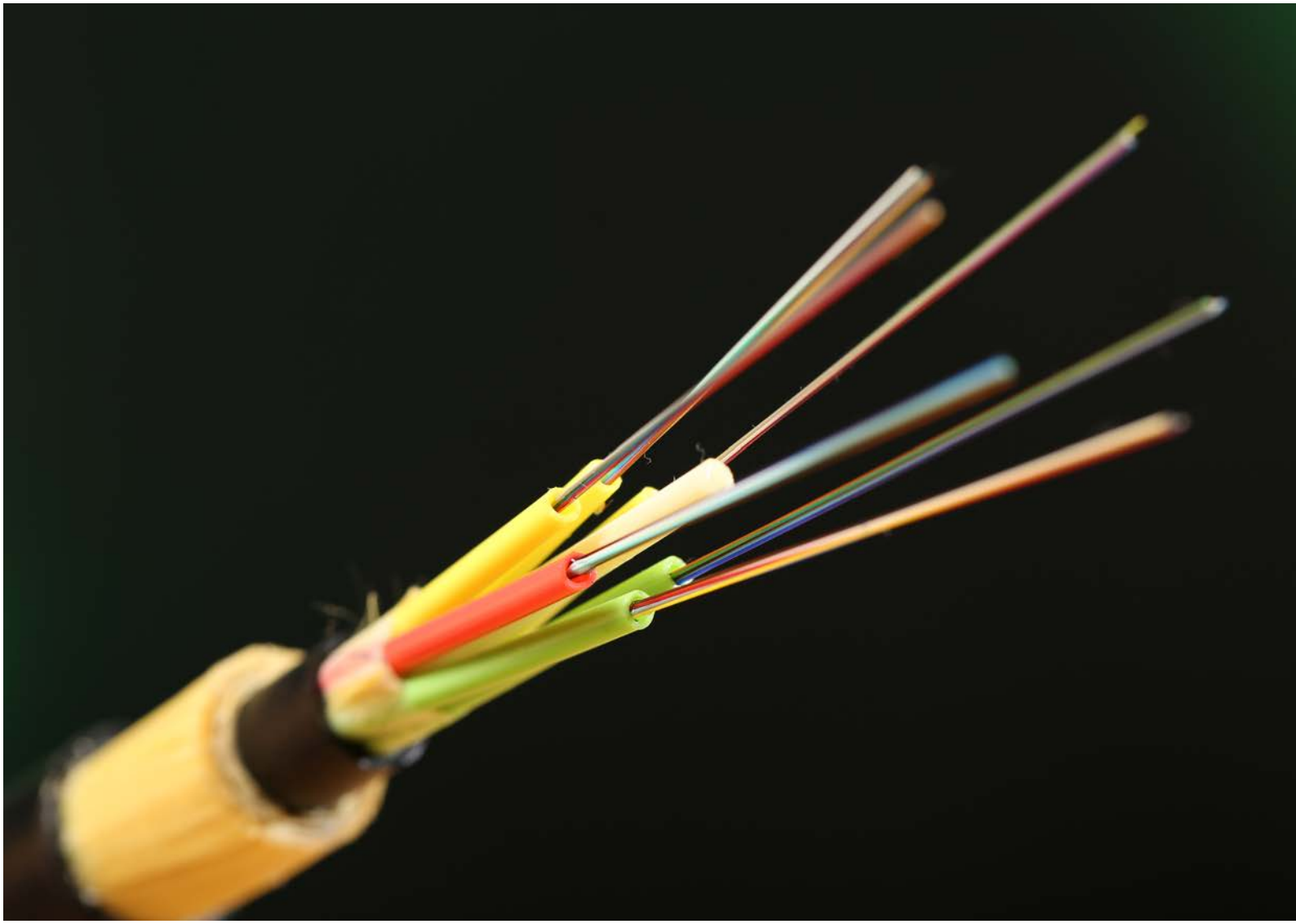
PENGG KABEL

Fiber Optic Cables



PENGG KABEL

PENGG KABEL GmbH is an Austrian producer of high-tech telecom copper and fiber optic cables and their components with usage in a wide range of applications in the area of railway technology, telecommunication and infrastructure. We have two sites, one in Kapfenberg where we produce **copper cables** and the second in Wartberg where we are specialised on **fiber optic cables** and **components**.

In addition to a quality management system according to **EN ISO 9001** we set a high value on the fact that the loads of the environment are kept as small as possible. Therefore we have also implemented an environmental management system according to **EN ISO 14001**.

The rapid development of modern regional and supra-regional high-speed data networks makes steadily increasing demands on fiber optical cables and fiber optical cable plugs and components. We take this market request into consideration and produce fiber optic cables and pre-assembled connectors with singlemode, multimode and NZDS fibers for highest requirements.

The range of types covers all usual ground cable constructions in jelly-filled and dry-filled design as well as metallic and metal-free (PA) rodent protection. Beyond that also metal-free overhead cables (ADSS) in self-supporting design for spans up to 700m and for 20kV or high voltage systems will be manufactured. Also special cable designs can be manufactured in Wartberg according to customers requirements.

By means of most modern measuring equipment the fiber optic cables are submitted according to international standards and regulations by permanent tests and checks. These measurement results serves as a basis for the constant advancement of our fiber optic cables.

With a constant expansion of most modern finishing technique with integrated production logistics, we are in the position to supply fiber optic cables on drums with all fiber types available on the free fiber market safely and reliably for its customer.

Flexibility and customer proximity are the bases for a successful development on the market. New developments and product improvements are always necessary. Apart of the permanent search for improvements of our products, our efforts for the future run towards reduction of production time, increase of flexibility and constant improvement of quality, in order to be a reliable partner for our customers.

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Fiber Optic Cables

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Outdoor cables

Center unitube construction

Outdoor cable

A-DQ(ZN)2Y | ø 7,0 mm

Center unitube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,5	1	24	24	1.500	40	7,0

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Outdoor cable

A-DQ(ZN)2Y4Y | ø 8,0 mm

Center unitube construction, metal-free, longitudinally watertight, rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,5	1	24	24	1.500	55	8,0

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- PE-outer sheath (1,5 mm), UV-resistant, black
- PA-protective cover (0,5 mm), UV-resistant, transparent

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased tensile strength
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Outdoor cable

A-DQ(BN)2Y | ø 6,3 mm | ø 7,0 mm

Center unitube construction, metal-free, longitudinally watertight, slight rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,0	1	24	24	1.000	30	6,3
3,0	1	24	24	1.000	40	7,0

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members and simultaneous rodent protection by swellable glass yarns
- PE-outer sheath (1,0 mm bzw. 1,3 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased tensile strength
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DQ(BN)2Y | ø 8,5 mm

Center unitube construction, metal-free, longitudinally watertight, slight rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,5	1	24	24	1.500	65	8,5

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members and simultaneous rodent protection by swellable glass yarns
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Outdoor cable

A-DQ(ZN)(SR)2Y | ø 9,0 mm

Center unitube construction, watertight, rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,5	1	24	24	1.500	75	9,0

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3500 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- corrugated steel tape, laminated
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

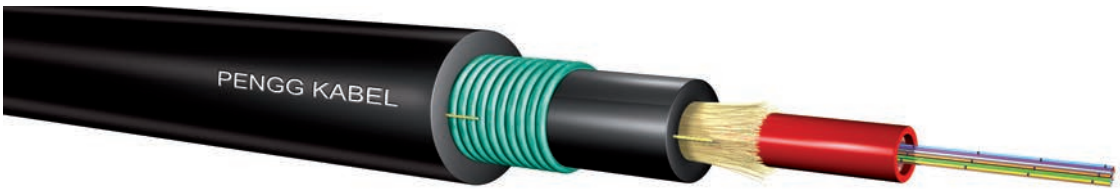
Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Outdoor cable

A-DQ(ZN)2Y(SR)2Y | ø 11,5 mm

Center unitube construction, watertight, rodent protection



tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,5	1	24	24	1.500	125	11,5

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 4000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

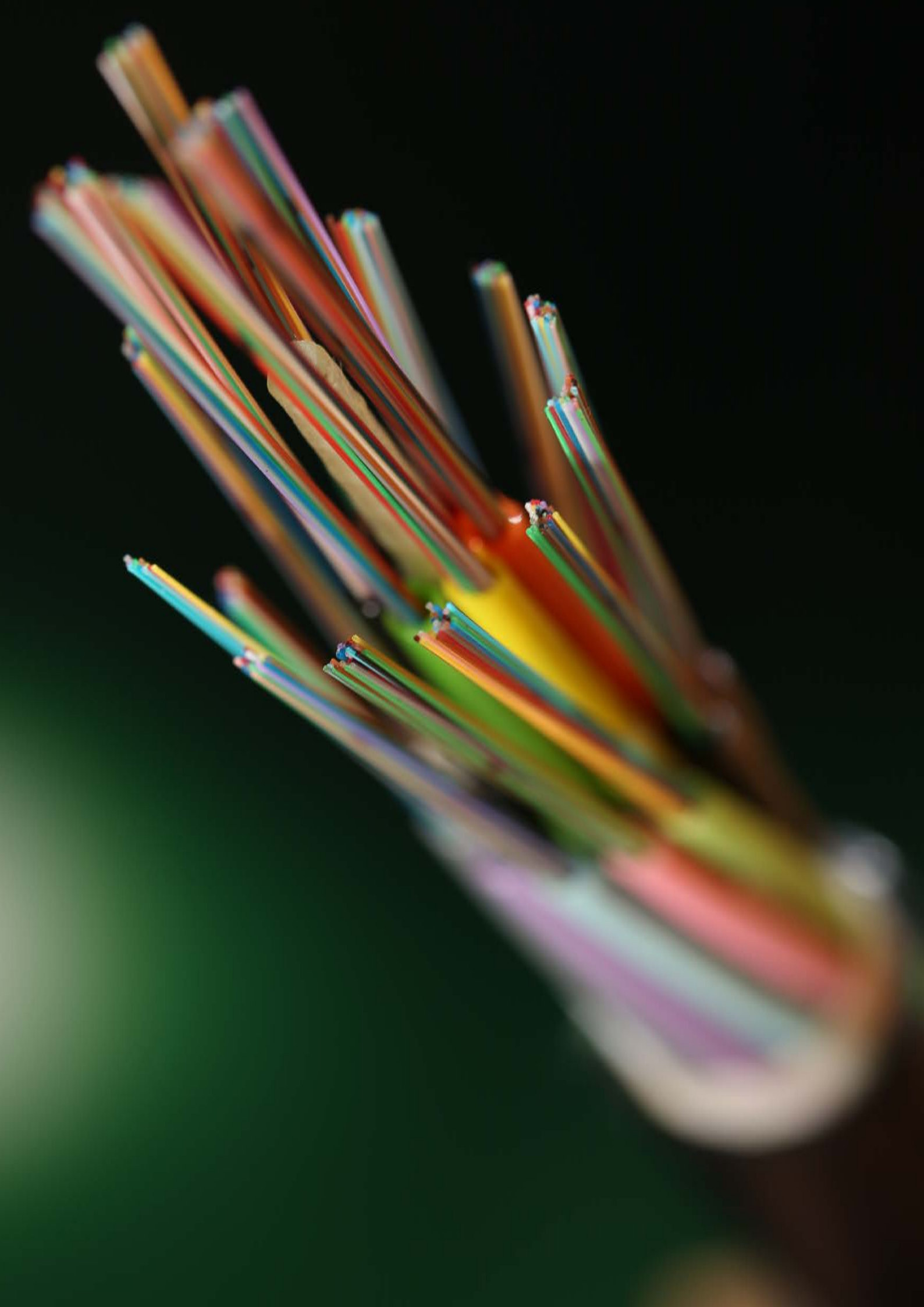
Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- PE-inner sheath (1,5 mm)
- corrugated steel tape, laminated
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased tensile strength
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking



Outdoor cables

Loose tube construction

Outdoor cable

A-DQ(ZN)2Y

Loose tube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	1.500	70	9,5
2,3	5*	12	60	1.500	75	10,0
2,3	6	12	72	1.500	90	10,5
2,3	8	12	96	2.000	110	12,0
2,3	10	12	120	2.000	140	13,5
2,3	12	12	144	3.000	180	15,0
2,3	16	12	192	3.000	160	14,5
2,3	18	12	216	3.000	180	15,0
2,8	5*	24	120	1.500	100	11,0
2,8	6	24	144	1.500	125	12,0
2,8	8	24	192	2.000	150	13,7
2,8	10	24	240	2.000	175	15,5
2,8	12	24	288	3.000	245	17,3
2,8	16	24	384	3.000	230	16,7
2,8	18	24	432	3.000	260	17,7

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (swellable aramid yarns (dry cable core))
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2500 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DQ(BN)2Y

Loose tube construction, metal-free, longitudinally watertight, slight rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	1.500	100	10,5
2,3	5*	12	60	1.500	105	11,0
2,3	6	12	72	1.500	120	11,5
2,3	8	12	96	2.000	140	13,0
2,3	10	12	120	2.000	170	14,5
2,3	12	12	144	3.000	205	16,0
2,3	16	12	192	3.000	190	15,5
2,3	18	12	216	3.000	210	16,0
2,8	5*	24	120	1.500	145	12,0
2,8	6	24	144	1.500	150	13,0
2,8	8	24	192	2.000	180	14,7
2,8	10	24	240	2.000	220	16,5
2,8	12	24	288	2.500	265	18,3
2,8	16	24	384	2.500	245	17,7
2,8	18	24	432	3.000	275	18,7

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- j jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members and simultaneous rodent protection by swellable glass yarns
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DQ(ZN)2Y4Y

Loose tube construction, metal-free, longitudinally watertight, rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	1.500	90	10,5
2,3	5*	12	60	1.500	90	10,8
2,3	6	12	72	1.500	105	11,5
2,3	8	12	96	2.000	130	12,8
2,3	10	12	120	2.000	160	14,5
2,3	12	12	144	2.500	205	16,0
2,3	16	12	192	2.500	185	15,5
2,3	18	12	216	3.000	205	16,0
2,8	5*	24	120	1.500	115	12,0
2,8	6	24	144	1.500	140	13,0
2,8	8	24	192	2.000	175	14,7
2,8	10	24	240	2.000	220	16,5
2,8	12	24	288	3.000	270	18,3
2,8	16	24	384	3.000	245	17,7
2,8	18	24	432	3.000	280	18,7

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (swellable aramid yarns (dry cable core))
- PE-outer sheath (1,5 mm), UV-resistant, black
- PA-protective cover (0,5 mm), UV-resistant, transparent

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DF2Y

Loose tube construction, jelly filled cable core, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	1.500	75	9,7
2,3	5*	12	60	1.500	75	10,0
2,3	6	12	72	1.500	90	10,7
2,3	8	12	96	2.000	115	12,0
2,3	10	12	120	2.000	145	13,5
2,3	12	12	144	3.000	181	15,2
2,3	16	12	192	3.000	165	14,6
2,3	18	12	216	3.000	185	15,3
2,8	5*	24	120	1.500	100	11,3
2,8	6	24	144	1.500	125	12,3
2,8	8	24	192	2.000	155	14,0
2,8	10	24	240	2.000	195	15,7
2,8	12	24	288	3.000	245	17,5
2,8	16	24	384	3.000	230	17,0
2,8	18	24	432	3.000	260	18,0

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2500 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DF2Y4Y

Loose tube construction, jelly filled cable core, metal-free, longitudinally watertight, rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	1.500	90	10,7
2,3	5*	12	60	1.500	95	11,0
2,3	6	12	72	1.500	110	11,7
2,3	8	12	96	2.000	135	13,0
2,3	10	12	120	2.000	165	14,5
2,3	12	12	144	3.000	205	16,2
2,3	16	12	192	3.000	190	15,6
2,3	18	12	216	3.000	210	16,3
2,8	5*	24	120	1.500	120	12,3
2,8	6	24	144	1.500	145	13,3
2,8	8	24	192	2.000	180	15,0
2,8	10	24	240	2.000	220	16,7
2,8	12	24	288	3.000	275	18,5
2,8	16	24	384	3.000	260	18,0
2,8	18	24	432	3.000	290	19,0

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- PE-outer sheath (1,5 mm), UV-resistant, black
- PA-protective cover (0,5 mm), UV-resistant, transparent

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry-filled cable core
- increased tensile strength
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DQ(ZN)2Y(BN)2Y

Loose tube construction, metal-free, longitudinally watertight, slight rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	2.000	160	14,0
2,3	5*	12	60	2.500	165	14,2
2,3	6	12	72	2.500	180	15,0
2,3	8	12	96	3.000	210	16,2
2,3	10	12	120	3.000	245	17,7
2,3	12	12	144	4.000	295	19,5
2,8	5*	24	120	2.500	190	15,5
2,8	6	24	144	2.500	215	16,5
2,8	8	24	192	3.000	250	18,0
2,8	10	24	240	3.000	300	20,0
2,8	12	24	288	4.000	355	21,7

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (swellable aramid yarns (dry cable core))
- PE-inner sheath (1,5 mm)
- strength members and simultaneous rodent protection by swellable glass yarns
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DF(ZN)(SR)2Y

Loose tube construction, jelly filled cable core, watertight, rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	2.000	120	11,5
2,3	5*	12	60	2.500	130	12,0
2,3	6	12	72	3.000	150	12,7
2,3	8	12	96	3.500	180	14,0
2,3	10	12	120	4.000	215	15,5
2,3	12	12	144	4.500	260	17,2
2,8	5*	24	120	2.500	155	13,1
2,8	6	24	144	3.000	185	14,1
2,8	8	24	192	3.500	215	15,7
2,8	10	24	240	4.000	270	17,5
2,8	12	24	288	4.500	335	19,5

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- strength members (aramide yarns)
- corrugated steel tape, laminated
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DF(ZN)2Y(SR)2Y

Loose tube construction, jelly filled cable core, watertight, rodent protection

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	2.000	180	13,8
2,3	5*	12	60	2.500	200	14,5
2,3	6	12	72	3.000	210	15,0
2,3	8	12	96	3.500	245	16,3
2,3	10	12	120	4.000	290	18,0
2,3	12	12	144	4.500	330	19,5
2,8	5*	24	120	2.500	230	16,1
2,8	6	24	144	3.000	260	17,1
2,8	8	24	192	3.500	300	18,7
2,8	10	24	240	4.000	365	20,5
2,8	12	24	288	4.500	425	22,3

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- strength members (aramide yarns)
- PE-inner sheath (1,5 mm), black
- corrugated steel tape, laminated
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry-filled cable core
- increased tensile strength
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DQ(BN)(L)2Y

Loose tube construction, watertight, rodent protection, Aluminium-PE-composite-layer sheath

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	1.500	125	11,6
2,3	5*	12	60	1.500	130	11,5
2,3	6	12	72	2.000	145	12,1
2,3	8	12	96	2.000	165	13,2
2,3	10	12	120	2.500	195	14,6
2,3	12	12	144	3.500	240	16,3
2,8	5*	24	120	1.500	145	12,5
2,8	6	24	144	1.500	170	13,5
2,8	8	24	192	2.000	200	15,0
2,8	10	24	240	2.000	245	16,8
2,8	12	24	288	3.500	295	18,6

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members and simultaneous rodent protection by swellable glass yarns
- Aluminium-PE-composite-layer-sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-D(ZN)13Y

Loose tube construction, metal-free, longitudinally watertight, for conveyor chains

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,6	2	13	26	1.200	45	7,3
2,8	2	24	48	1.200	55	8,0

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 further processing: up to +180°C installation: -25°C up to +80°C operation: -25°C up to +80°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suitable for further processing / stranding in conveyor chains compatible excavator lines

Construction
- 2 jelly-filled loose tubes + 2 FRP-supporting elements, SZ-cabling
- Hytrel-outer sheath (1,0 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

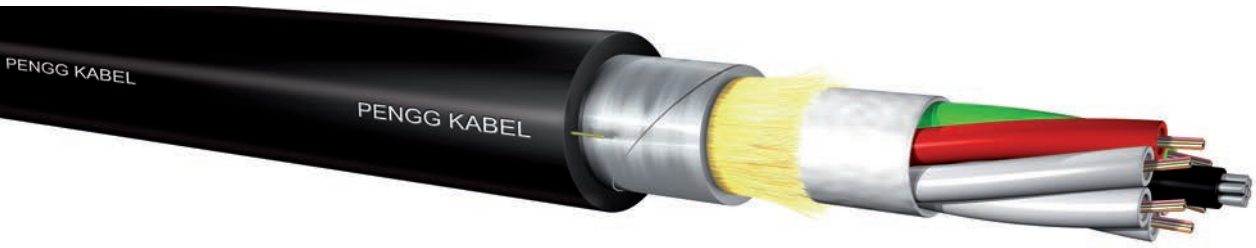
Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- increased sheath thickness
- other sheath colour
- other marking

Outdoor cable

A-(ZS)DF(ZN)(L)2Y

Loose tube construction, metallic central element, jelly filled cable core, watertight, rodent protection, Aluminium-PE-composite-layer sheath



tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	3.000	115	10,7
2,3	5*	12	60	3.100	115	11,0
2,3	6	12	72	3.100	130	11,7
2,3	8	12	96	3.500	155	13,0
2,3	10	12	120	4.000	190	14,5
2,3	12	12	144	4.500	225	16,2
2,8	5*	24	120	3.100	135	12,3
2,8	6	24	144	3.100	155	13,3
2,8	8	24	192	3.500	190	15,0
2,8	10	24	240	4.000	235	16,7
2,8	12	24	288	4.500	285	18,5

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- metallic central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- strength members (aramide yarns)
- Aluminium-PE-composite-layer-sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colour
- coloured stripes
- HDPE or LDPE sheath
- other marking

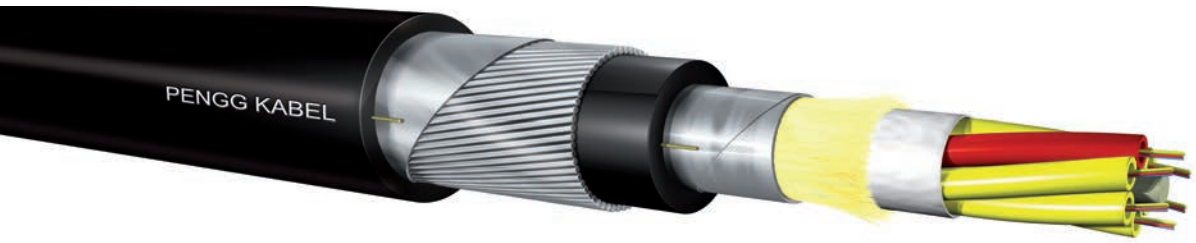
Technical data

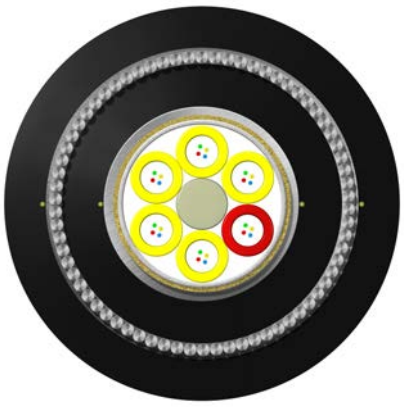
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 Wert: R = 15 x D (Kabelaußen-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Outdoor cable

A-DQ(ZN)(L)2YRG2Y

Railfoot cable, loose tube construction, metal-free, watertight, rodent protection, Aluminium-PE-composite-layer sheath, steel wire armouring





tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6	4	24	3.500	310	15,6

Technical data

specification	DB TL 416.0510
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 installation: ≥ 360 mm operation: ≥ 180 mm
temperature range	according to IEC 60794-1-F1 installation: -5°C up to +50°C storage and transport: -25°C up to +70°C operation: -25°C up to +60°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
The fiber-optic railfoot cable is designed for use in telecommunication systems. It can be laid directly on the rail foot or other areas subjected to vibrations and impacts, but is also suitable for fixed laying in cable ducts, conduits or direct burial.

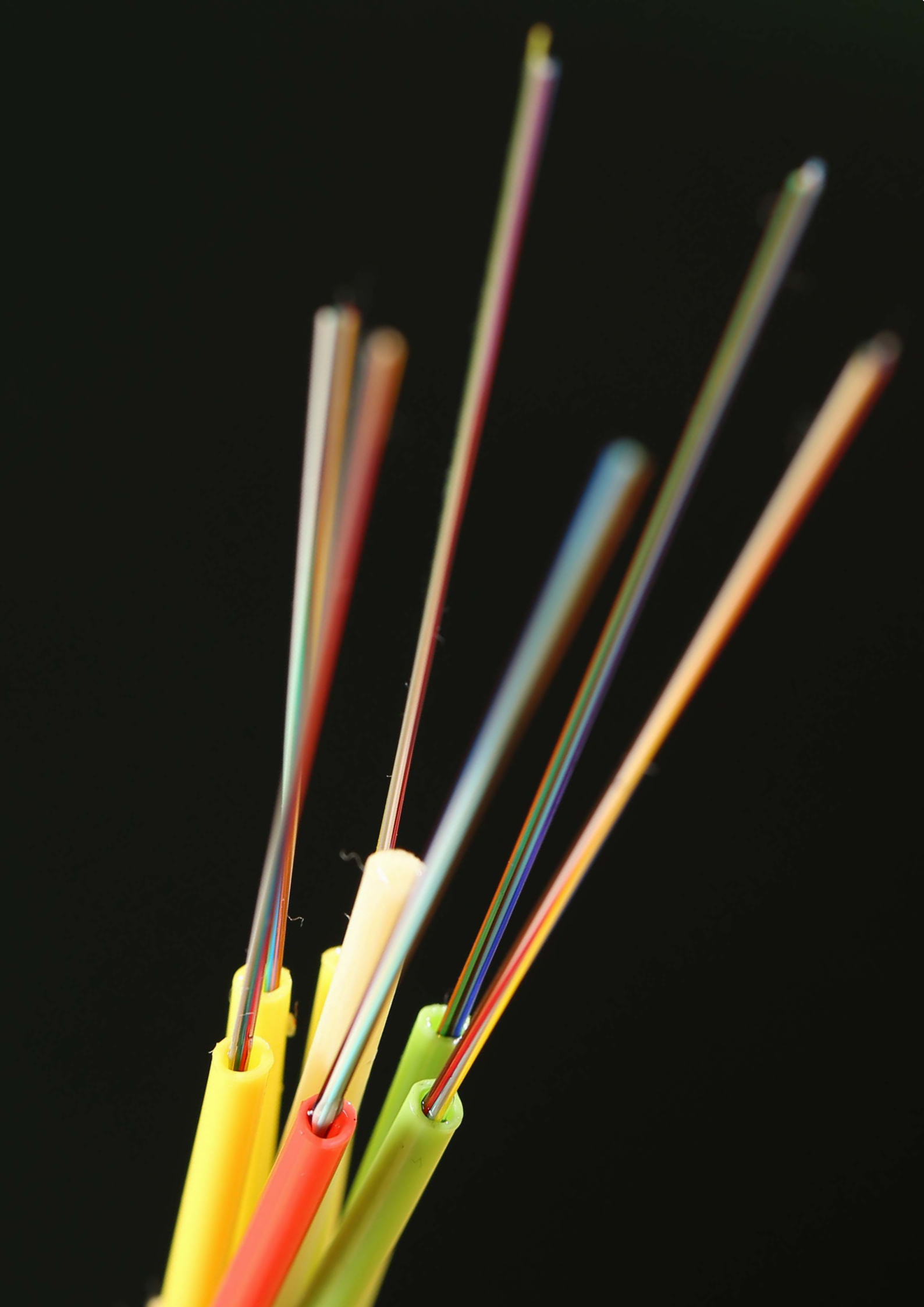
Construction
- FRP-central element (2,1 mm); swellable elements
- jelly-filled loose tubes (2,0 mm), SZ-cabling
- swellable tape
- strength members (aramide yarns (dry cable core))
- 2 ripcords
- Aluminium-PE-composite-layer-sheath, black
- steel wire armouring (55 x 0,6 mm; galv.)
- steel fixing tape (0,1 mm; galv.)
- 2 ripcords
- PE-outer sheath (1,5 mm), UV-resistant, black

Fiber colours
red, green, blue, yellow

Tube colours
first tube red, other tubes yellow

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- other fiber count
- other fiber colours
- other tube colours
- other marking
- increased sheath thicknesses
- other sheath colours
- other marking



Universal cables

Center unitube construction

Universal cable

A/I-DQ(BN)H | ø 6,3 mm

Center unitube construction, metal-free, longitudinally watertight, slight rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
3,0	1	24	24	1.000	35	6,3	1

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members and simultaneous rodent protection by swellable glass yarns
- FRNC-outer sheath (1,0 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- coloured stripes
- other marking

Universal cable

A/I-DQ(BN)H | ø 8,5 mm

Center unitube construction, metal-free, longitudinally watertight, slight rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
3,5	1	24	24	1.500	70	8,5	1

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members and simultaneous rodent protection by swellable glass yarns
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- coloured stripes
- other marking

Universal cable

A/I-DQ(ZN)H | ø 7,0 mm

Center unitube construction, metal-free, longitudinally watertight, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
3,5	1	24	24	1.500	45	7,0	1

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn togehter to a diameter of 100 mm.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thickness
- other sheath colour
- coloured stripes
- other marking

Universal cable

A/I-DQ(BN)(SR)H | ø 9,5 mm

Center unitube construction, watertight, rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
3,5	1	24	24	1.500	120	9,5	1,5

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- central, gel-filled loose tube
- strength members and simultaneous rodent protection by swellable glass yarns
- corrugated steel tape, laminated
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

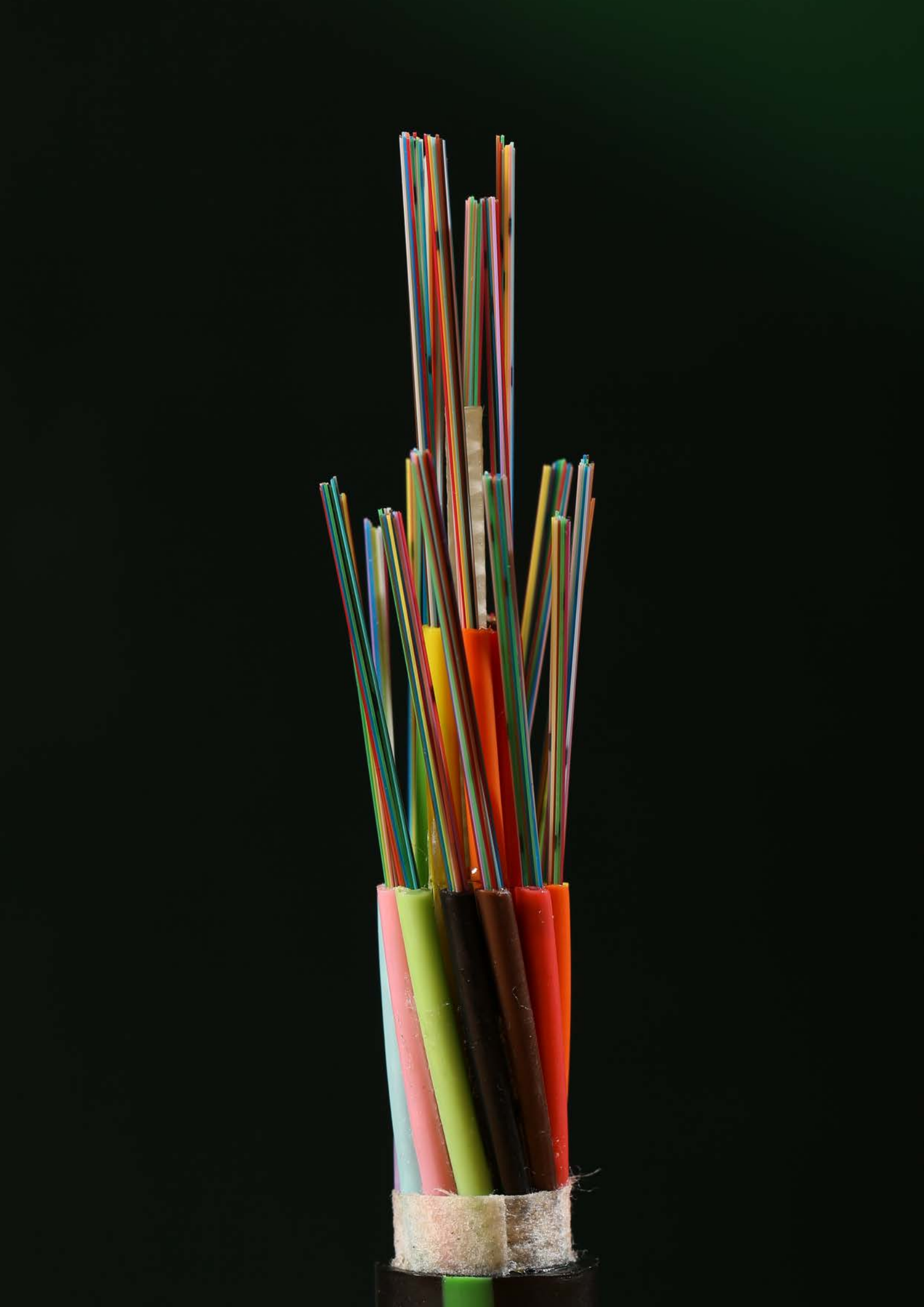
Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thickness
- other sheath colour
- coloured stripes
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.



Universal cables

Loose tube construction

Universal cable

A/I-DQ(BN)H

Loose tube construction, metal-free, longitudinally watertight, slight rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	6*	4	24	1.500	110	10,5	2
2,3	5*	12	60	1.500	115	11,0	2,5
2,3	6	12	72	1.500	130	11,5	2,5
2,3	8	12	96	2.000	150	13,0	3
2,3	10	12	120	2.000	180	14,5	3,5
2,3	12	12	144	3.000	215	16,0	4
2,3	16	12	192	3.000	200	15,5	5
2,3	18	12	216	3.000	220	16,0	6
2,8	5*	24	120	1.500	155	12,0	2,5
2,8	6	24	144	1.500	160	13,0	2,5
2,8	8	24	192	2.000	190	14,7	3
2,8	10	24	240	2.000	230	16,5	4
2,8	12	24	288	2.500	275	18,3	5
2,8	16	24	384	2.500	255	17,7	5
2,8	18	24	432	3.000	285	18,7	6

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members and simultaneous rodent protection by swellable glass yarns
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thickness
- other sheath colour
- coloured stripes
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Universal cable

A/I-DQ(ZN)H

Loose tube construction, metal-free, longitudinally watertight, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	6*	4	24	1.500	80	9,5	2
2,3	5*	12	60	1.500	85	10,0	2,5
2,3	6	12	72	1.500	100	10,5	2,5
2,3	8	12	96	2.000	120	12,0	3
2,3	10	12	120	2.000	150	13,5	3,5
2,3	12	12	144	3.000	195	15,0	4
2,3	16	12	192	3.000	175	14,5	5
2,3	18	12	216	3.000	195	15,0	6
2,8	5*	24	120	1.500	110	11,0	2,5
2,8	6	24	144	1.500	135	12,0	2,5
2,8	8	24	192	2.000	160	13,7	3
2,8	10	24	240	2.000	190	15,5	4
2,8	12	24	288	3.000	260	17,3	4,5
2,8	16	24	384	3.000	245	16,7	5
2,8	18	24	432	3.000	275	17,7	6

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (aramide yarns)
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thickness
- other sheath colour
- coloured stripes
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2500 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Universal cable

A/I-DQH(BN)H

Loose tube construction, longitudinally watertight, slight rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	6*	4	24	2.000	165	14,0	3
2,3	5*	12	60	2.500	170	14,2	3
2,3	6	12	72	3.000	185	15,0	3,5
2,3	8	12	96	3.500	220	16,2	4
2,3	10	12	120	4.000	255	17,7	5
2,3	12	12	144	4.500	310	19,5	6
2,8	5*	24	120	2.500	195	15,5	3,5
2,8	6	24	144	3.000	225	16,5	4
2,8	8	24	192	3.500	260	18,0	5
2,8	10	24	240	4.000	315	20,0	6
2,8	12	24	288	4.500	370	21,7	7

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- FRNC-inner sheath (1,0 mm) according to IEC 60332-2, black
- strength members and simultaneous rodent protection by swellable glass yarns
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Universal cable

A/I-DQ(ZN)(SR)H

Loose tube construction, watertight, rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	6*	4	24	2.000	130	11,0	3
2,3	5*	12	60	2.500	140	11,3	3
2,3	6	12	72	3.000	160	12,0	3
2,3	8	12	96	3.500	185	13,3	4
2,3	10	12	120	4.000	220	14,8	4,5
2,3	12	12	144	4.500	270	16,5	5
2,8	5*	24	120	2.500	170	12,8	3
2,8	6	24	144	3.000	195	13,8	4
2,8	8	24	192	3.500	235	15,5	5
2,8	10	24	240	4.000	260	16,0	5
2,8	12	24	288	4.500	345	19,0	6

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (aramide yarns)
- corrugated steel tape, laminated
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thickness
- other sheath colour
- coloured stripes
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Universal cable

A/I-DQ(ZN)H(SR)H

Loose tube construction, watertight, rodent protection, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	6*	4	24	2.000	200	14,0	
2,3	5*	12	60	2.500	195	14,2	
2,3	6	12	72	3.000	215	15,0	
2,3	8	12	96	3.500	245	16,2	
2,3	10	12	120	4.000	290	17,7	
2,3	12	12	144	4.500	345	19,5	
2,8	5*	24	120	2.500	285	16,3	
2,8	6	24	144	3.000	320	17,3	
2,8	8	24	192	3.500	370	19,0	
2,8	10	24	240	4.000	440	20,7	
2,8	12	24	288	4.500	510	22,5	

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (swellable aramid yarns)
- FRNC-inner sheath (1,5 mm) according to IEC 60332-2, black
- corrugated steel tape, laminated
- FRNC-outer sheath (1,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with hot-foil stamping

On request
- jelly-filled cable core
- increased tensile strength
- FRNC-sheath according to IEC 60332-3
- increased sheath thicknesses
- other sheath colours
- coloured stripes
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

All-dielectric-self-supporting cables

(ADSS)

All-dielectric-self-supporting cable (ADSS)

A-D(ZN)2Y (HD) ADSS 4kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	4.000	90	11,0
2,3	6	12	72	4.000	100	11,7
2,3	8	12	96	4.000	130	13,0
2,3	10	12	120	4.000	150	14,5
2,3	12	12	144	4.000	190	16,2

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 4 kN maximum 60 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colour
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 60 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

All-dielectric-self-supporting cable (ADSS)

A-D(ZN)2Y (HD) ADSS 6kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	6.000	95	11,3
2,3	6	12	72	6.000	105	12,0
2,3	8	12	96	6.000	135	13,3
2,3	10	12	120	6.000	155	14,8
2,3	12	12	144	6.000	195	16,5

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 6 kN maximum 100 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colour
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 100 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

All-dielectric-self-supporting cable (ADSS)

A-D2Y(ZN)2Y (HD) ADSS 4kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	4.000	110	11,9
2,3	6	12	72	4.000	135	13,4
2,3	8	12	96	4.000	150	14,2
2,3	10	12	120	4.000	185	15,7
2,3	12	12	144	4.000	230	17,1

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 4 kN maximum 60 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- PE-inner sheath (1,0 mm), black
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,2 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colours
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 60 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

All-dielectric-self-supporting cable (ADSS)

A-D2Y(ZN)2Y (HD) ADSS 6kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	6.000	115	12,2
2,3	6	12	72	6.000	140	13,7
2,3	8	12	96	6.000	155	14,2
2,3	10	12	120	6.000	190	16,0
2,3	12	12	144	6.000	235	17,4

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 6 kN maximum 100 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- PE-inner sheath (1,0 mm), black
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,2 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colours
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 100 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

All-dielectric-self-supporting cable (ADSS)

A-D2Y(ZN)2Y (HD) ADSS 9kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	9.000	120	12,6
2,3	6	12	72	9.000	145	14,1
2,3	8	12	96	9.000	160	14,6
2,3	10	12	120	9.000	200	16,8
2,3	12	12	144	9.000	250	18,0

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 9 kN maximum 200 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- PE-inner sheath (1,0 mm), black
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,2 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colours
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 200 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

All-dielectric-self-supporting cable (ADSS)

A-D2Y(ZN)2Y (HD) ADSS 16kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	16.000	140	14,0
2,3	6	12	72	16.000	165	14,4
2,3	8	12	96	16.000	180	15,4
2,3	10	12	120	16.000	220	17,5
2,3	12	12	144	16.000	270	18,8

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 16 kN maximum 350 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- PE-inner sheath (1,0 mm), black
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,2 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colours
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 350 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

All-dielectric-self-supporting cable (ADSS)

A-D2Y(ZN)2Y (HD) ADSS 35kN

Loose tube construction, metal-free

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,3	5*	12	60	35.000	180	16,5
2,3	6	12	72	35.000	195	17,7
2,3	8	12	96	35.000	220	18,4
2,3	10	12	120	35.000	250	19,9
2,3	12	12	144	35.000	195	21,6

* at lower number of tubes corresponding blind elements are used

Application
ADSS (all-dielectric-self-supporting) cable are metal-free air hanging cable, suited for fixing on poles. The pole distance is at 35 kN maximum 700 m.

Construction
- FRP-central element
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- PE-inner sheath (1,0 mm), black
- strength members (swellable aramid yarns (dry cable core))
- HDPE-outer sheat (1,2 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- dry or jelly-filled cable core
- other sheath colours
- coloured stripes
- tracking resistant outer sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -30°C up to +70°C
span distance	up to 700 m

Span calculation available on request:
We need the following parameter values:
- *horinzontal distance from pole to pole [m]*
- *height difference from pole to pole [m]*
- *sag in meters or percent to the above mentioned values [m-%]*
- *ballast or added weight (ice and wind) [kg/m]*

Hybrid cables

(Fiber optic cables with copper elements)

Hybrid cable

A-DSF(ZN)(L)2Y + Cu 0.6

Loose tube construction, jelly filled cable core, watertight, rodent protection, Aluminium-PE-composite-layer sheath, copper pair ⌀ 0,6 mm

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	2.000	135	12,4
2,3	5*	12	60	2.000	140	12,7
2,3	6	12	72	2.000	155	13,3
2,3	8	12	96	2.000	180	14,7
2,3	10	12	120	2.500	225	16,3
2,3	12	12	144	3.000	265	17,9
2,8	5*	24	120	2.000	180	14,3
2,8	6	24	144	2.000	195	15,0
2,8	8	24	192	2.500	235	16,8
2,8	10	24	240	3.000	290	18,6
2,8	12	24	288	3.500	350	20,5

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes + 1 copper pair (Ø 0,6 m)
- SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- strength members (swellable aramid yarns)
- Aluminium-PE-composite-layer-sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- construction with 2 cores or 1 quad
- constrution with several copper elements
- dry-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 Wert: R = 20 x D (Kabelaußen-)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Hybrid cable

A-DSF(ZN)(L)2Y + Cu 0.8

Loose tube construction, jelly filled cable core, watertight, rodent protection, Aluminium-PE-composite-layer sheath, copper pair ⌀ 0,8 mm

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
2,0	6*	4	24	2.000	180	15,0
2,3	5*	12	60	2.000	175	14,3
2,3	6	12	72	2.000	185	15,0
2,3	8	12	96	2.500	230	16,8
2,3	10	12	120	3.000	280	18,6
2,3	12	12	144	3.500	340	20,5
2,8	5*	24	120	2.000	180	14,3
2,8	6	24	144	2.000	195	15,0
2,8	8	24	192	2.500	235	16,8
2,8	10	24	240	3.000	290	18,6
2,8	12	24	288	3.500	350	20,5

* at lower number of tubes corresponding blind elements are used

Application
Suited for outdoor use - for fixed laying in cable ducts, conduits or direct burial

Construction
- FRP-central element
- jelly-filled loose tubes + 1 copper pair (Ø 0,8 mm)
- SZ-cabling (if necessary with fillers)
- jelly-filled cable core (petrol jelly)
- strength members (swellable aramid yarns)
- Aluminium-PE-composite-layer-sheath (1,5 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colours
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with hot-foil stamping

On request
- construction with 2 cores or 1 quad
- constrution with several copper elements
- dry-filled cable core
- increased tensile strength
- increased sheath thickness
- other sheath colours
- coloured stripes
- HDPE or LDPE sheath
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 3000 N/10 cm
impact	according to IEC 60794-1-E4 value: 25 Nm
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 Wert: R = 20 x D (Kabelaußen-)
temperature range	according to IEC 60794-1-F1 storage and transport: -40°C up to +70°C installation: -5°C up to +60°C operation: -25°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Micro cables

Center unitube construction

Micro cable

A-DQ(ZN)2Y (HD) | ø 2,5 mm

Center unitube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
1,7	1	12	12	250	6,0	2,5

Application
Suited for outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems.

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- HDPE-outer sheat (0,3 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- other sheath colour
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 1 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation[1)]: -5°C up to +50°C operation: -20°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

[1)] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Micro cable

A-DQ(ZN)2Y (HD) | ø 3,9 mm

Center unitube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,0	1	24	24	400	13,0	3,9

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 1 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation[1]: -5°C up to +50°C operation: -20°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems.

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- HDPE-outer sheat (0,3 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- other sheath colour
- other marking

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Micro cable

A-DQ(ZN)4Y | ø 2,5 mm

Center unitube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
1,7	1	12	12	250	6,0	2,5

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 1 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation[1]: -5°C up to +50°C operation: -20°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems. This cable has a lower friction coefficient due to the PA-sheath.

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- PA-outer sheath (0,3 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- other sheath colour
- other marking

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Micro cable

A-DQ(ZN)4Y | ø 3,9 mm

Center unitube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
3,0	1	24	24	400	13,0	3,9

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 1 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation[1]: -5°C up to +50°C operation: -20°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems. This cable has a lower friction coefficient due to the PA-sheath.

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- PA-outer sheath (0,3 mm), UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- other sheath colour
- other marking

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Micro cable

A/I-DQ(ZN)H | ø 2,8 mm

Center unitube construction, metal-free, longitudinally watertight, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
1,7	1	12	12	250	8,0	2,8	0,5

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 1 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation[1]: -5°C up to +50°C operation: -20°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for indoor and outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems.

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- FRNC-outer sheath (0,5 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- other marking

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Micro cable

A/I-DQ(ZN)H | ø 4,7 mm

Center unitube construction, metal-free, longitudinally watertight, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
3,0	1	24	24	400	20	4,7	1

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 1 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation[1]: -5°C up to +50°C operation: -20°C up to +70°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

Application
Suited for indoor and outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems.

Construction
- central, gel-filled loose tube
- strength members (aramide yarns)
- FRNC-outer sheath (0,7 mm) according to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- other marking

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*


REL

Mini cables

Loose tube construction

Mini cable

A-DQ(ZN)2Y (HD)

Loose tube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
1,5	6*	12	72	700	30	5,6
1,5	8	12	96	700	43	6,3
1,5	12	12	144	700	63	8,3
1,7	6*	12	72	900	37	6,4
1,7	8	12	96	900	56	7,6
1,7	12	12	144	900	90	10,5
2,1	6*	24	144	900	71	7,9

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems.

Construction
- FRP-central element (as strength member)
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- swellable aramid yarns (dry-cable core)
- HDPE-outer sheath, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- other sheath colour
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 900 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +60°C installation[1)]: -5°C up to +50°C operation: -30°C up to +60°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

[1)] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Mini cable

A-DQ(ZN)4Y

Loose tube construction, metal-free, longitudinally watertight

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm
1,5	6*	12	72	700	32	5,6
1,5	8	12	96	700	45	6,5
1,5	12	12	144	700	65	8,5
1,7	6*	12	72	900	39	6,4
1,7	8	12	96	900	58	7,6
1,7	12	12	144	900	92	10,5
2,1	6*	24	144	900	73	7,9

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems. This cable has a lower friction coefficient due to the PA-sheath.

Construction
- FRP-central element (as strength member)
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- swellable aramid yarns (dry-cable core)
- PA-outer sheath, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- other sheath colour
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 900 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +60°C installation[1]: -5°C up to +50°C operation: -30°C up to +60°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Mini cable

A/I-DQ(ZN)H

Loose tube construction, metal-free, longitudinally watertight, halogen-free, flame retardant

tube diameter mm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
1,5	6*	12	72	700	38	5,8	1
1,5	8	12	96	700	50	6,7	1
1,5	12	12	144	700	70	8,7	1
1,7	6*	12	72	900	45	6,6	1
1,7	8	12	96	900	65	7,8	1
1,7	12	12	144	900	95	10,7	1,5
2,1	6*	24	144	900	75	8,2	2

* at lower number of tubes corresponding blind elements are used

Application
Suited for indoor and outdoor use - for Metro, Access or FTTx implementations and and for blowing in into mini pipe systems.

Construction
- FRP-central element (as strength member)
- jelly-filled loose tubes, SZ-cabling (if necessary with fillers)
- swellable aramid yarns (dry-cable core)
- FRNC-outer sheath acc. to IEC 60332-2, UV-resistant, black

Fiber colours
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Tube colour
PENGG KABEL standard according to page 90 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 90)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- other marking

Technical data

tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 900 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm (3 impacts, 300 mm hammer radius)
torsion	according to IEC 60794-1-E7 value: 5 cycles ±1 turn
kink, cable	according to IEC 60794-1-E10 value: The cable do not form a kink when a loop is drawn together to a diameter 12 times the cable outer diameter.
kink, tube	according to IEC 60794-1-E16 value: The tube do not kink.
min. bending radius	according to IEC 60794-1-E11 value: R = 20 x D (cable outer-Ø)
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +60°C installation[1]: -5°C up to +50°C operation: -30°C up to +60°C
water penetration	according to IEC 60794-1-F5 value: No water on free end.

[1] *Cable installation by using the cable blowing technology we recommend the following points to consider:*
- *During unreeling the cable from the drum (coil, ring) twists and kinks must be avoided.*
- *The indicated bending radii must not be undershot under any circumstances.*
- *The cable must be protected 24 hours before installation of direct sunlight or bad weather conditions and have to be stored at an ambient temperature of max. 25°C.*
- *The cable must be clean and dry at the blowing-in process.*
- *Pipe and cable diameter must be coordinated.*
- *The optimal ambient temperature during blowing-in is +5°C to +20°C.*

Indoor cables

Indoor cable

I-V

Tight buffered fiber, single fiber, metal-free

ø secondary coating µm	number of tubes	max. fibers / tube	fiber count	tensile strength approx. N	weight approx. kg/km	Außendurchmesser µm	fire load MJ/m
600	-	-	-	-	0,5	600	0,1
900	-	-	-	-	0,7	900	0,1

Technical data

min. bending radius	according to IEC 60794-1-E11 value ≥60 mm
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +70°C installation: -5°C up to +50°C operation: -5°C up to +50°C

Application
Suitable for assembling to pigtails or as connecting cable in mechanically protected areas

Construction
- fiber with primary-coating (colored)
- sliding layer
- secondary-coating of acrylate, transparent

Fiber colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

On request
- pre-assembled with different connectors

Indoor cable

I-V(ZN)H

Simplex cable, metal-free, halogen-free, flame retardant

ø single cable mm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	outer diameter mm	fire load MJ/m
2,0	-	-	1	200	4,5	2,0	0,15
2,8	-	-	1	400	7,4	2,8	0,2

* with reversible increase of the attenuation

Application
Suitable for assembling to a connecting cable between passive and active network components indoors

Construction
- tight buffered fiber
- aramid strength members
- FRNC-outer sheath acc. to IEC 60332-2

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 100 N/10 cm
impact	according to IEC 60794-1-E4 value: 2 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 15 x cable-diameter dynamic 20 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +60°C installation: -10°C up to +50°C operation: -20°C up to +70°C

Indoor cable

I-V(ZN)H

Duplex cable, Zipcord figure-8, metal-free, halogen-free, flame retardant

ø single cable mm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	dimensions mm	fire load MJ/m
2,0	-	-	2	400	10,8	2,0 x 4,3	0,25
2,8	-	-	2	500	17,5	2,8 x 5,9	0,3

* with reversible increase of the attenuation

Application
Suitable for assembly into a duplex connection cable between passive and active network components in-doors, designed as a "zip-cord"

Construction
- 2 parallel guided simplex cables (page 63) - via a web connected together

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 600 N/10 cm
impact	according to IEC 60794-1-E4 value: 2 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 15 x cable-diameter dynamic 20 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +60°C installation: -10°C up to +50°C operation: -20°C up to +70°C

Indoor cable

I-V(ZN)HH

Duplex cable, figure-0, metal-free, halogen-free, flame retardant

ø single cable mm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	dimensions mm	fire load MJ/m
2,0	-	-	2	200	7,8	3,0 x 5,0	0,4
2,8	-	-	2	500	12,5	4,2 x 7,0	0,45

* with reversible increase of the attenuation

Application
Suitable for assembly into a duplex connection cable between passive and active network components in-doors, designed as “figure 0"

Construction
- 2 parallel guided simplex cables (page 63) with common FRNC-outer sheath acc. to IEC 60332-2, UV-resistant

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1000 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 15 x cable-diameter dynamic 20 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: 0°C up to +50°C installation: 0°C up to +50°C operation: 0°C up to +50°C

Indoor cable

I-VQ(ZN)H

Indoor/Riser cable, metal-free, halogen-free, flame retardant

ø secondary coating µm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
600	-	-	2	400	7,5	2,8	0,25
600	-	-	4	400	8,0	2,8	0,25
900	-	-	2	400	8,5	3,0	0,3
900	-	-	4	400	9,0	3,0	0,3

* with reversible increase of the attenuation

Application
Robust riser cable for the FTTH area, ideal for vertical laying into existing cable ducts of buildings for example. Upon request, this cable is pre-assembled in practical installation boxes.

Construction
- 2 or 4 tight buffered fibers (page 62)
- aramid strength members
- FRNC-outer sheath acc. to IEC 60332-2, UV-resistant

Fiber colour
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Sheath colour
grey (acc. to VDE 0888 / part 3);
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 500 N/10 cm
impact	according to IEC 60794-1-E4 value: 2 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 15 x cable-diameter dynamic 20 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +60°C installation: -10°C up to +50°C operation: -20°C up to +70°C

Indoor cable

I-V(ZN)H

Mini-Breakoutcable, metal-free, halogen-free, flame retardant

ø secondary coating µm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
900	-	-	4	650	28	5,1	0,4
900	-	-	6	850	33	5,5	0,4
900	-	-	8	950	39	6,1	0,4
900	-	-	10	950	42	6,3	0,4
900	-	-	12	1.100	46	6,6	0,5
900	-	-	16	1.300	58	7,5	0,5
900	-	-	24	1.600	73	8,5	0,7

* with reversible increase of the attenuation

Application
Mini-Breakoutcable for FTTx and data center applications. Suitable for laying on cable trays or cable channels indoors. Can be ordered pre-assembled with connectors.

Construction
- up to 24 tight buffered fibers (page 62)
- aramid strength members
- FRNC-outer sheath acc. to IEC 60332-2, UV-resistant

Fiber colour
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 20 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 15 x cable-diameter dynamic 20 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -20°C up to +60°C installation: -5°C up to +50°C operation: -20°C up to +60°C

Indoor cable

I-V(ZN)HH

Breakoutcable, metal-free, halogen-free, flame retardant

ø single cable mm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	-	-	4	800	55	7,4	1,5
2,0	-	-	6	1.800	74	8,4	1,5
2,0	-	-	8	2.400	96	9,7	1,5
2,0	-	-	12	3.000	144	12,2	2
2,0	-	-	16	3.400	137	12,0	2
2,0	-	-	18	3.700	151	12,4	2
2,0	-	-	24	4.000	196	14,3	2,5

* with reversible increase of the attenuation

Application
Breakoutcable for FTTx and data center applications. Suitable for laying on cable trays or cable channels indoors. Can be ordered pre-assembled with connectors.

Construction
- FRP-central element
- up to 24 simplex cables (page 63), stranded
- FRNC-outer sheath acc. to IEC 60332-2, UV-resistant

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 1500 N/10 cm
impact	according to IEC 60794-1-E4 value: 10 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 10 x cable-diameter dynamic 15 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +60°C installation: -5°C up to +40°C operation: -5°C up to +50°C

Indoor cable

I-V(ZN)H(BN)2Y

Breakoutcable, metal-free, slight rodent protection

ø single cable mm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	-	-	4	2.400	73	8,3	2,5
2,0	-	-	6	2.800	92	9,3	2,5
2,0	-	-	8	3.700	118	10,7	3
2,0	-	-	12	4.100	167	13,1	3
2,0	-	-	16	3.500	154	12,7	3
2,0	-	-	18	3.900	169	13,3	3
2,0	-	-	24	5.200	224	15,9	3,5
2,4	-	-	4	2.200	83	9,9	2,5
2,4	-	-	6	2.900	89	11,2	2,5
2,4	-	-	8	3.300	117	12,7	3
2,4	-	-	12	4.400	220	15,9	3,5
2,4	-	-	16	4.600	209	15,3	3,5
2,4	-	-	18	4.800	228	16,2	4
2,4	-	-	24	5.500	297	18,9	5

* with reversible increase of the attenuation

Application
Breakoutcable for FTTx and data center applications with additionally rodent protection. Suitable for laying on cable trays or cable channels indoors and outdoors. Can be ordered pre-assembled with connectors.

Construction
- FRP-central element
- up to 24 simplex cables (page 63), stranded
- strength members and simultaneous rodent protection by swellable glass yarns
- PE-outer sheath, UV-resistant, black

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 20 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 10 x cable-diameter dynamic 15 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +60°C installation: -5°C up to +40°C operation: -5°C up to +50°C

Indoor cable

I-V(ZN)H(BN)H

Breakoutcable, metal-free, slight rodent protection, halogen-free, flame retardant

ø single cable mm	number of tubes	max. fibers / tube	fiber count	tensile strength* approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	-	-	4	2.400	73	8,3	1,5
2,0	-	-	6	2.800	92	9,3	1,5
2,0	-	-	8	3.700	118	10,7	1,5
2,0	-	-	12	4.100	167	13,1	2
2,0	-	-	16	3.500	154	12,7	2
2,0	-	-	18	3.900	169	13,3	2
2,0	-	-	24	5.200	224	15,9	3,5
2,4	-	-	4	2.200	83	9,9	2
2,4	-	-	6	2.900	89	11,2	2
2,4	-	-	8	3.300	117	12,7	3
2,4	-	-	12	4.400	220	15,9	3,5
2,4	-	-	16	4.600	209	15,3	3,5
2,4	-	-	18	4.800	228	16,2	4
2,4	-	-	24	5.500	297	18,9	5

* with reversible increase of the attenuation

Application
Breakoutcable for FTTx applications and datacenters with additional rodent protection. Suitable for laying on cable trays or in cable ducts and pipes indoors. Can be ordered pre-assembled with connectors.

Construction
- FRP-central element
- up to 24 simplex cables (page 63), stranded
- strength members and simultaneous rodent protection by swellable glass yarns
- FRNC-outer sheath acc. to IEC 60332-2, UV-resistant

Sheath colour
yellow (E9), orange (G50, G62,5) or turquoise (G50 OM3)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- pre-assembled with different connectors
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 2000 N/10 cm
impact	according to IEC 60794-1-E4 value: 20 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 10 x cable-diameter dynamic 15 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -25°C up to +60°C installation: -5°C up to +40°C operation: -5°C up to +50°C

Indoor cable

Flat Drop cable

Breakoutkabel, metal-free, halogen-free, flame retardant

fiber diameter µm	number of tubes	max. fibers / tube	max. number of fibers	tensile strength* approx. N	weight approx. kg/km	outer diameter approx. mm	fire load MJ/m
2,0	-	-	1	80	7,6	2,0x3,0	0,4
2,0	-	-	2	80	7,6	2,0x3,0	0,4

* with reversible increase of the attenuation

Application
A very robust indoor cable with 1-2 fibers for indoor installation for direct customer connection with good cross-pressure values. Easy access to fibers

Construction
- 1-2 centrally managed fibers (without secondary coating)
- FRNC-outer sheath acc. to IEC 60332-2, UV-resistant, cream-colored
- 2 FRP-supporting elements as strength members in the sheath

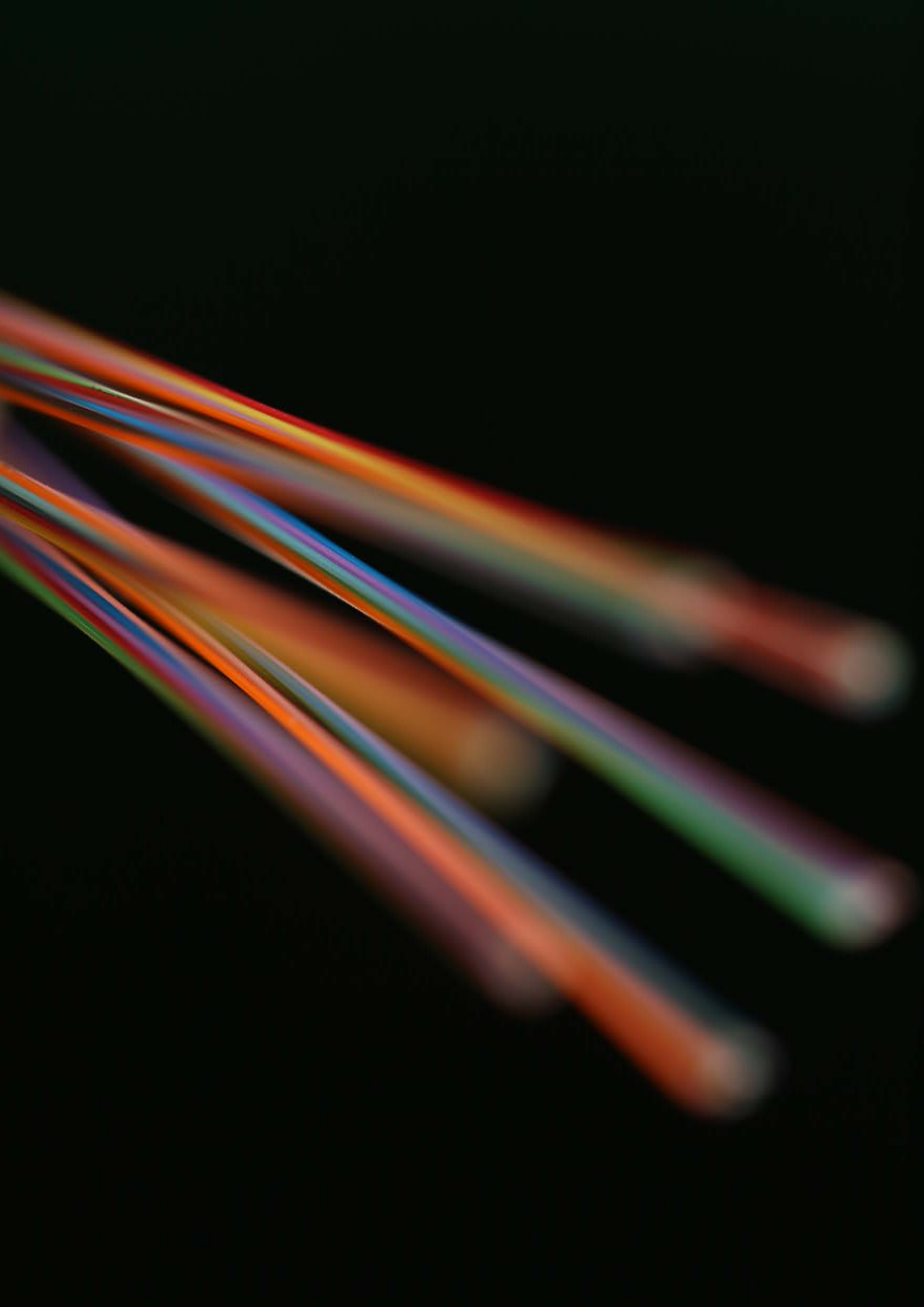
Fiber colour
PENGG KABEL standard according to page 89 - or upon customer requirements other color codes (DIN, TIA / EIA-598 (MPO), IEC - see page 89)

Standard marking:
PENGG KABEL - cable type - fiber count/type - ID number - CPR class CE-marking - meter - with inkjet

On request
- FRNC-sheath according to IEC 60332-3
- other sheath colour
- other marking

Technical data

specification	IEC 60794
tensile strength	according to IEC 60794-1-E1 value: see above table
compressive strength (crush)	according to IEC 60794-1-E3 value: 4000 N/10 cm
impact	according to IEC 60794-1-E4 value: 5 Nm
min. bending radius	according to IEC 60794-1-E11 values: static 20 x cable-diameter dynamic 35 x cable-diameter
temperature range	according to IEC 60794-1-F1 storage and transport: -30°C up to +70°C installation: -5°C up to +50°C operation: -30°C up to +70°C



Fiber data sheets

Fiber data sheets

E9/125

Singlemodefiber
G.652 D

General

Regulations	ITU-T G.652 D, IEC 60793-2-50, VDE 0888-325
Description	The fiber is ideally designed for use in metropolitan, local and access networks due to its superior specifications - low optical loss aross the entire wavelength range from 1260 to 1625 nm, tightest available geometry, low splice loss and low polarization mode dispersion.
Construction	The fiber consists of a light-guiding core with 9 µm and a cladding made of high purity silica glass SiO2. Surface protection (coating) from 2-layer UV hardened acrylic.

Mechanical properties

Mode field diameter d	at 1310 nm	9.2 ±0.4	µm
	at 1550 nm	10.4 ±0.5	µm
Core/Clad Concentricity Error (offset)		≤0.5	µm
Clad diameter		125 ±0.7	µm
Clad non-circularity		0.7	%
Coating-clad concentricity error (offset)		≤12.0	µm
Coating diameter	uncoloured	235 - 245	µm
Coating strip force		1.0 ÷ 8.9	N
Tensile proof test		100	kpsi

Optical properties

		max. / typical	
Attenuation	at 1310 nm	≤0.34 / ≤0.33	dB/km
	at 1385 nm	≤0.31 / ≤0.27	dB/km
	at 1490 nm	≤0.24 / ≤0.21	dB/km
	at 1550 nm	≤0.21 / ≤0.19	dB/km
	at 1625 nm	≤0.24 / ≤0.20	dB/km
Attenuation uniformity	at 1310 and 1550 nm	≤0.05	dB/km
Macrobending attenuation	at 1310 and 1550 nm	≤0.05	dB
Attenuation alteration (range -60 up to +85°C)	at 1310 and 1550 nm	≤0.05	dB/km
Polarization moden dispersion (PMD)	max. individual fiber	≤0.1	ps/√km
Cut-off wavelength	λ_{cff}	≤1260	nm
Point Discontinuities	at 1310 and 1550 nm	≤0.05	dB
Zero dispersion wavelength	λ_0	1302 ÷ 1322	nm
Zero dispersion slope	s_0	≤0.090	ps/(nm²*km)
Group refractive index	at 1310 nm	1.467	
	at 1550 nm	1.468	

E9/125

Singlemodefiber with higher bend performance G.657 A1/A2

General

Regulations	ITU-T G.657 A1/A2, IEC 60793-2-50, VDE 0888-325
Description	The macrobending and microbending loss improvements of this low bend sensitive fiber offer a number of advantages for demanding access, enterprise and central office applications. The fiber enables more compact cabinet and enclosure designs and protects the network against excessive loss resulting from inadvertent fiber bends. It is less susceptible to physical disturbancees from cable flexing, pulling and crushing, as well as the intricate routing conditions within enclosures and cabinets. The optimized bend characteristics of this fiber also help improve cable performance in demanding high-stress and low-temperature environments by providing double the microbend protection of conventional singl-mode fibers.
Construction	The fiber consists of a light-guiding core with 9 µm and a cladding made of high purity silica glass SiO2. Surface protection (coating) from 2-layer UV hardened acrylic.

Mechanical properties		**A1**	**A2**	
Mode field diameter d	at 1310 nm	8.5 - 9.3	8.4 - 9.2	µm
	at 1550 nm	9.4 - 10.4	9.4 - 10.4	µm
Core/Clad Concentricity Error (offset)		≤0.5	≤0.5	µm
Clad diameter		125 ±0.7	125 ±0.7	µm
Clad non-circularity		≤0.7	≤0.7	%
Coating-clad concentricity error (offset)		≤12.0	≤12.0	µm
Coating diameter*	uncoloured	235 - 245	235 - 245	µm
Coating strip force		1.0 ÷ 8.9	1.0 ÷ 8.9	N
Tensile proof test		100	100	kpsi

Optical properties		max. / typical	max. / typical	
Attenuation	at 1310 nm	≤0.35 / ≤0.33	≤0.35 / ≤0.33	dB/km
	at 1385 nm	≤0.31 / ≤0.27	≤0.31 / ≤0.28	dB/km
	at 1490 nm	≤0.24 / ≤0.21	≤0.24 / ≤0.21	dB/km
	at 1550 nm	≤0.21 / ≤0.19	≤0.21 / ≤0.19	dB/km
	at 1625 nm	≤0.24 / ≤0.20	≤0.24 / ≤0.20	dB/km
Macrobending attenuation				
100 turns, Ø 25 mm	at 1550 nm	≤0.01	-	dB
	at 1625 nm	≤0.05	-	dB
10 turns, Ø 15mm	at 1550 nm	≤0.2	≤0.03	dB
	at 1625 nm	≤0.5	≤0.1	dB
1 turn, Ø 10 mm	at 1550 nm	≤0.2	≤0.1	dB
	at 1625 nm	≤0.5	≤0.2	dB
1 turn, Ø 7.5mm	at 1550 nm	-	≤0.5	dB
	at 1625 nm	-	≤1.0	dB
Group refractive index	at 1310 nm	1.467	1.467	
	at 1550 nm	1.468	1.468	
Attenuation uniformity	at 1310 and 1550 nm	≤0.05	≤0.05	dB/km
Attenuation alteration (range -60 up to +85°C)	at 1310 and 1550 nm	≤0.05	≤0.05	dB/km
Polarization moden dispersion (PMD)		≤0.1	≤0.1	ps/√km
Cut-off wavelength	λ_{cff}	≤1260	≤1260	nm
Point Discontinuities	at 1310 and 1550 nm	≤0.05	≤0.05	dB
Zero dispersion wavelength	λ_0	1302 ÷ 1322	1302 ÷ 1322	nm
Zero dispersion slope ps/(nm²*km)	s_0	≤0.092	≤0.092	

* These fibers are also available with 200 µm coating diameter

Fiber data sheets

E9/125

Singlemodefiber - AllWave®+
G.652 D, G.657 A1

General

Regulations	ITU-T G.652 D, G.657 A1, IEC 60793-2-50, VDE 0888-325
Description	The new generation of single-mode fibers for the whole wavelength range from 1260 nm to 1625 nm. Compared to traditional fiber G.652D this fiber has lower PMD values, but achieves very low bending loss. Despite the seamless compatibility with G.652 D fibers with identical, nominal mode field diameter of 9,2 µm this fiber complies the G.657 A1 recommendations. It is therefore suitable for a huge range of applications.
Construction	The fiber consists of a light-guiding core with 9 µm and a cladding made of high purity silica glass SiO2. Surface protection (coating) from 2-layer UV hardened acrylic.

Mechanical properties

Mode field diameter d	at 1310 nm	9.2 ±0.4	µm
	at 1550 nm	10.4 ±0.5	µm
Core/Clad Concentricity Error (offset)		≤0.5	µm
Clad diameter		125 ±0.7	µm
Clad non-circularity		0.7	%
Coating-clad concentricity error (offset)		≤12.0	µm
Coating diameter	uncoloured	235 - 245	µm
Coating strip force		1.0 ÷ 8.9	N
Tensile proof test		≥100	kpsi

Optical properties

		max.	
Attenuation	at 1310 nm	≤0.34	dB/km
	at 1385 nm	≤0.31	dB/km
	at 1490 nm	≤0.24	dB/km
	at 1550 nm	≤0.21	dB/km
	at 1625 nm	≤0.24	dB/km
Macrobending attenuation			
100 turns, Ø 30 mm	at 1550 nm	≤0.03	dB
	at 1625 nm	≤0.03	dB
10 turns, Ø 15 mm	at 1550 nm	≤0.25	dB
	at 1625 nm	≤1.0	dB
1 turn, Ø 10 mm	at 1550 nm	≤0.75	dB
	at 1625 nm	≤1.5	dB
Chromatische Dispersion			
Zero dispersion wavelength	λ_0	1302 ÷ 1322	nm
Zero dispersion slope	s_0	≤0.090	ps/(nm²*km)
Typical dispersion slope		0.087	ps/(nm²*km)
Polarization moden dispersion (PMD)	max. individual fiber	≤0.1	ps/√km
	Link design value	≤0.04	ps/√km
Cut-off wavelength	λ_{cff}	≤1260	nm
Point Discontinuities	at 1310 and 1550 nm	≤0.05	dB
Group refractive index	at 1310 nm	1.467	
	at 1550 nm	1.468	

E8/125

Non-Zero-Dispersion-Shifted Singlemodefiber (NZDF) - True Wave® REACH G.656, G.655 C and E

General

Regulations	ITU-T G.655, ITU-T G.656, IEC 60793-2-50, VDE 0888-325
Description	The REACH fiber provides maximum performance in optically amplified systems over long distances with high capacity. It corresponds at least the requirements of the G.655 C and E, as well as the G.656 recommendations. Optimized for use in systems where EDFA or RAMAN amplifiers gets used.

Mechanical properties

Mode field diameter d	at 1550 nm	8.6 ±0.4	µm
Effective area	at 1550 nm	55	µm² (typical)
Clad diameter		125 ±0.7	µm
Core/Clad Concentricity Error (offset)		≤0.5	µm
Clad non-circularity		≤0.7	%
Coating-clad concentricity error (offset)		≤12.0	µm
Coating diameter	uncoloured	235 - 245	µm
Coating strip force		1.0 ÷ 8.9	N
Tensile proof test		100	kpsi

Optical properties

		max. / typical	
Attenuation	at 1310 nm	≤0.4 / ≤0.35	dB/km
	at 1383 nm	≤0.4 / ≤0.35	dB/km
	at 1450 nm	≤0.26 / ≤0.25	dB/km
	at 1550 nm	≤0.22 / ≤0.20	dB/km
	at 1625 nm	≤0.24 / ≤0.21	dB/km
Macrobending attenuation			
1 turn, Ø 32 mm	at 1550 nm	≤0.5	dB
	at 1625 nm	≤0.5	dB
100 turns, Ø 60 mm	at 1550 nm	≤0.05	dB
	at 1625 nm	≤0.05	dB
Attenuation alteration (range -60 up to +85°C)	at 1550 and 1625 nm	≤0.05	dB/km
Attenuation uniformity	at 1550 nm	≤0.05	dB
Chromatic dispersion	at 1310 nm	-5	ps/(nm*km) (typical)
	at 1530 ÷ 1565 nm	5.5-8.9	ps/(nm*km)
	at 1565 ÷ 1625 nm	6.9-11.4	ps/(nm*km)
	at 1460 ÷ 1625 nm	2.0-11.4	ps/(nm*km)
Dispersion slope	at 1550 nm	≤0.045	ps/(nm²*km)
Zero dispersion wavelength	λ_0	≤1405	nm
Polarization moden dispersion (PMD)	link design value	≤0.04	ps/√km
	max. individual fiber	≤0.1	ps/√km
	typical fiber LMC PMD	≤0.02	ps/√km
Cut-off wavelength	λ_{cff}	≤1310	nm
Group refractive index	at 1550 nm	1.470	

E8/125

Non-Zero-Dispersion-Shifted Singlemodefiber (NZDF) - True Wave® RS G.655 C and D

General

Regulations	ITU-T G.655, ITU-T G.656, IEC 60793-2-50, VDE 0888-325
Description	The RS fiber is ideal for use in DWDM-systems in metro and long haul areas. Especially in the traditional C-band and L-band. Further the fiber is characterized by low dispersion values and a low dispersion slope and complies with the recommendations of the ITU-T G.655 C and D.

Mechanical properties

Mode field diameter d	at 1550 nm	8.4 ±0.6	µm
Effective area	at 1550 nm	52	µm² (typical)
Clad diameter		125 ±0.7	µm
Core/Clad Concentricity Error (offset)		≤0.5	µm
Clad non-circularity		≤0.7	%
Coating-clad concentricity error (offset)		≤12.0	µm
Coating diameter	uncoloured	235 - 245	µm
Coating strip force		1.0 ÷ 8.9	N
Tensile proof test		100	kpsi

Optical properties

		max. / typical	
Attenuation	at 1310 nm	≤0.4 / ≤0.35	dB/km
	at 1383 nm	≤0.4 / ≤0.35	dB/km
	at 1550 nm	≤0.22 / ≤0.20	dB/km
	at 1625 nm	≤0.24 / ≤0.21	dB/km
Macrobending attenuation			
1 turn, Ø 32 mm	at 1550 nm	≤0.5	dB
	at 1625 nm	≤0.5	dB
100 turns, Ø 60 mm	at 1550 nm	≤0.05	dB
	at 1625 nm	≤0.05	dB
Attenuation alteration (range -60 up to +85°C)	at 1550 and 1625 nm	≤0.05	dB/km
Point discontinuity	at 1550 nm	≤0.05	dB
Chromatic dispersion	at 1310 nm	-8	ps/(nm*km) (typical)
	at 1530 ÷ 1565 nm	2.6-6.0	ps/(nm*km)
	at 1565 ÷ 1625 nm	4.0-8.9	ps/(nm*km)
	at 1460 ÷ 1625 nm	-1.0-8.9	ps/(nm*km)
Dispersion slope	at 1550 nm	≤0.05	ps/(nm²*km)
Polarization moden dispersion (PMD)	link design value	≤0.04	ps/√km
	max. individual fiber	≤0.1	ps/√km
	typical fiber LMC PMD	≤0.02	ps/√km
Cut-off wavelength	λ_{cff}	≤1260	nm
Group refractive index	at 1550 nm	1.470	

E8/125

Non-Zero-Dispersion-Shifted Singlemodefiber (NZDF) - LEAF®
G.655 C and D

General

Regulations	ITU-T G.655, ITU-T G.656, IEC 60793-2-50, VDE 0888-325
Description	This fiber is optimized for long haul and metro networks in DWDM-operation. It has a high capacity, low attenuation and excellent PMD values. It is ideally suited for both existing 10G and 40G networks, as well as for 100G networks of the future. The recommendations of the ITU-T G.655 C and D gets satisfied at least .

Mechanical properties

Mode field diameter d	at 1550 nm	9.6 ±0.4	µm
Effective area	at 1550 nm	72	µm² (typical)
Clad diameter		125 ±0.7	µm
Core/Clad Concentricity Error (offset)		≤0.5	µm
Clad non-circularity		≤0.7	%
Coating-clad concentricity error (offset)		≤12.0	µm
Coating diameter	uncoloured	242 ±5	µm
Coating strip force		≤3.5	N
Tensile proof test		≥100	kpsi

Optical properties

Attenuation (Water Peak)	at 1383 ±3 nm	≤0.4	dB/km
Attenuation	at 1410 nm	≤0.32	dB/km
	at 1450 nm	≤0.26	dB/km
	at 1550 nm	≤0.19	dB/km
	at 1625 nm	≤0.21	dB/km
Macrobending attenuation			
1 turn, Ø 32 mm	at 1550 nm	≤0.5	dB
	at 1625 nm	≤0.5	dB
100 turns, Ø 60 mm	at 1550 nm	≤0.05	dB
	at 1625 nm	≤0.05	dB
Attenuation alteration (range -60 up to +85°C)	at 1550 and 1625 nm	≤0.05	dB/km
Point discontinuity	at 1550 nm	≤0.05	dB
Chromatic dispersion	at 1530 nm	2.0-5.5	ps/(nm*km)
	at 1565 nm	4.5-6.0	ps/(nm*km)
	at 1625 nm	5.8-11.2	ps/(nm*km)
Polarization moden dispersion (PMD)	link design value	≤0.04	ps/√km
	max. individual fiber	≤0.1	ps/√km
Group refractive index	at 1550 nm	1.4693	

Fiber data sheets

E8/125

Non-Zero-Dispersion-Shifted Singlemodefiber (NZDF) G.655, G.656

General

Regulations	ITU-T G.655, ITU-T G.656, IEC 60793-2-50, VDE 0888-325
Description	PENGG KABEL offers non-zero dispersion shifted single mode optical fibers produced by the Vapour Phase Axial Deposition (VAD) method, which enables construction of high-capacy, ultra long haul WDM systems. This fibers allows the easier deployment of WDM in metropolitan areas, and increases the capacity of fiber in WDM systems throughout the wavelength region between 1460 nm and 1625 nm (S, C, L-bands, 1460 nm only for G.656 fiber). It's non-zero dispersion caracteristic reduces four-wave mixing and cross-phase modulation over a wider wavelength range than conventional NZDF. Our NZDF fibers has the ability to increase transmission speeds of systems up to 10 Gb/s and 40 Gb/s and also has superior polarization mode dispersion performance.

Construction

Core	high purity silica glass (SiO_2) with Germanium doped silica (GeO_2)
Clad	silica glass (SiO_2)
Coating	2-layer UV hardened acrylic

Geometric properties		**G.656 (G.655 C, E)**	**G.655 A (G.655 D)**	
Mode field diameter d	at 1550 nm	9.0 ±0.5	9.6 ±0.4	µm
Clad diameter		125.0 ±1.0	125.0 ±0.7	µm
Core/Clad Concentricity Error (offset)		≤0.5	≤0.5	µm
Fiber curl radius		≥4	≥4	m
Primary coating diameter		242 ±5	245 ±5	µm
Coating-clad concentricity error (offset)		≤12	≤12	µm
Optical properties				
Attenuation	at 1460 nm (only G.656)	≤0.26	-	dB/km
	at 1550 nm	≤0.22	≤0.22	dB/km
	at 1625 nm	≤0.25	≤0.25	dB/km
Point discontinuity	at 1550 nm	≤0.10	≤0.05	dB
Chromatic dispersion	at 1460 bis 1625 nm (only G.656)	2.0 bis 13.5	-	ps/(nm*km)
	at 1530 bis 1565 nm	5.5 bis 10.0	2.0 bis 6.0	ps/(nm*km)
	at 1565 bis 1625 nm	7.5 bis 13.5	4.5 bis 11.2	ps/(nm*km)
Cut-off wavelength of cables fiber		≤1450	≤1450	nm
Polarization moden dispersion (PMD)	individual fiber	≤0.10	≤0.10	ps/√km
	link design value (typical)	-	≤0.04	ps/√km
Mechanical properties				
Tensile proof test		≥120	≥120	kpsi (1.2% strain)
Macrobending attenuation				
100 turns, Ø 75 bzw. 60 mm	at 1550 nm	≤0.05	≤0.05	dB
	at 1625 nm	-	≤0.05	dB
1 turn, Ø 32 mm	at 1550 nm	≤0.5	≤0.5	dB
	at 1625 nm	-	≤0.5	dB
Coating strip force		1.3 bis 8.9	1.3 bis 8.9	N
Dynamic fatigue resistance parameter		≥20	≥20	
Enviromental properties				
induced attenuation at 1310 nm and 1550 nm				
from -60°C to +85°C temperature cycling		≤0.05	≤0.05	dB/km
85°C / 98% RH temperature humidity cycling		≤0.05	-	dB/km
85°C / 85% RH temperature humidity cycling		-	≤0.05	dB/km
+85°C heating aging		≤0.05	≤0.05	dB/km
+23°C water immersion		≤0.05	≤0.05	dB/km

Fiber data sheets

G50/125 OM 2

Multimodefiber
G.651

General

Regulations	ITU-T G.651, IEC 60793-2-10, VDE 0888-321
Description	These gradient index multimode fiber provides excellent bending properties and is the best choice - because most cost-effective - for transmission rates of 1Gb/s in Gigabit Ethernet systems. The fiber can also get used for 150m link lengths in 10Gb/s area (at 850 nm).
Construction	The fiber consists of a light-guiding core with 50 µm and a cladding made of high purity silica glass SiO2. Surface protection (coating) from 2-layer UV hardened acrylic.

Mechanical properties

Mode field diameter d		50 ±2.5	µm
Core non-circularity		≤5.0	%
Core/Clad concentricity error (offset)		≤1.0	µm
Clad diameter		125 ±0,8	µm
Clad non-circularity		≤0,7	%
Coating-clad concentricity error (offset)		≤8.0	µm
Coatings non-circularity		≤5.0	%
Coating diameter	uncoloured	242 ±5	µm
Tensile proof test		100	kpsi
Coating strip force		1.0 ÷ 4.4	N
Bending radius		≥30	mm

Optical properties

Attenuation	at 850nm	≤3.5	dB/km
	at 1300 nm	≤1.5	dB/km
Bandwidth			
Overfilled bandwidth	at 850 nm	≥700	MHz*km
	at 1300 nm	≥500	MHz*km
Laser bandwidth/EMB	at 850 nm	≥950	MHz*km
	at 1300 nm	≥500	MHz*km
Macrobending attenuation			
100 turns, Ø 37.5 mm	at 850 nm	≤0.5	dB
	at 1300 nm	≤0.5	dB
2 turns, Ø 15 mm	at 850 nm	≤0.1	dB
	at 1300 nm	≤0.3	dB
2 turns, Ø 7.5 mm	at 850 nm	≤0.2	dB
	at 1300 nm	≤0.5	dB
Attenuation alteration (range -60 up to +85°C)		≤0.2	dB/km
Numerical Aperture	at 850 nm	0.200 ±0.010	
Group refractive index	at 850 nm	1.483	
	at 1300 nm	1.479	
Link length at 1 Gb/s	at 850 nm	750	m
	at 1300 nm	600	m
Link length at 10 Gb/s	at 850 nm	150	m

Fiber data sheets

G50/125 OM 3, OM 4

Multimodefiber
G.651

General

Regulations	ITU-T G.651, IEC 60793-2-10, VDE 0888-321
Description	These gradient index multimode fiber provides excellent bending properties and is suitable for transmission rates of 10 Gb/s, 40Gb/s and 100Gb/s in the 850nm range - in data centers, central offices as well as in LAN networks.
Construction	The fiber consists of a light-guiding core with 50 µm and a cladding made of high purity silica glass SiO2. Surface protection (coating) from 2-layer UV hardened acrylic.

Mechanical properties

Mode field diameter d		50 ±2.5	µm
Core non-circularity		≤5.0	%
Core/Clad concentricity error (offset)		≤1.0	µm
Clad diameter		125 ±0.8	µm
Clad non-circularity		≤0.7	%
Coating-clad concentricity error (offset)		≤8.0	µm
Coating non-circularity		≤5.0	%
Coating diameter	uncoloured	242 ±5	µm
Tensile proof test		100	kpsi
Coating strip force		1.0 ÷ 4.4	N
Bending radius		≥30	mm

Optical properties

Attenuation	at 850nm	≤3.5	dB/km
	at 1300 nm	≤1.5	dB/km
Bandwidth			
Overfilled bandwidth	OM3 at 850 nm	≥1500	MHz*km
	OM3 at 1300 nm	≥500	MHz*km
Laser bandwidth/EMB	OM3 at 850 nm	≥2000	MHz*km
	OM3 at 1310 nm	≥500	MHz*km
Overfilled bandwidth	OM4 at 850 nm	≥3500	MHz*km
	OM4 at 1300 nm	≥500	MHz*km
Laser bandwidth/EMB	OM4 at 850 nm	≥4700	MHz*km
	OM4 at 1310 nm	≥500	MHz*km
Group refractive index	at 850 nm	1.483	
	at 1300 nm	1.479	
Macrobending attenuation			
100 turns, Ø 37.5 mm	at 850 nm and 1300 nm	≤0.5	dB
2 turns, Ø 15 mm	at 850 nm	≤0.1	dB
	at 1300 nm	≤0.3	dB
2 turns, Ø 7.5 mm	at 850 nm	≤0.2	dB
	at 1300 nm	≤0.5	dB
Attenuation alteration (range -60 up to +85°C)		≤0.2	dB/km
Numerical aperture	at 850 nm	≤0.200 ±0.015	

G62,5/125 OM 1

Multimodefiber

General

Regulations	IEC 60793-2-10, VDE 0888-321, IEEE 802.3 Gigabit Ethernet Standard
Description	Laser optimized gradient index multimode fiber for Gigabit Ethernet and high-speed communication protocols.
Construction	The fiber consists of a light-guiding core with 62,5 µm and a cladding made of high purity silica glass SiO2. Surface protection (coating) from 2-layer UV hardened acrylic.

Mechanical properties

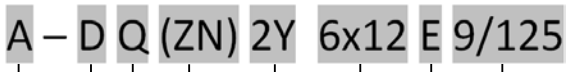
Mode field diameter d		62.5 ±2.5	µm
Core non-circularity		≤5.0	%
Clad diameter		125 ±1.0	µm
Core/clad concentricity error (offset)		≤1.0	µm
Clad non-circularity		≤1.0	%
Coating-clad concentricity error (offset)		≤8.0	µm
Coating non-circularity		≤5.0	%
Coating diameter	uncoloured	245 ±10	µm
Tensile proof test		100	kpsi
Coating strip force		1.0 ÷ 4.4	N

Optical properties

Attenuation	at 850 nm	≤3.5	dB/km
	at 1300 nm	≤1.5	dB/km
Bandwidth			
Overfilled bandwidth	at 850 nm	220	MHz*km
	at 1300 nm	500	MHz*km
Macrobending attenuation			
100 turns, Ø 75 mm	at 850 nm and 1300 nm	≤0.5	dB
Attenuation alteration (range -60 up to +85°C)		≤0.2	dB/km
Numerical aperture	at 850 nm	≤0.275 ±0.015	dB
Group refractive index	at 850 nm	1.496	
	at 1300 nm	1.491	
Link length at 1 Gb/s	at 850 nm	≤300	m
	at 1300 nm	≤550	m

General information

Letter symbols - Fiber optic cables



Area of application	
Indoor cable	I
Universal cable	A/I
Outdoor cable	A
Dividable cables, Breakout cables	AT

Core type	
Tight buffered fiber	V
Jelly-filled loose tube	D

Construction	
Swellable filling material for dry cable core	Q
Jelly-filled cable core (petrol jelly)	F
Metal elements in the cable core	S
Aramid yarns as strength member	(ZN)
Glass-rovings as strength member	(BN)
Metallic element as strength member	(ZS)

Sheath variants	
Polyvinylchloride (PVC)	Y
Polyethylene (PE)	2Y
Polyamide (PA)	4Y
Hytrel®	13Y
FRNC (flame retardant non corrosive) bzw. LS0H (low smoke - zero halogens)	H
Corrugated steel tape – Polyethylene (PE)	(SR)2Y
Polyethylene (PE) – steel wire armouring – Polyethylene (PE)	2YR2Y
Aluminium – Polyethylene (PE) composite layer sheath	(L)2Y

Number of fibers or fiber bundle	
Number of fibers	n
Number of fiber bundle x number of fibers per tube	nxm

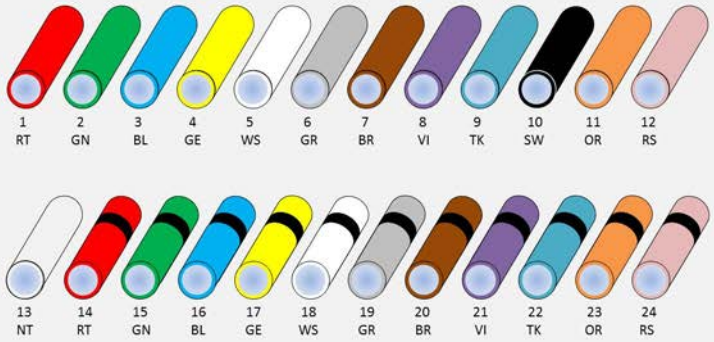
Fiber type	
Singlemode fiber	E
Multimode-gradient index fiber	G

Fiber dimension	
Ø fiber core / Ø fiber cladding	x/y

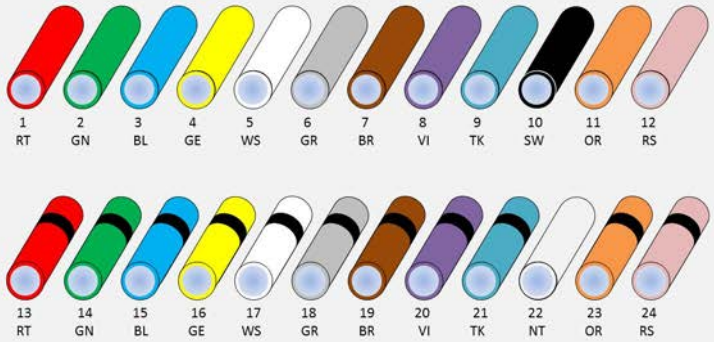
Colour codes - Fiber optic cables

Color specifications of the fibers

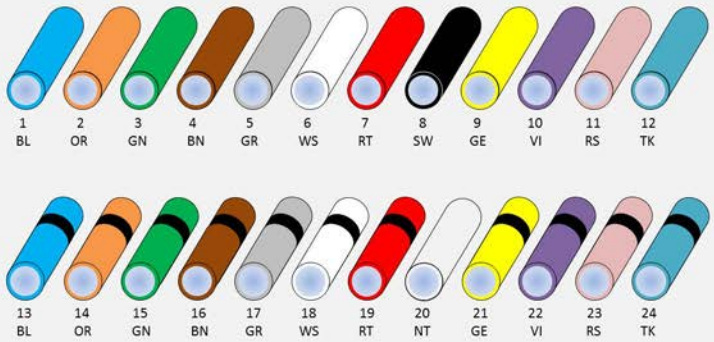
PENGG KABEL Standard



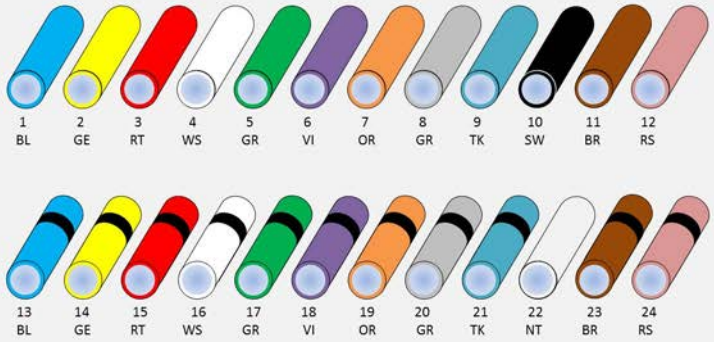
DIN



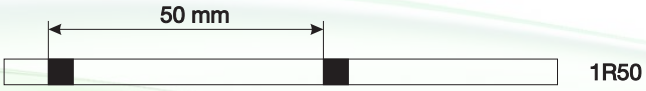
TIA/EIA-598 (MPO)



IEC



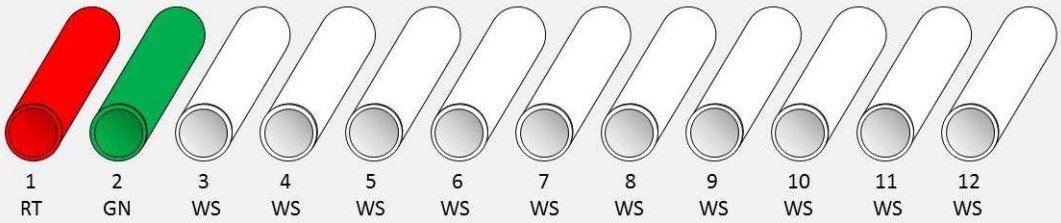
Ring marking:



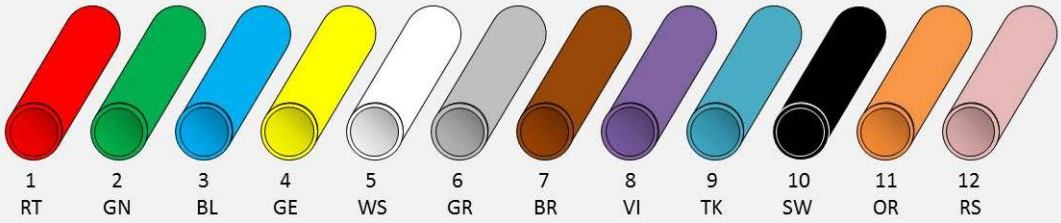
Colour codes - Fiber optic cables

Color specifications of the loose tubes

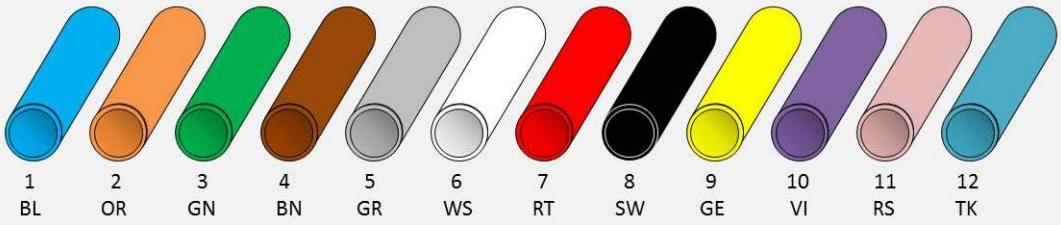
PENGG KABEL Standard



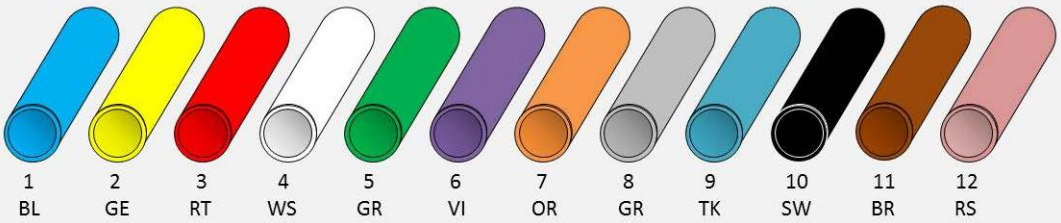
DIN



TIA/EIA-598 (MPO)



IEC



Pictograms

All datasheets are signed with common pictograms, which describe the cable make up and will make it easier to find out of the most applicable cable type.

Construction

metal-free

halogen-free, flame retardant

rodent protection

longitudinally-, radially-watertight

Application

indoor cable

outdoor cable

aerial cable (ADSS)

Cooper-elements

single core

pair

quad

Planning- and installation advices

Laying-guideline

Cables are not allowed to be unwinded from the drum against their original running direction (fig. 3).

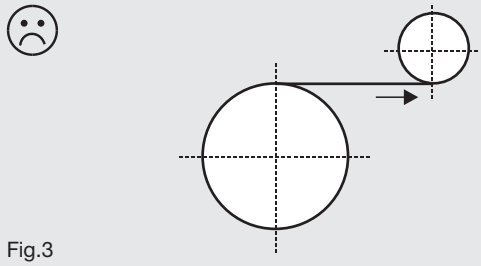


Fig.3

As well twisting of the cable (fig.4) is not allowed.

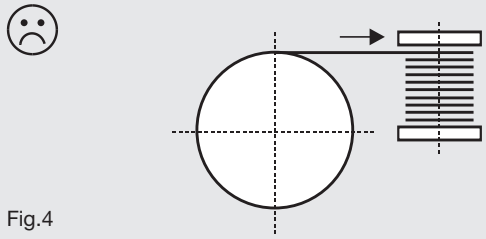


Fig.4

During an installation the cable drum shall always be situated horizontally (fig.5), preferred on an unroll stand. When this is considered, the cable will not be demaged due to mechanical stress during installation or laying out on the floor.

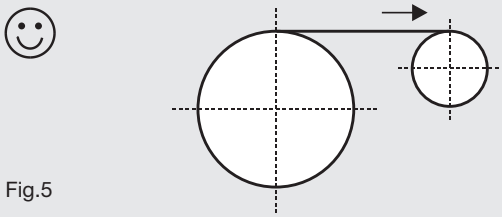


Fig.5

To prevent a torsions effect, a cable coil has to be situated vertically (fig.6) and unreeled or layed out on the floor.

If there is not enough space to unreel the cable coil in the necessary length, a sufficiently big bend must be considered by laying back the cable.

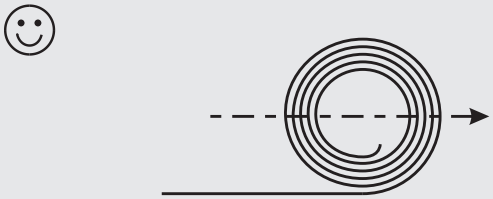


Fig.6

A cable bundle always shall be layed straight, to prevent a possible blocking during the installation. If e.g. several cables are layed parallely in cable trays, it is recommended to bundle them with cable straps or insulating tapes (fig.7).

Fig.7

During bundling up the cables, a sqeezing has to be prevented (fig. 8).

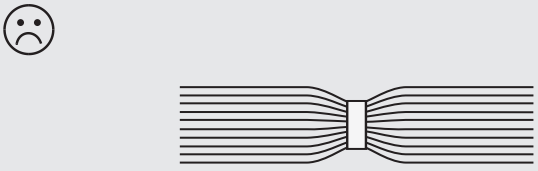
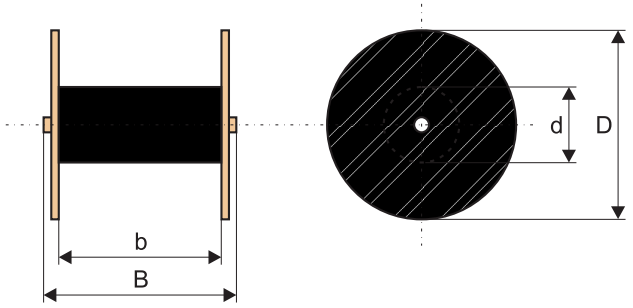


Fig.8

Nominal data of wooden drums

Drums according to DIN 46391 (dimensions, weights)



identification number	drum dimension	flange-diameter D [mm]	barrel-diameter d [mm]	width B [mm]	traverse width b [mm]	carrying capacity aprrox. [kg]	drum-weight aprrox. [kg]
051	05	500	150	470	400	–	8
E6	06	600	300	450	–	–	20
061	06	630	315	415	315	250	13
071	07	710	355	500	400	400	25
E8	08	800	400	560	–	–	40
081	08	800	400	500	400	600	31
091	09	900	450	670	560	800	47
E10	10	1000	550	700	–	–	80
101	10	1000	500	690	560	900	71
E12	12	1200	700	790	–	–	150
121	12	1250	630	860	666	1700	144
E14	14	1400	850	870	–	–	200
141	14	1400	710	870	660	2000	175
E16	16	1600	1000	970	–	–	350
161	16/8	1600	800	1060	844	3000	280
162	16/10	1600	1000	1100	835	3000	271
E18	18	1800	1150	1110	–	–	500
181	18/10	1800	1000	1060	835	4000	380
182	18/12	1800	1250	1100	825	4000	352
E20	20	2000	1300	1190	–	–	600
201	20/12	2000	1250	1310	1035	5000	550
202	20/14	2000	1400	1345	1030	5000	544
E22	22	2200	1450	1330	–	–	700
221	22/14	2240	1400	1410	1140	6000	710
222	22/16	2240	1600	1475	1130	6000	738
E24	24	2400	1600	1380	–	–	900
250	25/14	2500	1400	1450	1140	7500	875
251	25/16	2500	1600	1450	1130	7500	900
252	25/18	2500	1800	1475	1120	7500	909
E26	26	2600	1700	1450	–	–	1100
E28	28	2800	1800	1650	–	–	1400
281	28/18	2800	1800	1590	1280	10000	1175
E30	30	3000	1900	–	1270	10000	1600

up to drum dimension 10 with cable bushing

Terms of delivery

for cables, furnitures and insulated cords from Pengg Kabel GmbH, later named seller.

1. Scope

1.1. These General Terms shall govern legal transactions between business enterprises, namely the delivery of commodities and, mutatis mutandis, the rendering of services. Software transactions are with precedence governed by the Software Conditions issued by the Austrian Electrical and Electronics Industry Association, assembly work by the Terms and Conditions for Assembly Work issued by the Austrian Power Current and Light Current Engineering Industry and/or (where applicable) the Terms and Conditions for the Assembly of Electrical Equipment used in Medicine issued by the Austrian Electrical and Electronics Industry (the current versions are available at www.feei.at).

1.2. Any departure from the terms and conditions mentioned in 1.1 above shall be valid only if expressly accepted in writing by Seller.

2. Submission of offers

2.1. Seller's offers shall be deemed offers without engagement.

2.2. Tender documents and project documentation must not be duplicated nor made available to third parties without the permission of Seller. They may be claimed back at any time and shall be returned to Seller immediately if the order is placed elsewhere.

3. Conclusion of contract

3.1. The contract shall be deemed concluded upon written confirmation by Seller of an order received or upon dispatch of a delivery.

3.2. Particulars appearing in catalogues, folders etc. as well as any oral or written statements shall only be binding if Seller makes express reference to them in the confirmation of the order.

3.3. Subsequent amendments of or additions to the contract shall be subject to written confirmation.

4. Prices

4.1. Prices shall be quoted ex works or ex Seller's warehouse without VAT, packing and packaging, loading, disassembly, take-back and proper recycling and disposal of waste electrical and electronic equipment for commercial purposes as defined by the Ordinance Regulating the Handling of Waste Electrical Equipment. Buyer shall be liable for any and all charges, taxes or other duties levied in respect of delivery. If the terms of delivery include transport to a destination designated by Buyer, transport costs as well as the cost of any transport insurance desired by Buyer shall be borne by the latter. Delivery does not, however, include unloading and subsequent handling. Packaging materials will be taken back only by express agreement.

4.2. Seller reserves the right to modify prices if the order placed is not in accordance with the offer submitted.

4.3. Prices are based on costs obtaining at the time of the first quotation. In the event that the costs have increased by the time of delivery, Seller shall have the right to adjust prices accordingly.

4.4. In carrying out repair orders, Seller shall provide all services deemed expedient and shall charge Buyer for the same on the basis of the work input and/or expenditures required. The same holds for any services or additional services the expediency of which becomes apparent only as the repair order is executed. In such an event special notification of Buyer shall not be required.

4.5. Expenses for estimates of costs of repair and maintenance or for expert valuations shall be invoiced to Buyer.

5. Delivery

5.1. The period allowed for delivery shall commence at the latest of the following dates:

a) the date of order confirmation by Seller;

b) the date of fulfilment by Buyer of all the conditions, technical, commercial and other, for which he is responsible;

c) the date of receipt by Seller of a deposit or security due before delivery of the goods in question.

5.2. Buyer shall obtain whatever licences or approvals may be required from authorities or third parties for the construction of plant and equipment. If the granting of such licences or approvals is delayed for any reason the delivery period shall be extended accordingly.

5.3. Seller may carry out, and charge Buyer for, partial or advance deliveries. If delivery on call is agreed upon, the commodity shall be deemed called off at the latest one year after the order was placed.

5.4. In case of unforeseeable circumstances or circumstances beyond the parties control, such as all cases of force majeure, which impede compliance with the agreed period of delivery, the latter shall be extended in any case for the duration of such circumstances; these include in particular armed conflicts, official interventions and prohibitions, delays in transport or customs clearance, damages in transit, energy shortage and raw materials scarcity, labour disputes, and default on performance by a major component supplier who is difficult to replace. The aforesaid circumstances shall be deemed to prevail irrespective of whether they affect Seller or his subcontractor(s).

5.5. If a contractual penalty for default of delivery was agreed upon by contracting parties when the contract was concluded, it shall be executed as follows, and any deviations concerning individual items shall not affect the remaining provisions: Where delay in performance can be shown to have occurred solely through the fault of Seller, Buyer may claim for each completed week of delay an indemnity of at most one half of one per cent, a total of no more than 5 %, however, of the value of that part of the goods to be delivered which cannot be used on account of Seller's failure to deliver an essential part thereof, provided the Buyer has suffered a damage to the aforesaid extent. Assertion of rights of damages exceeding this extent is precluded.

6. Passage of risk and place of performance

6.1. Unless otherwise agreed, the delivery of goods is considered sold EXW in accordance with INCOTERMS® 2010.

6.2. For services, the place of performance shall be the place indicated in the written order confirmation, secondary to that at which the service is actually rendered by Seller. The risk in respect of such services or any part thereof shall pass to Buyer at the time the services have been rendered.

7. Payment

7.1. Unless otherwise agreed, one third of the purchase price shall fall due at the time of receipt by Buyer of the order confirmation of Seller, one third after half the delivery period has elapsed and the balance at the time of delivery. Irrespective thereof the turnover tax comprised in the amount of the invoice shall be paid within 30 days of the invoice date. If bankruptcy proceedings are instituted against the assets of Buyer or if an application for bankruptcy proceedings is not granted for insufficiency of assets, deliveries shall only be made against cash in advance.

7.2. In the case of part settlements the individual part payments shall fall due upon receipt of the respective invoices. The same shall apply to amounts invoiced for additional deliveries or resulting from additional agreements beyond the scope of the original contract, irrespective of the terms of payment agreed upon for the principal delivery.

7.3. Payment shall be made without any discount free Seller's domicile in the agreed currency. Drafts and checks shall be accepted on account of payment only, with all interest, fees and charges in connection therewith (such as collection and discounting charges) to be borne by Buyer.

7.4. Buyer shall not be entitled to withhold or offset payment on the grounds of any warranty claims or other counterclaims.

7.5. Payment shall be deemed to have been effected on the date at which the amount in question is at Seller's disposal.

7.6. If Buyer fails to meet the terms of payment or any other obligation arising from this or other legal transactions, Seller may without prejudice to his other rights

a) suspend performance of his own obligations until payments have been made or other obligations fulfilled, and exercise his right to extend the period of delivery to a reasonable extent,

b) call in debts arisen from this or any other legal transactions and charge default interest amounting to 1.25 % per month plus turnover tax for these amounts beginning with the due dates, unless Seller proves costs exceeding this.

c) only perform other legal transactions against cash in advance in the case of qualified insolvency, in other words, following two delays in payment.

In any case Seller has the right to invoice all expenses arising prior to a lawsuit, especially reminder charges and lawyer's fees.

7.7. Discounts or bonuses are subject to complete payment in due time.

7.8. Seller retains title to all goods delivered by him until receipt of all amounts invoiced including interests and charges.

Buyer herewith assigns his claim out of a resale of conditional commodities, even if they are processed, transformed or combined with other commodities, to Seller to secure the latter's purchase money claim. In the case of resale granting respite Buyer shall have the power of disposal of the product under retention of ownership only with the proviso that upon reselling Buyer notifies the secondary buyer of the assignment for security or enters the assignment in his account books. Upon request Buyer has to notify the assigned claim and the debtor thereof to Seller, and to make all information and material required for his debt collection available and to notify the assignment to the third-party debtor. If the goods are attached or otherwise levied upon, Buyer shall draw attention to Sellers title and immediately inform Seller of the attachment or levy.

8. Warranty and acceptance of obligation to repair defects

8.1. Once the agreed terms of payment have been complied with, Seller shall, subject to the conditions hereunder, remedy any defect existing at the time of acceptance of the article in question whether due to faulty design, material or manufacture, that impairs the functioning of said article. From particulars appearing in catalogues, folders, promotional literature as well as written or oral statements which have not been included in the agreement no warranty obligations may be deduced.

8.2. Unless special warranty periods operate for individual items the warranty period shall be 12 months. These conditions shall also apply to any goods supplied, or services rendered in respect of goods supplied, that are firmly attached to buildings or the ground. The warranty period begins at the point of passage of risk acc. to paragraph 6.

8.3. For improved or exchanged parts, the warranty period shall start again, but shall end in any case 6 months after the original warranty period has expired.

8.4. If delivery or the performance of services is delayed for reasons outside the control of Seller, the warranty period shall begin 2 weeks after Seller is ready to deliver or perform services.

8.5. The foregoing warranty obligations are conditional upon the Buyer giving within a reasonable period notice in writing of any defects that have occurred and such notice reaching the Seller. Buyer shall prove within a reasonable period the presence of a defect, in particular he shall make available within a reasonable period to Seller all material and data in his possession. Upon receipt of such notice Seller shall, in the case of a defect covered by the warranty under 8.1 above, have the option to replace the defective goods or defective parts thereof or else to repair them on Buyer's premises or have them returned for repair, or to grant a fair and reasonable price reduction.

8.6. Any expenses incurred in connection with rectifying defects (e. g. expenses for assembly and disassembly, transport, waste disposal, travel and site-to-quarters time) shall be borne by Buyer. For warranty work on Buyer's premises Buyer shall make available free of charge any assistance, hoisting gear, scaffolding and sundry supplies and incidentals that may he required. Replaced parts shall become the property of Seller.

8.7. If an article is manufactured by Seller on the basis of design data, design drawings, models or other specifications supplied by Buyer, Seller's warranty shall be restricted to non-compliance with Buyers specifications.

8.8. Seller's warranty obligation shall not extend to any defects due to assembly and installation work not undertaken by Seller, inadequate equipment, or due to non-compliance with installation requirements and operating conditions, overloading of parts in excess of the design values stipulated by Seller, negligent or faulty handling or the use of inappropriate materials, nor for defects attributable to material supplied by Buyer. Nor shall Seller be li- able for damage due to acts of third parties, atmospheric discharges. Excess voltage and chemical influences. The warranty does not cover the replacement of parts subject to natural wear and tear. Seller accepts no warranty for the sale of used goods.

8.9. The warranty shall lapse immediately if, without written consent of Seller, Buyer himself or a third party not expressly authorised undertakes modifications or repairs on any items delivered.

8.10. Claims acc. to § 933b ABGB are struck by the statute of limitation with lapse of the period mentioned under point 8.2.

8.11. The provisions of sub-paragraphs 8.1 to 8.10 shall apply, mutatis mutandis, to all cases where the obligation to repair defects has to be accepted for other reasons laid down by law.

9. Withdrawal from contract

9.1. Buyer may withdraw from the contract only in the event of delays caused by gross negligence on the part of Seller and only after a reasonable period of grace has elapsed. Withdrawal from contract shall be notified in writing by registered mail.

9.2. Irrespective of his other rights Seller shall be entitled to withdraw from the contract

a) if the execution of delivery or the inception or continuation of services to be rendered under the contract is made impossible for reasons within the responsibility of Buyer and if the delay is extended beyond a reasonable period of grace allowed;

b) if doubts have arisen as to Buyer's creditworthiness and if same fails, on Seller's request, to make an advance payment or to provide adequate security prior to delivery, or

c) if, for reasons mentioned in 5.4, the period allowed for delivery is extended by more than half of the period originally agreed or by at least 6 months, or

d) if Buyer does not or does not properly meet the obligations imposed as per paragraph 13.

9.3. For the reasons given above withdrawal from the contract shall also be possible in respect of any outstanding part of the delivery or service contracted for.

9.4. If bankruptcy proceedings are instituted against Buyer or an application for bankruptcy proceedings is not granted for insufficiency of assets, Seller may withdraw from the contract without allowing a period of grace. If this withdrawal is taken, it shall take effect immediately upon the decision that the business will not be continued. If the business will be continued, a withdrawal shall not take effect until 6 months after the institution of bankruptcy proceedings or after an application for bankruptcy proceedings has not been granted for insufficiency of assets. In any case, the contract shall be terminated immediately unless the bankruptcy law to which Buyer is subject conflicts with this or if termination of the contract is necessary to prevent significant damages to Seller.

9.5. Without prejudice to Seller's claim for damages including expenses arising prior to a lawsuit, upon withdrawal from contract any open accounts in respect of deliveries made or services rendered in whole or in part shall be settled according to contract This provision also covers deliveries or services not yet accepted by Buyer as well as any preparatory acts performed by Seller. Seller shall, however, have the option alternatively to require the restitution of articles already delivered.

9.6. Withdrawal from contract shall have no consequences other than those stipulated above.

9.7. The assertion of claims on the ground of laesio enormis, error, or lapse of purpose by the Buyer is excluded.

10. Disposal of waste electrical and electronic equipment

10.1. The Buyer of electrical/electronic equipment for commercial purposes, incorporated in Austria, is responsible for the financing of the collection and treatment of waste electrical and electronic equipment as defined by the Ordinance Regulating the Handling of Waste Electrical Equipment, if he is himself the user of the electrical/electronic equipment. If the Buyer is not the end user, he shall transfer the full financial commitment to his customer by agreement and furnish proof thereof to the Seller.

10.2. The Buyer incorporated in Austria shall ensure that the Seller is provided with all information necessary to meet the Seller's obligations as manufacturer/importer, particularly according to §§ 11 and 24 of the Ordinance Regulating the Handling of Waste Electrical Equipment and the Waste Management Act.

10.3. The Buyer incorporated in Austria is liable vis-à-vis the Seller for any dam- age and other financial disadvantages incurred by Seller due to Buyer's failure to meet or fully meet his financing commitment or any other obligations according to Article 10. The Buyer shall bear the burden of proof of performance of this obligation.

11. Seller's liability

11.1. Outside the scope of the Product Liability Act, Seller shall be liable only if the damage in question is proved to be due to intentional acts or acts of gross negligence, within the limits of statutory provisions. Seller's total liability in cases of gross negligence is limited to the net value of the order or EUR 500,000, depending on which amount is lower.

11.2. For each incident of damage, Seller shall be liable for 25% of the net value of the order or EUR 125,000, depending on which amount is lower.

11.3. Seller shall not be liable for damage due to acts of ordinary negligence nor for consequential damages or damages for pure economic loss, indirect damages, loss of production, financing costs, costs for replacement energy, loss of energy, data or information, loss of profits, loss of savings or interest, or damage resulting from third-party claims against buyer.

11.4. Seller shall not be liable for damages in case of non-compliance with instructions for assembly, commissioning and operation (such as are contained in instructions for use) or non-compliance with licensing requirements.

11.5. Claims that exceed the contractual penalties that were agreed on are excluded from the respective title. The provisions of paragraph 11 apply exclusively for all claims by Buyer against Seller, regardless of the legal basis or entitlement, and also apply to all employees, subcontractors and subsuppliers of Seller.

12. Industrial property rights and copyrights

12.1. Buyer shall indemnify Seller and hold him harmless against any claims for any infringement of industrial property rights raised against him if Seller manufactures an article pursuant to any design data, design drawings, models or other specifications made available to him by Buyer.

12.2. Design documents such as plans and drawings and other technical specifications as well as samples, catalogues, prospectuses, pictures and the like shall remain the intellectual property of Seller and are subject to the relevant statutory provisions governing reproduction, imitation, competition etc. The provisions of 2.2 above shall also cover design documents.

13. Compliance with export provisions

13.1. When passing on goods delivered by Seller to third parties (as well as any related documentation, regardless of the method of provision or the services performed by Seller [including technical support of any kind]), Buyer must comply with the applicable regulations of national and international (re-)export provisions. In any case, Buyer must observe the (re-)export provisions of Seller's country of residence, the European Union and the United States of America.

13.2. If necessary for export controls, Buyer must provide Seller with all necessary information immediately after being requested to do so, for example, information about the final recipient, final destination and purpose of the goods or services.

14. General

Should individual provisions of the contract or of these provisions be invalid the validity of the other provisions shall not be affected. The invalid provision shall be replaced by a valid one, which comes as close to the target goal as possible.

15. Jurisdiction and applicable law

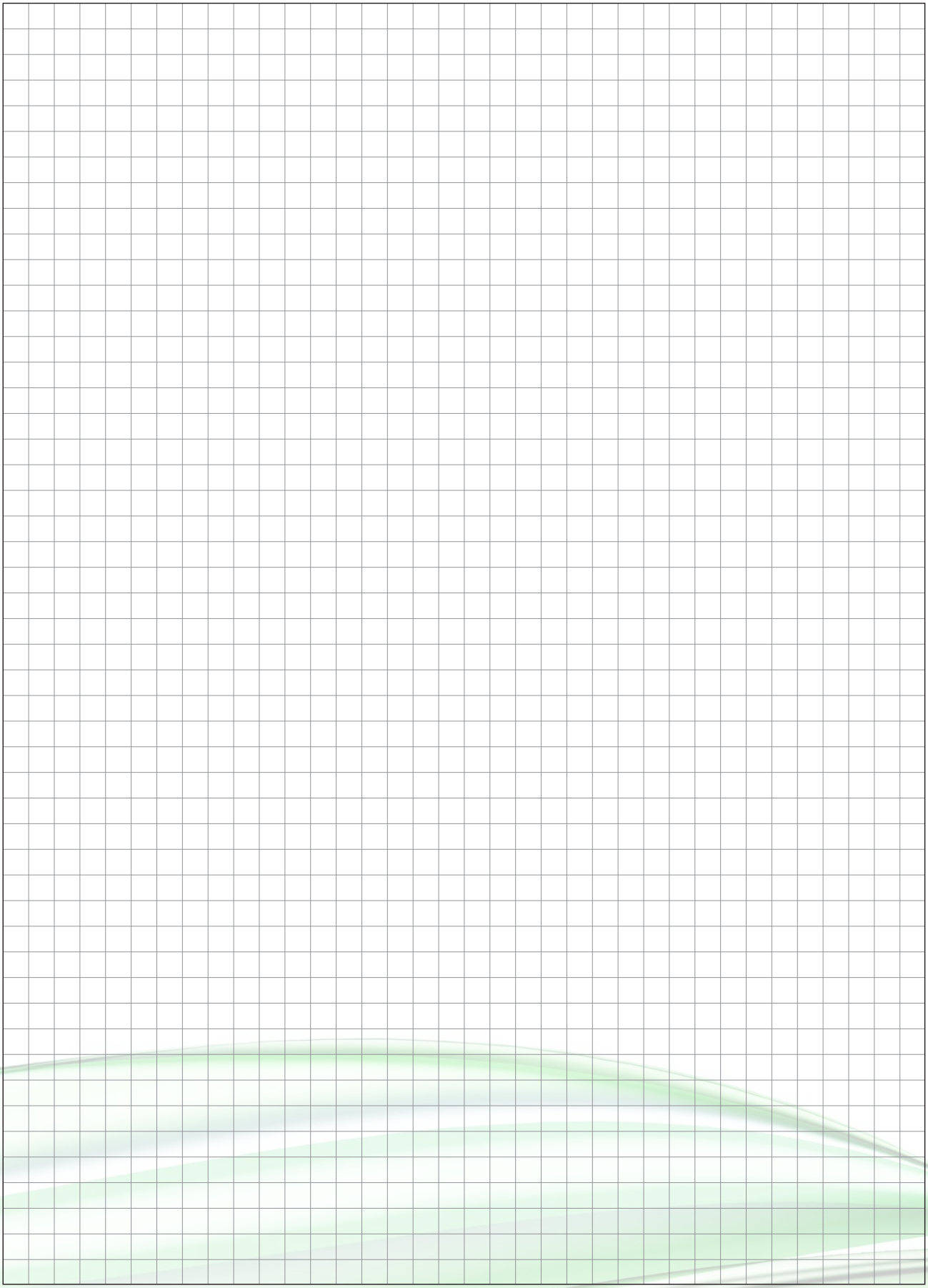
Any litigations arising under the contract including litigations over the existence or non-existence thereof shall fall within the exclusive jurisdiction of the competent court at Sellers domicile; the competent court of the Bezirksgericht Innere Stadt, Vienna, shall have exclusive jurisdiction if Seller is domiciled in Vienna. The contract is subject to Austrian law excluding the referral rules. Application of the UN Convention on Contracts for the International Sale of Goods is renounced.

16. Proviso

The execution of the contract by Seller is subject to the condition that there are no obstacles standing in the way of execution due to national or international (re-)export provisions, and especially no embargos and/or other sanctions.

Last revised in September 2011

Notes



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