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SIEMENS



Flexible cables

Australian catalogue

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Version 1

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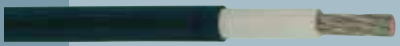
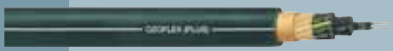
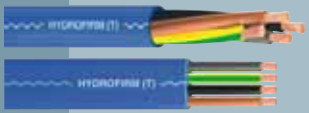
APPLICATION SELECTION GUIDE

Construction	Designation
 1. PCP elastomer sheath 2. Protolon R-EP-110 insulation 3. Tinned copper conductor, highly flexible	**3.3kV 110⁰ Flex** 5DF2
 1. CSP elastomer sheath 2. Elastomer inner sheath 3. EPR insulation 4. Copper conductors, flexible	**OZOFLEX** 5DH2
 1. Special CPE elastomer sheath 2. Elastomer inner sheath 3. EPR insulation 4. Copper conductors, flexible	**OZOFLEX (PLUS)** 5DH10

Rated voltage	Application and design	Page
0.6/1kV to 1.9/3.3kV	Single core highly flexible cable for switchboard cabling; submains, machine and equipment cabling. Suitable for high and sub-zero temperatures with a high short circuit strength.	34
0.6/1kV	Heavy duty EPR/CSP flexible for power and control supply. Suitable as flexible leads in mining, industry and agriculture. Suitable for hazardous locations	40
0.6/1kV	Especially suitable for submersion in sewage and effluent, waste water, polluted liquids containing oils, fats, solvents and chemicals etc. For pumps and aerators. Suitable for hazardous locations	52

APPLICATION SELECTION GUIDE

Construction	Designation
 1. CPE elastomer outer sheath 2. Copper braid screen 3. Elastomer inner sheath 4. EPR insulation 5. Copper conductor, flexible	**OZOFLEX (PLUS) SCREENED (FC+)** 5DH5
 1. Special EPR sheath 2. Watertight bond between insulation and sheath 3. EPR insulation 4. Copper conductors, flexible	**HYDROFIRM (T)** 5DH1
 1. EPR outer elastomer sheath 2. Copper braid screen 3. Elastomer inner sheath 4. EPR insulation 5. Copper conductor, flexible	**HYDROFIRM (T) SCREENED** 5DH5

Rated voltage	Application and design	Page
0.6/1kV	Screened cable suitable for VSD's submersion in sewage and effluent, waste water, polluted liquids containing oils, fats, solvents and chemicals etc. For pumps and aerators requiring control cores. Suitable for hazardous locations	60
0.6/1kV	Circular and flat flexible cable especially developed for continuous submersion in fresh, salt and bore water as a power supply to pumps and underwater electrical equipment.	66
0.6/1kV	Screened flexible cable especially developed for continuous submersion in fresh, salt and bore water as a power supply with control cores to pumps and underwater electrical equipment.	76

APPLICATION SELECTION GUIDE

Construction	Designation
 1. PCP elastomer sheath 2. Elastomer inner sheath 3. PROTOLON EPR insulation 4. Copper conductors, flexible	**PROTOMONT HD** 5DL1
 1. PCP elastomer sheath 2. Copper braid screen 3. Elastomer inner sheath 4. EPR insulation 5. Copper conductor, flexible	**PROTOMONT SCREENED** 5DL2
 1. Silicone rubber insulation 2. Copper conductors, flexible	**SINOTHERM 180°C** 5DR3 5DR4 5DR5

Rated voltage	Application and design	Page
0.6/1kV	Extra heavy duty flexible cable for mining, construction, industry and harsh environments. Designs suitable for submersion in aggressive liquids. Suitable for hazardous locations	80
0.6/1kV	Heavy duty overall screened EPR/PCP flexible in 4 and 5 core constructions. Submersible pumps, mining where earth screen protection in required. Suitable for hazardous locations	88
380/660V 0.6/1kV	High temperature silicone cables up to 180°C. Suitable for motor rewinds, heating appliances, steelwork, floodlights etc. Available with glass braid and in flexible multicore constructions.	95

APPLICATION SELECTION GUIDE

Construction	Designation
 1. Heat resistant, cross-linked elasto meric special compound 2. Copper conductors, flexible	**SINOTHERM 110°C** 5DR7
 1. EVA Elastomer insulation 2. Copper conductors, flexible	**EVA 125 FLEX** 5DR7
 1. EVA Elastomer insulation 2. Multi stranded tinned copper 4. Cross-linked polyolefine	**TECSUN (PV)** 5DH9 **TECSUN TWIN (PV)** 5DH

Rated voltage	Application and design	Page
0.6/1kV	These cables are intended for use as fixed wiring, or wiring where limited flexing in operation is encountered.	104
0.6/1kV	High temperature EVA flexible cables for 125°C application. Increased mechanical strength with low smoke, and a non toxic gas emission and halogen free sheath in the event of fire. For switchboard wiring and coils.	110
0.9/1.8kV DC	Tecsun (PV) 120 C (degrees) solar cables are designed for use in photovoltaic power supply systems.	114

APPLICATION SELECTION GUIDE

Construction	Designation
 1. PVC sheath 2. Copper conductors, flexible	**PROTOFLEX** 5DE7 **PROTOFLEX** **SCREENED** 5DE7
 1. UV-stabilised PVC orange transparent outer sheath. 2. Tinned copper braid screen. 3. Cross linked poly ethylene (XLPE) insulation.	**PROTOFLEX** **EMV-FC** **UV stabilized** **90° rating** 5DE6
 1. Clear PVC outersheath. 2. Tinned copper braided screen	**PROTOFLEX** **EMC** 5EMC **PROTOFLEX** **EMC-FC** 5EMV

Rated voltage	Application and design	Page
300/500V	Light duty flexible PVC control cable for machine tools, process automation and control devices.	120
	Flexible overall screened PVC control cable for EMI and RFI interference suppression in industrial electronics, switchboards, PLC connections, etc.	130
0.6/1 kV	Flexible tinned copper braid screened XLPE power cable for variable speed drive to motor connections.	132
0.6/1 kV	Very flexible screened cable for variable speed drive to motor connections. UV-stabilised	136

APPLICATION SELECTION GUIDE

Construction	Designation
 1. Highest protection IP68 & 15 bar. 2. One gland body for several cable O.D's. 3. Highest strain relief.	**EMC cable glands**
 1. Highest protection IP68 up to 15 bar. 2. One gland for several cable O.D's. 3. Highest strain relief.	***blue*globe® cable glands**
 1. PCP elastomer sheath 2. Anti torsion textile braid 3. Elastomer inner sheath 4. Protolon EPR insulation 5. Copper conductors, highly flexible	**CORDAFLEX (SMK)** 5DH3

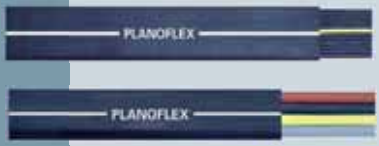
Rated voltage	Application and design	Page
	EMC metric glands are IP68, brass, galv nickel plated. Designed for EMC environments, ensuring positive contact with the cable.	138
	Blueglobe cable glands are available in brass, plastic and stainless steel. Widest sealing range in one gland body. Highest strain relief and IP68 up tp 15 bar.	142
0.6/1kV	Crane, reeling and festoons cable designed to withstand tensile and torsional stresses. Suitable for all types of mobile equipment e.g., stackers, reclaimers, hoists, cranes, ship loaders, trippers etc. Screened data cores for PLC and communications are standard. Integrated fibre optics available. Suitable for hazardous locations	147

APPLICATION SELECTION GUIDE

Construction	Designation
 1. PCP elastomer sheath 2. Protolon insulation 3. Tinned finely stranded conductors 4. Braid screen available	**RONDOFLEX** 5DG6
 1. PCP elastomer sheath 2. Protolon insulation 3. Tinned finely stranded conductors 4. Overall braid screen shield	**RONDOFLEX** **(C)-FC** 5DG6

Rated voltage	Application and design	Page
0.6/1kV	Flexible power and control cable, for use on festoon systems and for connecting moving parts of machine tools, material handling equipment, etc, associated with high mechanical stresses and frequent bending operation. Suitable for simple reeling.	160
0.6/1kV	Shielded EMC festoon power cable used for applications where there is a danger of interference to data transmission systems from power cables. This cable is suitable for festoon systems.	166

APPLICATION SELECTION GUIDE

Construction	Designation
 1. PCP elastomer sheath 2. Protolon EPR insulation 3. Tinned copper conductors, extremely flexible 4. Individual copper braid screens	**RONDOFLEX (CHAIN)** 5DG4
 1. PCP elastomer sheath 2. PROTOLON EPR insulation 3. Copper conductors, extremely flexible 4. Individual copper braid screens	**PLANOFLEX** 5DG5

Rated voltage	Application and design	Page
0.6/1kV	Specially designed for outdoor applications with long travel distances at high speeds. Including drag cabin systems on container stacking cranes. Key benefits are reliability, abrasion resistance and long life time.	172
380/660V 0.6/1kV	Flat form elastomer cable for gantry and festoon installations in mining, marine and sub zero environments. Screened cores, pairs and integrated fibre optics available for data transmission.	184

APPLICATION SELECTION GUIDE

Construction	Designation
 1. Orange PCP outer sheath. 2. Kevlar braided coverage of core assembly. 3. 50/125; 62.5/125 micron graded index and E9 mono mode fibres.	**OPTOFLEX (M)** 5DG8
 1. Black PCP outer sheath. 2 Kevlar braided coverage of core assembly. 3. 50/125; 62.5/125 micron graded index and E9 mono mode fibres.	**OPTOFLEX (F.O)** 5DG8
 1. Polyurethane sheath 2. Lead beaded core elements 3. Kevlar rope strength support 4. PROTODUR PVC insulation 5. Copper conductors, highly flexible	**SPREADERFLEX** 5DE5

Rated voltage	Application and design	Page
	Optical signal and data transmission cable for fixed installations for material handling and mining equipment and in open pits on conveyors.	196
	Flexible fibre optic cable suitable for cable handling systems, cable tenders on cranes and material handling systems. Key benefits are high data rates, large bandwith and absolute immunity to EMI.	200
300/500V	Dedicated flexible cable for free fall coiling in spreader crane applications. Kevlar reinforced with lead bead weights to improve performance in high speed, high wind environments.	204

APPLICATION SELECTION GUIDE

Construction	Designation
 1. PVC sheath 2. PROTODUR PVC insulation 3. Copper conductors, flexible 4. Central support element	**PENDANTFLEX** 5DE5
 1. PCP heavy duty sheath 2. Elastomer inner sheath 3. Individual copper core screens 4. PROTOLON EPR insulation 5. Copper conductors, flexible	**PROTOMONT XHD** 5DL/5DM
 1. CPE Sheath 2. Exceptional flexibility 3. Robust construction 4. EPR insulation 5. Copper conductors, highly flexible	**PROTOMONT 241.1**

Rated voltage	Application and design	Page
300/500V	Lift control and pendant cable with central support element. Extremely flexible and lightweight for elevators, hoists, cranes and for increased suspension distances.	208
0.6/1kV	Extra heavy duty mining cable with screened power cores and separate control cores. Abrasion and tear resistant, suitable for all above ground mining installations and industry eg., drills, pumps, conveyors and 400 Hz installations.	213
1.1/1.1kV	Extra heavy duty semi conductive screened cable for mining applications including supply cable for underground cutting machines and pumping.	222

APPLICATION SELECTION GUIDE

Construction	Designation
 1. CPE sheath 2. Overall copper braid screen 3. Elastomer inner sheath 4. Polyethylene insulation 5. Copper conductors, flexible, screened pairs	**MINING MSR** 5DM4
 1. Protofirm PCP sheath 2. Elastomer inner sheath 3. Protolon EPR insulation 4. Semiconductive core screens 5. Copper conductors, flexible	**PROTOLON (N)** 5DK8
 1. Protofirm PCP HD 2. Anti torsion textile braid 3. Elastomer inner sheath 4. Protolon EPR insulation 5. Semiconductive core screens 6. Copper conductors, highly flexible	**PROTOLON (SMK)** 5DK8

Rated voltage	Application and design	Page
250/250V	Twisted pair screened elastomer cable for mining installations. Heavy duty and flexible, resistant to UV with excellent transmission characteristics for PLC's, instrumentation and control signals.	228
3.3/3.3kV to 33/33kV	High voltage flexible reeling cable specifically designed to withstand torsional and tensile forces of medium duty reeling. Suitable for all mobile equipment in mining, marine and materials handling facilities.	234
3.3/3.3kV to 33/33kV	High voltage, heavy duty reeling cable specifically designed for extreme dynamic applications eg., high mount reelers, high speed cranes, multiple deflection guidance systems.	234

APPLICATION SELECTION GUIDE

Construction	Designation
	**PROTOLON (SM-R) FO FIBRE OPTICS** 5DK8
 1. Protofirm PCP heavy duty sheath 2. Anti torsion textile braid 3. Elastomer inner sheath 4. Protolon EPR insulation 5. Semiconductive core screens 6. Copper conductors, highly flexible	**PROTOLON (SB)** 5DK8
 1. Protofirm PCP sheath 2. Elastomer inner sheath 3. Protolon EPR insulation 4. Semiconductive core screens 5. Copper conductors, flexible	**PROTOLON (Single core)** 5DK8

Rated voltage	Application and design	Page
3.3/3.3kV to 33/33kV	High voltage reeling cable with integrated fibre optics for transmission of voice, video and data signals thereby eliminating the need for a separate control reeler.	234
3.3/3.3kV to 33/33kV	Designed as a power supply or connection cable for large material handling machines in open cut mines where they are subject to extremely high mechanical stresses due to abrasion and trailing. Also available with screened power cores.	236
3.3/3.3kV to 22/22kV	Designed for voltages up to 22kV for power supply interconnections, transformer drop cable, mobile sustations, over head service line connections and H.V switchboards.	242

FLEXIBLE CABLE DESIGN AND ELECTRICAL CRITERIA

The design and proper selection of a cable should take into account environmental conditions, electrical, thermal and mechanical stresses that can be expected as these all have a bearing on its operating life. All Siemens flexible cables are designed to suit their application perfectly, thereby ensuring a long trouble free service life even under the harshest conditions.

CONDUCTORS

Siemens flexible cables utilise high conductivity copper in accordance with the Australian Standard AS 1125 either finely or extra finely stranded, depending on its intended application, and these are bunched or rope laid to provide a flexible conductor assembly with increased mechanical strength. All values for strandings are given as approximate due to final conductance values of the copper used in production. The Australian Standard AS1125 now nominates for flexible cables a maximum DC resistance value for a given conductor cross section. In this way the cross- sectional area of the conductor is stated not as the geometrical, but as the electrically effective cross-sectional area determined by the resistance measurement. Thereby, all cables will have equivalent electrical characteristics irrespective of the manufacturer or the origin of the base copper used.

INSULATION

Insulation materials covered within this catalogue are of basically two types. Thermoplastic polyvinyl chloride (PVC) and cross linked compounded elastomers such as Ethylene Propylene Rubber (EPR), Ethyl Vinyl Acetate (EVA) and Silicone rubber. The Silicone and EVA compounds permit higher operating temperatures, and accordingly higher current capacities, whilst EPR exhibits excellent dielectric properties, low temperature flexibility and resistance to ozone, ionization and weather. To attain resistance against elevated water temperatures Cross Linked Polyethylene (XLPE) is used in single core and flat form HYDROFIRM and Protoflex EMV-FC.

SHEATH MATERIALS

Likewise sheath materials are either thermoplastic or elastomeric compounds such as Chlorosulphonated Polyethylene (CSP), Polychloroprene (PCP), Chlorinated Polyethylene (CPE), Silicone (SR), Ethylene Propylene Rubber (EPR), or Polyurethane (PU). CSP is often known by the DuPont trade name Hypalon and PCP as Neoprene.

Each particular sheath material is selected or specially compounded for its specific characteristics. eg. EPR (HYDROFIRM) compounded with additives to achieve total water resistance. PCP (CORDFLEX) for a high mechanical strength and abrasion resistance. Although the base polymer name is used eg. CSP, up to 14 additives may be compounded to achieve the desired characteristics based on years of research, field service and customer's requirements.

INSULATION AND SHEATH THICKNESSES

All Siemens elastomer (synthetic rubber) cables meet or exceed the values laid down in AS/NZS 5000-1 and AS 3191 (flexible cords).

Voltage ratings based on the insulation electrical, thermal and mechanical characteristics for each cable are given.

AMBIENT AND CONDUCTOR OPERATING TEMPERATURE

Ambient temperature is that surrounding the cable. All values stated in this catalogue are based on an ambient of 40°C which is generally considered the norm for Australian conditions when averaged annually. Surface temperature is the maximum permissible temperature onto which the cable can be laid upon without damage to the sheath. Conductor temperature is the temperature the conductor will maintain when loaded fully in accordance with its rated current carrying capacity. The maximum permissible conductor temperature is also the temperature rating of the insulation which it can withstand indefinitely without effect on its properties. The difference between the ambient temperature and the maximum conductor temperature is the window of thermal heat rise generated when current is passed. Basically the heat generated by current flow must be equalised by convection and thermal radiation so that an equilibrium is maintained at the maximum insulation temperature. For this reason the derating factors are applicable when higher or lower ambients are present.

HIGH AND LOW TEMPERATURES

Siemens elastomer cables utilise insulation and sheathing compounds which provide excellent performance in extremes in ambient temperatures. In sub zero environments the catalogue lists the absolute minimum that the cable can withstand and additionally the minimum for fully flexible operation in its intended application.

Elastomer insulated conductors operate continuously at 90.5°C with an emergency overload up to 130°C and short circuit temperature withstand of up to 250.5°C. Experience has shown that flexible reeling cables with tinned conductors should be limited to a short circuit temperature of 200.5°C. Exposure to higher temperatures than the cables are rated will lead to degredation over a period of time of the compounds based on the rate of exposure and intensity. Fig. 1 shows the service life characteristic for EPR insulation. The temperature index criteria was 113.5°C, ie., the compound will remain serviceable for 20,000hrs at 113.5°C in accordance with IEC 216. This table is purely indicative as many variables can effect the result.

GRAPH RANGE/TEMPERATURE

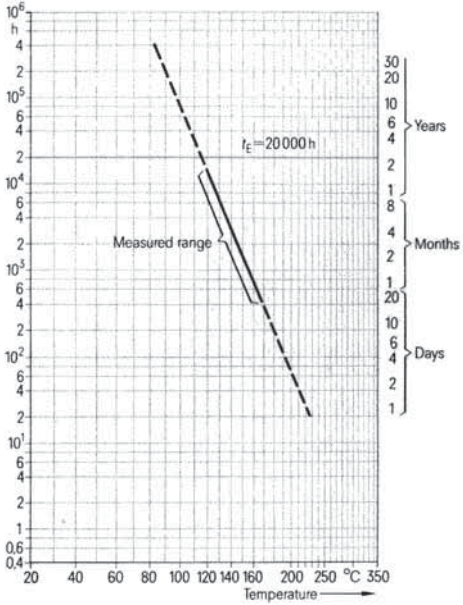


Fig. 1
Service life of EPR insulation compounds

VOLTAGE RATINGS

Voltage values are usually expressed in the form Uo/U and Um. Uo is the rms power frequency voltage between phase and earth. U is the rms power frequency voltage between phases. Um is the maximum continuous rms power frequency voltage between any two phases and excludes fault conditions or sudden disconnection of large loads.

CURRENT CARRYING CAPACITY

Current ratings are dependant on the method of installation, the insulation material affecting the maximum conductor temperature, internal thermal resistance and external ambient conditions. Unless otherwise indicated the ratings stated within are for cables touching a surface and unenclosed, based on a 50Hz system either single phase or balanced three phase. For all intents and purposes current ratings for DC are equivalent to AC values.

VOLTAGE DROP

Volt drop is dependant on the impedance of the conductor, the load current, power factor and route length. In accordance with AS/NZS 3008.1.1:1998 the milli-volts per ampere meter (mV/A.m) are listed on Page 213 / 214, Table 41/42 together with the formula to satisfy the voltage drop limitations. AS 3000 generally limits the allowable voltage drop to 5% of the system Voltage, however some mining installations may nominate a lower value. It is important where practicable in the case of single core cables they are run in trefoil arrangement to minimise impedance.

SHORT CIRCUIT

Symetrical short circuit calculations are given on page 206 / 207, table 6.2 and are based on the maximum operating temperature of the insulation and the maximum final safe short circuit temperature of the insulated conductor.

AUSTRALIAN STANDARDS

The following Australian Standards relate to cables, their design and application.

AS 1125 Conductors in Flexible Cables and Cords
AS 3191 Electric Flexible Cords 250V, 440V and 0.6/1kV
AS/NZ 3008.1.1:2009 Cable Selection 0.6/1kV
AS 1802 Cables for Underground Mining (Reeling)
AS 5000 Electric cables – polymeric insulation 0.6/1 (1-2kV)
AS 2802 Cables for Above Ground (open cut) Mining

AS 1660 Test Methods for Cables
AS 1429 Electric cables – polymeric insulation working voltages 3.3/33kV

Generally all Australian Standards are aligned with the relevant IEC Standards to enable them to conform internationally.

IEC 227 Flexible PVC Cables and Cords
IEC 245 Flexible Elastomer Cables and Cords
VDE 0250 Cables, Wires and Flexible Cords for Power Installations
VDE 0282 Elastomer Cables and Flexible Cords for Power Installations

CABLE REPAIR

In the event of damage to either the insulation or sheath or where two cables must be spliced together, the use of commercially available repair materials are suitable for use with Siemens flexible cable compounds. Various methods and types are available from cast kits which offer a simple, effective, however non-flexible joint to electrical repair and self-fusing tapes which when applied build up the insulation and sheath to their specified dimensions and provide a flexible, weatherproof repair equal to the original cable. It is most important that the repair tapes and kit compounds match those of the cables and this should be confirmed with the supplier prior to use. R-EP-90 (EPR) tape must be used on all Siemens elastomer insulated cables and HD-85-PCP and HD-90-CSP tapes should be used on their appropriate sheath types. Other repair materials from Calico and polyester tapes, semi conductive screen tape, silicone, vinyl/mastic and glass cloth tapes to tinned copper wire braid screen tapes are available from various manufacturers and include all instructions on preparation and installation.

QUALITY ASSURANCE

We, at Siemens, have a deep commitment to quality assurance at all levels of our organisation. In fact, this catalogue represents one step in the quality effort by presenting complete product and applications information in such a way that leads to optimum product selection to satisfy the customer's needs.Our internal quality assurance programme includes quality audits, the maintenance of a quality assurance manual and many other procedures designed to optimise quality.

SECTION 1



GENERAL FLEXIBLE ELASTOMER CABLES

SINGLE CORE FLEX	5DF2	PAGE 34
OZOFLEX	5DH2	PAGE 40
OZOFLEX (PLUS)	5DH1	PAGE 52
OZOFLEX (PLUS) SCREENED (FC+)	5DH5	PAGE 60
HYDROFIRM (T)	5DH1	PAGE 66
HYDROFIRM (T) SCREENED	5DH5	PAGE 76
PROTOMONT HD	5DL1	PAGE 80
PROTOMONT SCREENED	5DL2	PAGE 88

SINGLE CORE – SDI 110⁰ FLEX

Highly flexible, single core rubber cables



APPLICATION

- Internal switchboard cabling
- Sub-mains
- Electrical traction vehicles
- Battery bank connections
- Machine & equipment cabling
- Steelworks, cranes & hoists
- Stacker & reclaimer cabling
- DC wiring
- Submersible to 100 metres then depending on application to IEC 60332-1-2
- For fixed installation infoor and outdoor
- Installed in electrical conduit, on surface and flush-mounted, in closed electical installation ducts and in equipment.
- In switchgear and distribution boards up to 1000 V.

Special-purpose rubber insulated single-core cabled with a rated voltage of at least U_0/U 1,8/3.3kV may be used here. Because of their increased mechanical strength due to the greater insulation thickness as compared with LV single-core cables, they are classified as short-circuit-proof and earth-fault-proof. The short-circuit withstand capability, on the other hand, must be assured by specifying a conductor cross-section suitable for the short-circuit currents concerned. Please see under "Short-Circuit" for the permissible short-circuit currents.

DESIGN

Single core flex cables consist of extra finely stranded tinned copper conductors laid up to provide an extremely flexible design. The Protolon R-E-110 elastomer insulation is rated at 3.3kV with an oil resistant, flame retardant PCP sheath completing the construction.

Designed in accordance with AS1429, AS/NZS 3008.1.1:2009, and VDE0250 part 602. for NSGAFoeu.

Permissable thermal short-circuit currents for 1 s duration (conductor temperature at start of short-circuit: 110°C):

[mm²]	4	6	10	16	25	35	50	70	95	120	150	185	240
[kA]	0.488	0.732	1.22	1.95	3.05	4.27	6.10	8.54	11.6	14.6	18.3	22.6	29.3

The thermal as well as the dynamic short-circuit strength must be taken into account. The cables must in particular be firmly fixed to protect them from the effects of peak short-circuit currents.

Special-purpose rubber insulated single-core cables have a sheath over the insulation to serve as mechanical protection while cable laying is in progress, but are without electrical touch protection. Care should therefore be taken to ensure that cables generally cannot be touched during operation.

SINGLE CORE – SDI 110⁰ FLEX

OPERATING TEMPERATURE

- Minimum permissible ambient temperature -40°C
- Maximum permissible conductor temperature 110°C
- Maximum permissible short circuit temperature 250°C
- Minimum ambient temperature for optimum fully flexible operation -25°C

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

For fixed installation 6 x cable diameter

When freely flexing 8 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz at 40°C ambient temperature.

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2.

This ensures no conductor damage will occur in operation.

VOLTAGE RATING

■ Rated voltage:	*Uo/U*	= 0.6/1kV to 3.3kV AC
■ Maximum operating voltages in:		
3 phase AC operation	*Uo/U*	= 2.1/3.6kV
DC operation	*Uo/U*	= 2.7/5.4kV
■ AC test voltage		= 6kV (5min)
■ Also used on		0.6/1kV Systems

CORE COLOUR IDENTIFICATION

The core insulation is white.

SINGLE CORE – SDI 110⁰ FLEX

Selection and ordering data

No. of cores x conductor size	Part No.	Nominal diameter of bare
mm²		mm
1 x 1.5	5DF2 043	1.5
1 x 2.5	5DF2 053	1.9
1 x 4	5DF2 063	2.5
1 x 6	5DF2 073	3.2
1 x 10	5DF2 103	4.1
1 x 16	5DF2 123	6.5
1 x 25	5DF2 133	6.8
1 x 35	5DF2 143	8.1
1 x 50	5DF2 153	9.6
1 x 70	5DF2 163	11.2
1 x 95	5DF2 173	13.2
1 x 120	5DF2 183	14.9
1 x 150	5DF2 203	16.6
1 x 185	5DF2 213	18.0
1 x 240	5DF2 223	21.2
1 x 300	5DF2 233	23.6
1 x 400	5DF2 243	26.5
1 x 500	5DF2 244	30.1
1 x 630	5DF2 254	34.3

SINGLE CORE – SDI 110⁰ FLEX

Current ratings are based on AS/NZS 3008.1.1:2009.

Normal overall cable conductor diameter	Net cable weight	Unenclosed Spaced 
mm	kg/km	A
5.8	47	31
6.3	59	42
6.8	77	55
7.3	97	70
8.8	153	99
10.2	214	130
12.2	324	173
13.3	421	214
14.7	564	270
16.6	758	340
18.9	995	410
21.0	1253	487
23.0	1540	562
25.0	1862	644
28.3	2428	775
31.3	3006	995
35.3	3898	1079
39.5	5016	1260
43.7	6450	1498

Heavy duty EPR/CSP rubber flexible cables

Marking <VDE><HAR>OZOFLEX H07RN-F 4G35



APPLICATION

The cables are suitable for:

- Heavy duty construction site leads for drills, pumps, saws, kangos
- Cranes, hoists & festoon systems
- Stage & theatre power & lighting
- Portable motors, generators & power supplies
- Submersible to 100 metres plus
- Suitable for hazardous locations
- Use in dry, humid or moist rooms and outdoors: transportable motors or machines on building sites or in agricultural workings, etc.:
- medium mechanical stresses, e.g. for industrial and agricultural workshop appliances, large boiling installations, heating plates, inspection lamps, electric tools such as drills, circular saws, domestic electric tools:
- Use in workshops having an explosive atmosphere.
- When a cable is to be used in the presence of explosive or flammable atmospheres, guidance should be sought by reference to specifications and guidance should be sought in selecting suitable cables.
- Fixed installations e.g. on rough-cast in temporary buildings and huts for accommodation purposes:
- Wiring of constructional components in lifting appliances, machinery, etc.

DESIGN

OZOFLEX is designed as a heavy duty flexible for dry, damp and wet environments, areas of stress caused by vibration or impact and is resistant to abrasion, exposure to radiated heat and chemical contamination.

OZOFLEX cables consist of finely stranded copper conductors laid up to provide a flexible design. Vulcanized rubber compound, basis EPR compound, insulation (E14) provides improved current capacities.

Cables above 16mm^2 and all control cables have an elastomer inner sheath. The CSP elastomer sheath (Hypalon) is oil resistant and flame retardant in accordance with VDE 0472, IEC 6032-1.

Designed in accordance with the Australian Standards AS 1125, AS 3191, AS/NZS 5000-1 & AS/NZS 3008.1.1:2009.

OPERATING TEMPERATURE

- Minimum permissible ambient temperature – when stationary -40°C
- Maximum permissible short circuit temperature 250°C (max 5sec)
- Minimum ambient temperature for optimum fully flexible operation – when in motion -25°C

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz at 40°C ambient temperature.

AS PER AS/NZS 3008.1.1:2009 – 3.5.2.8

Where layers of flexible cables are wound on a cylindrical-type drum or reel, the current-carrying capacity of the cable shall be derated by the appropriate factor, as follows:

Number of layers:	**1**	**2**	**3**	**4**
Derating factor:	**0.85**	**0.65**	**0.45**	**0.32**

VOLTAGE RATING

■ Rated voltage:	*Uo/U*	= 0.6/1kV
■ Maximum operating voltages in:		
3 phase AC operation	*Uo/U*	= 0.7/1.15kV
DC operation	*Uo/U*	= 0.9/1.73kV
■ AC test voltage		= 2.5kV for 15min

*****The cable is designated with EI4 insulation compound in accordance with VDE/IEC and is in accordance with Australian Standard AS/NZS 5000-1 for the voltage rating of 0.6/1kV.

OZOFLEX – Flexible cables with cross linked elastomeric insulation

CORE COLOUR IDENTIFICATION

Single Core	black
3 Core	blue, brown, **green/yellow**
4 Core	brown, black, grey, **green/yellow**
5 Core	blue, brown, black, grey, **green/yellow**
Multi core	black insulation white cores sequentially numbered including a **green/yellow** earth core.
Australian core colours	red, white, blue, black, **green/yellow**

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
	mm^2		mm
OZOFLEX with black insulation and sheath	**1 x 1.5**	**5DH2 104-5**	30x0.25
	1 x 2.5	**5DH2 105-5**	50x0.25
	1 x 4	**5DH2 106-5**	56x0.30
	1 x 6	**5DH2 107-5**	84x0.30
	1 x 10	**5DH2 110-5**	80 x 0.40
	1 x 16	**5DH2 112-5**	126 x 0.40
	1 x 25	**5DH2 113-5**	196 x 0.40
	1 x 35	**5DH2 114-5**	276 x 0.40
	1 x 50	**5DH2 115-5**	396 x 0.40
	1 x 70	**5DH2 116-5**	546 x 0.40
	1 x 95	**5DH2 117-5**	724 x 0.40
	1 x 120	**5DH2 118-5**	926 x 0.40
	1 x 150	**5DH2 120-5**	1156 x 0.40
	1 x 185	**5DH2 121-5**	1406 x 0.40
	1 x 240	**5DH2 122-5**	1862 x 0.40
	1 x 300	**5DH2 123-5**	1456 x 0.50

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2.
This ensures no conductor damage will occur in operation.

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of bare conductor	Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
1.6	6.2	49	20
2.1	6.8	64	27
2.6	7.7	89	36
3.2	8.4	114	46
4.2	10.0	180	64
5.3	11.2	253	85
6.6	13.1	354	114
70.8	14.5	465	141
9.3	16.7	642	178
10.9	18.9	864	225
12.6	21.4	1117	271
14.2	23.7	1399	322
15.9	26.1	1729	372
17.5	27.5	2095	427
20.2	31.8	2624	514
22.3	35.9	3315	591

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
	mm²		mm
without a green/yellow earth	2 x 1	5DH2 203-5	32 x 0.20
	2 x 1.5	5DH2 204-5	30 x 0.25
	2 x 2.5	5DH2 205-5	50 x 0.25
	2 x 4	5DH2 206-5	56 x 0.30
	2 x 6	5DH2 207-5	84 x 0.30
	3 x 0.75	5DH2 995-6	24 x 0.20
	3 x 1.0	5DH2 997-6	32 x 0.20
	3 x 1.5	5DH2 855-4	30 x 0.25
OZOFLEX including a green/yellow earth core	3G1	5DH2 303-5	32 x 0.22
	3G1.5	5DH2 304-5	30 x 0.25
	3G2.5	5DH2 305-5	50 x 0.25
	3G4	5DH2 306-5	56 x 0.30
	3G6	5DH2 307-5	84 x 0.30
	3G10	5DH2 310-5	80 x 0.40
	3G16	5DH2 312-5	126 x 0.40
	4G1	5DH2 403-5	32 x 0.20
	4G1.5	5DH2 404-5	30 x 0.25
	4G2.5	5DH2 405-5	50 x 0.25
	4G4	5DH2 406-5	56 x 0.30
	4G6	5DH2 901-5	84 x 0.30
	4G10	5DH2 410-5	80 x 0.40
	4G16	5DH2 412-5	126 x 0.40
	4G25	5DH2 413-5	196 x 0.40
	4G35	5DH2 414-5	276 x 0.40

OZOFLEX – Flexible cables with cross linked elastomeric insulation

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of bare conductor	Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
1.3	8.1	83	18
1.6	9.1	106	23
2.1	10.4	152	30
2.6	12.0	213	40
3.2	13.7	278	51
1.2	7.7	95	13
1.3	9.3	101	15
1.6	10.2	135	19
1.3	8.8	102	15
1.6	9.5	131	19
2.1	11.2	189	26
2.6	12.9	264	34
3.2	14.1	344	43
4.2	19.7	644	61
5.3	24.5	903	81
1.3	9.3	125	15
1.6	10.5	159	19
2.1	12.2	231	26
2.6	14.1	329	34
3.2	15.7	440	43
4.2	21.4	799	61
5.3	23.9	1096	81
6.6	29.3	1627	108
7.8	32.5	2108	135

OZOFLEX – Flexible cables with cross linked elastomeric insulation

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
	mm²		mm
OZOFLEX including a green/yellow earth core	4G50	5DH2 415-5	396 x 0.40
	4G70	5DH2 416-5	546 x 0.40
	4G95	5DH2 417-5	724 x 0.40
	4G120	5DH2 418-5	926 x 0.40
	5G1	5DH2 503-5	32 x .0.20
	5G1.5	5DH2 504-5	30 x 0.25
	5G2.5	5DH2 505-5	50 x 0.25
Aust. Core Colours R,W,B,B, green/yellow earth core	5G2.5 – Australian	5DH2 958-6	50 x 0.25
	5G4 – Australian	5DH2 961-6	56 x 0.30
	5G6 – Australian	5DH2 907-6	84 x 0.30
	5G10	5DH2 510-5	80 x 0.40
	5G10 – Australian	5DH2 941-6	80 x 0.40
	5G16	5DH2 939	126 x 0.40
	5G25	5DH2 513-5	196 x 0.40
	5G25 – Australian	5DH2 942-6	196 x 0.40
	5G35 – Australian	5DH2 514-5	276 x 0.40
	5G50	5DH2 515-5	396 x 0.40
	5G70	5DH2 516-5	546 x 0.40
	5G95	5DH2 517-5	274 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal Diameter of bare conductor	Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
9.3	38.5	2908	170
10.9	43.4	3856	214
12.6	49.1	5062	256
14.2	54.5	6262	303
1.3	10.3	157	15
1.6	11.6	194	19
2.1	13.6	280	26
2.1	13.6	280	26
2.6	15.6	407	34
3.2	17.5	542	43
4.2	23.7	972	61
4.2	23.7	972	61
5.3	26.9	1352	81
6.6	32.5	1999	108
6.6	32.5	1999	108
7.8	36.4	2554	135
9.3	42.2	3515	170
10.9	48.4	4831	214
12.6	54.8	6262	256

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
	mm^2		mm
OZOFLEX (Control) including a green/yellow earth core	3G1.5	5DH2 844-5	30 x 0.25
	7G1.5	5DH2 580-5	30 x 0.25
	8G1.5	5DH2 940-5	30 x 0.25
	10G2.5	5DH2 592-5	50 x 0.25
	12G1.5	5DH2 583-5	30 x 0.25
	18G1.5	5DH2 258-5	30 x 0.25
	24G1.5	5DH2 943-5	30 x 0.25
	7G2.5	5DH2 590-5	50 x 0.25
	8G2.5	5DH2 591-5	50 x 0.25
	12G2.5	5DH2 593-5	50 x 0.25
	18G2.5	5DH2 595-5	50 x 0.25
	24G2.5	5DH2 596-5	50 x 0.25

OZOFLEX – Flexible cables with cross linked elastomeric insulation

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal Diameter of bare conductor	Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
1.9	10	165	19
1.6	14.7	323	19
1.6	18.5	450	19
2.1	20.7	647	19
1.6	18.2	482	19
1.6	21.0	689	19
1.6	24.5	919	19
2.1	17.2	456	26
2.1	18.3	519	26
2.1	21.1	692	26
2.1	24.7	993	26
2.1	28.7	1331	26

Flexible cables for submersion in polluted liquids



APPLICATION

OZOFLEX(PLUS) rubber-sheathed cables are intended for connection of electrical equipment in contaminated water and for medium mechanical stresses. Owing to the various (and frequently changing) substances of which the contaminated water is made up, the cables may be used only in easily accessible areas that can be inspected (installation depth of approximately 10 m, as customarily encountered in sewage water tanks).

These cables are also suitable for use in process water, cooling water, mine surface water, rainwater and combined waste water. They also can be used in groundwater and seawater; it is possible to impose less stringent specifications in terms of accessibility and inspection. In such cases the cables can be used at depths up to 500 m.

If the water concerned is aggressive or composed of special substances, the cable's resistance properties should be examined. These cables can be used indoors, outdoors, in explosion-hazard areas, in fire-hazard locations, on construction sites, in open-cast mining and in quarries, in industry and in agriculture. They can also be permanently installed, e.g. on plaster, on excavators or on hoisting gear.

The permissible AC test voltage in connection with motor tests is 3 kV, the maximum test duration is 3 minutes.

The insulating and sheath materials used allow a maximum temperature at the conductor of 90 °C.

Typical uses include:

- Sewage treatment plants
- Waste water pumps – effluent aerators
- Abattoirs (high temp chemical cleaning)
- Dairy industry
- Mining – de-watering
- Chemical plants & steelworks
- Hygenic cleaning in breweries, food processing plants etc.
- Water depth approx. 10m in waste water, up to 500m in all other types
- Suitable in seawater

DESIGN

OZOFLEX (PLUS) cables consist of finely stranded copper conductors laid up to provide a flexible design. R-EP-90 elastomer insulation provides improved current capacities. Cables above 16mm^2 and all control cables include an additional elastomer inner sheath and all cables up to 6mm^2 have tinned conductors. The specially compounded heavy duty CPE Elastomer sheath (Hypalon) is oil resistant and flame retardant and resists the effects of water absorption.

The construction is in accordance with the Australian Standards AS 1125, AS 3191, AS/NZS 5000-1.

THERMAL CHARACTERISTICS

Maximum permissible operating temperature at conductor	90 °C
Maximum permissible short circuit temperature at conductor	250 °C (max. 5 s)
Maximum permissible water temperature (At higher water temperatures, a shortened cable service life is to be expected)	40 °C
Minimum permissible temperatures	
when in motion	-25 °C
when stationary	-40 °C

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz at 40°C ambient temperature. Touching a surface, two or three cores loaded, multi-core cables all cores loaded.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.15kV
  - DC operation *Uo/U* = 0.9/1.73kV
- AC test voltage (test duration) = 2.5 kV (15 min)

* Meets or exceeds the Australian Standard AS 5000 for the voltage rating of 0.6/1kV, R-EP-90.

CORE COLOUR IDENTIFICATION

Single Core	black
3 Core	blue, brown, **green/yellow**
4 Core	brown, black, grey, **green/yellow**
5 Core	blue, brown, black, grey, **green/yellow**
Multi core	black insulation sequentially numbered including a **green/yellow** earth core.

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2.
This ensures no conductor damage will occur in operation.

OZOFLEX (PLUS)
Flexible cables for submersion in polluted liquids

Selection and ordering data

OZOFLEX H0RN-F 1X ...	No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
	mm^2		mm
OZOFLEX (PLUS) including a green/yellow earth	**3G1**	**5DH1 014**	29 x 0.20
	3G1.5	**5DH1 015**	27 x 0.25
	3G2.5	**5DH1 016**	45 x 0.25
	3G4	**5DH1 017**	50 x 0.30
	3G6	**5DH1 018**	75 x 0.30
	3G10	**5DH1 020**	78 x 0.30

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal Diameter of bare conductor	Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
1.5	9.6	122	14
1.8	10.6	154	19
2.6	12.8	229	26
3.2	14.8	319	35
3.9	16.9	420	45
5.1	22.4	780	62

OZOFLEX (PLUS)
Flexible cables for submersion in polluted liquids

Selection and ordering data

"Brown, black, grey, green/yellow"	No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
	mm^2		mm
OZOFLEX (PLUS) including a green/yellow earth	4G1	5DH1 245	27 x 0.26
	4G1.5	5DH1 021	27 x 0.26
	4G2.5	5DH1 022	45 x 0.26
	4G4	5DH1 023	50 x 0.31
	4G10	5DH1 025	78 x 0.41
	4G16	5DH1 026	124 x 0.41
	4G25	5DH1 027	192 x 0.41
	4G35	5DH1 028	271 x 0.41
	4G50	5DH1 030	388 x 0.41
	4G70	5DH1 031	551 x 0.41
	4G95	5DH1 032	733 x 0.41
	4G120	5DH1 033	938 x 0.41
	7G1.5	5DH1 241	30 x 0.26
OZOFLEX (PLUS) with pilots	4G1.5 + 2 x 1.5	5DH1 069	28 x 0.25
	4G2.5 + 2 x 1.5	5DH1 070	45 x 0.25
	4G4 + 2 x 1.5	5DH1 071	51 x 0.30
	4G6 + 2 x 1.5	5DH1 072	75 x 0.31
	4G10 + 2 x 1.5	5DH1 073	77 x 0.25
	4G10 + 4 x 1.5	5DH1 276	268 x 0.40
	4G16 + 2 x 1.5	5DH1 275	123 x 0.40
	4G25 + 2 x 1.5	5DH1 075	190 x 0.40
	4G35 + 2 x 1.5	5DH1 076	268 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal Diameter of bare conductor	Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
1.8	11.2	192	19
1.8	11.2	192	19
2.6	13.2	279	26
3.2	15.3	388	34
5.1	23.2	940	61
6.3	27.6	1310	81
7.8	31.8	1890	108
9.2	36.1	2460	135
11.0	41.8	3390	170
11.3	45.7	4450	214
13.2	52.0	5830	256
15.0	56.5	7140	303
1.5	15.75	355	19
1.5	15.00	310	19
1.9	17.25	420	26
2.5	20.20	570	35
3.2	22.20	720	45
4.1	28.20	1170	62
8.1	36.70	2460	135
5.6	28.20	1310	83
6.8	33.20	1910	110
8.1	36.70	2460	135

OZOFLEX (PLUS) SCREENED (FC+)

Submersible overall screened cable (emc compliant)

Flexible cables with cross linked elastomeric insulation:



APPLICATION

For making connections to electrical equipment used in a waste-water environment and subject to medium mechanical stress. Especially for frequency converter controlled AC drives and if considerable demands in respect of electromagnetic compatibility (EMC) according to the EMC directive imposes.

For an effective shielding both ends of cable must have a good shield contact to ground. For connection with 1-level frequency converter, rated output voltage max. 690 V.

Owing to the various (and frequently changing) substances of which the contaminated water is made up, the cables may be used only in easily accessible areas that can be inspected (installation depth of approximately 10 m, as customarily encountered in sewage water tanks).

These cables are also suitable for use in process water, cooling water, mine surface water, rainwater and combined waste water. Under certain circumstances they can be suitable for groundwater and seawater; it is possible to impose less stringent specifications in terms of accessibility and inspection. In such cases the cables can be used at depths up to 500 m.

If the water concerned is aggressive or composed of special substances, the cable's resistance properties should be examined.

These cables can be used indoors, outdoors, in explosion-hazard areas, in fire-hazard locations, on construction sites, in open-cut mining and in quarries.

In industry and in agriculture. They can also be permanently installed, e.g. on plaster, on excavators or on hoisting gear. If they are permanently

installed in protective conduits or equipment, or e.g. in well installations or are used as rotor circuit cables for motors.

The permissible AC test voltage in connection with motor tests is 3 kV, the maximum test duration is 3 minutes.

Specifically designed for pumps in waste-water under medium mechanical stress.

Typical uses include:

- Sewage treatment plants
- Waste water pumps, effluent aerators
- For pumps requiring control cores
- Electromagnetic compatibility (EMC)
- Abattoirs (high temp chemical cleaning)
- Dairy industry
- Mining – de-watering
- Chemical plants & steelworks
- Hygenic cleaning in breweries, food processing plants etc.
- Water depth approx. 10m in waste water, as customarily Encounted in sewerage tanks
- Suitable in seawater under certain circumstances
- Suitable for hazardous locations

DESIGN

OZOFLEX (PLUS) SCREENED cables consist of finely stranded copper conductors laid up to provide a flexible design. R-EP-90 elastomer insulation provides improved current capacities. All cables up to 6mm^2 have tinned conductors. Between the elastomer inner and outer sheaths there is an overall tinned copper screen. The specially compounded heavy duty CSP Elastomer sheath (Hypalon) is oil resistant and flame retardant and resists the effects of water absorption.

Designed in accordance with the Australian Standards
AS 1125, AS 3191, AS/NZS 5000-1.

OZOFLEX (PLUS) SCREENED (FC+)

THERMAL CHARACTERISTICS

- Maximum permissible operating temperature at conductor — 90 °C
- Maximum permissible short circuit temperature at conductor — 250 °C (max. 5 s)
- Maximum permissible water temperature (At higher water temperatures, a shortened cable service life is to be expected) — 40 °C
- Minimum permissible temperatures
  - when in motion — -25 °C
  - when stationary — -40 °C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz at 40°C ambient temperature. Touching a surface, two or three cores loaded, multi-core cables all cores loaded.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.15kV
  - DC operation *Uo/U* = 0.9/1.73kV
- AC test voltage = 2.5kV

*****The cable is designated 450/750V with EI1 insulation compound in accordance with VDE/IEC and meets or exceeds the Australian Standard AS 5000 for the voltage rating of 0.6/1kV, R-EP-90.

CORE COLOUR IDENTIFICATION

Single Core	black
3 Core	blue, brown, **green/yellow**
4 Core	brown, black, **green/yellow**, grey
Multi core	black insulation sequentially numbered including a **green/yellow** earth core.

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2.

This ensures no conductor damage will occur in operation.

OZOFLEX (PLUS) SCREENED (FC+)

Selection and ordering data

No. of cores x conductor size	Part No.	Nominal No. of strands x and strand diameter
mm²		mm
3 G 1.5	5DH5 305	30 x 0.25
3 G 2.5	5DH5 306	50 x 0.25
4 G 1.5	5DH5 312	30 x 0.25
4 G 2.5	5DH5 313	50 x 0.25
4 G 4	5DH5 314	56 x 0.30
4 G 6	5DH5 315	84 x 0.30
4 G 10	5DH5 316	80 x 0.40
4 G 16	5DH5 317	126 x 0.40
4 G 25	5DH5 160	196 x 0.40
4 G 35	5DH5 320	276 x 0.40
4 G 50	5DH5 321	396 x 0.40
4 G 70	5DH5 322	546 x 0.40
4 G 95	5DH5 323	724 x 0.40
4 G 120	5DH5 324	926 x 0.40

OZOFLEX (PLUS) screened with pilots

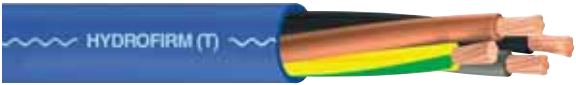
4 G 2.5 + 4 x 1.5	5DH5 146	50 x 0.25
4 G 4 + 4 x 1.5	5DH5 147	56 x 0.30
4 G 6 + 4 x 1.5	5DH5 148	84 x 0.30
4 G 10 + 4 x 1.5	5DH5 149	80 x 0.40
4 G 16 + 4 x 1.5	5DH5 150	126 x 0.40
4 G 25 + 4 x 2.5	5DH5 152	196 x 0.40
4 G 35 + 4 x 2.5	5DH5 151	276 x 0.40
4 G 50 + 4 x 2.5	5DH5 154	396 x 0.40
4 G 70 + 4 x 2.5	5DH5 153	546 x 0.40
4 G 95 + 4 x 2.5	5DH5 155	724 x 0.40
4 G 120 + 4 x 2.5	5DH5 156	926 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal cable overall diameter	Approx. net cable weight	Unenclosed Touching 
mm	kg/km	A
13	230	19
15	300	26
14	266	19
16.8	388	26
18.5	516	34
20.8	630	43
24.8	972	61
29.3	1447	81
34.3	2015	108
37.8	2539	135
43.8	3458	170
48.3	4800	214
55.8	6280	256
59.8	7520	303
21.7	630	26
24.0	905	34
26.0	930	43
26.7	1133	61
28.4	1363	81
34.0	2022	108
36.4	2550	135
42.50	3600	170
48.20	4800	214
52.00	5450	256
61.00	6900	303

HYDROFIRM (T)
Round and Flat Cables for Drinking Water Application

Flexible cables for use underwater and for submersible pumps





APPLICATION

- Submersible pumps in boreholes, mining, irrigation dams, reticulation systems
- Ponds and fountains
- For fresh, salt & lightly polluted water (60°C)
- Underwater and marine installations
- Sub zero installations (-40°C)
- De-watering & drainage systems
- For pumps with thermistors
- Water authorities
- Flexible marina power supplies
- Round version suitable for depths up to 2000mts

For making connections to electrical equipment used in water and subjected to medium mechanical stress. The cables can also be used in drinking water, industrial water, cooling water, surface water, rainwater, ground water and sea water (salt water).

When corrosive water is involved, or water of some other special compositions must be investigated in each individual case. They may not be used in water containing more than 0,5 mg/l of chlorine These cables can be used indoors, outdoors, in industrial and agricultural plant, but not in explosion-hazard areas.

For protected, fixed installation within equipment, pipes or wells, as well as for rotor connections, these cables may be operated with an AC voltage to 1000 V or a DC voltage to 750 V with respect to earth. The permissible AC voltage for motor tests is 3 kV for a maximum duration of 3 minutes.

DESIGN

HYDROFIRM (T) cables consist of finely stranded copper conductors laid up to provide a flexible design. R-EP-90 elastomer insulation enables improved current capacities and a specially compounded EPR sheath inhibits water absorption. A hand stripable bond between insulation and sheath stops any moisture migration along the insulated conductors should the sheath be damaged. HYDROFIRM (T) is suitable for water temperatures up to 60°C and is designed and approved for use in drinking water eg., mineral spring and spa pumps. For particularly aggressive liquids refer to OZOFLEX (PLUS) and PROTOMONT HD. The sheath colour is blue for identification. Designed in accordance with the Australian Standard, AS/NZS 5000-1, AS/NZS 3191 and DIN VDE 0282 pt 810.

OPERATING TEMPERATURE

■ Minimum permissible ambient temperature	-40°C
■ Maximum permissible conductor temperature	90°C
■ Maximum permissible short circuit temperature	250°C (max 5sec)
■ Minimum ambient temperature for optimum fully flexible operation	-25°C

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following factors. For HYDROFIRM (T) the water temperature should be considered as the ambient depending on the % of cable submerged.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz at 40°C ambient temperature. Touching a surface, two or three cores loaded, multi-core cables all cores loaded.

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2. This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  DC operation *Uo/U* = 0.9/1.73kV
- AC test voltage = 3kV

*The cable is designated 450/750V in accordance with VDE/IEC designed in accordance with Australian Standard AS/NZS 5000-1 for the voltage rating 0.6/1kV

CORE COLOUR IDENTIFICATION

Single core	–	black
3 core	–	blue, brown and **green/yellow**
4 core	–	brown, black, grey and **green/yellow**
5 core	–	brown, black, grey, blue, **green/yellow**
Multi core	–	black insulation, sequentially numbered, including a **green/yellow** earth core

THERMAL CHARACTERISTICS

Maximum permissible water temperature. (At higher water temperatures, a shortened cable service life is to be expected)	60 °C

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal. No. of strands and strand diameter
	mm²		mm
HYDROFIRM (T) with black core insulation	1 x 1.5	5DH1 302	30 x 0.25
	1 x 2.5	5DH1 602	50 x 0.25
	1 x 4	5DH1 603	56 x 0.30
	1 x 6	5DH1 305	84 x 0.30
	1 x 10	5DH1 306	80 x 0.40
	1 x 16	5DH1 307	126 x 0.40
	1 x 25	5DH1 308	196 x 0.40
	1 x 35	5DH1 310	276 x 0.40
	1 x 50	5DH1 311	396 x 0.40
	1 x 70	5DH1 312	546 x 0.40
	1 x 95	5DH1 313	724 x 0.40
	1 x 120	5DH1 314	926 x 0.40
	1 x 150	5DH1 315	1156 x 0.40
	1 x 185	5DH1 316	1406 x 0.40
	1 x 240	5DH1 317	1862 x 0.40
	1 x 300	5DH1 318	1995 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Spaced 
mm	mm	kg/km	A
1.6	6.3	50	25
2.1	6.9	62	33
2.6	7.9	86	45
3.2	8.3	120	57
4.2	10.3	180	80
5.3	12.5	265	106
6.6	14.5	380	142
7.8	16.5	500	177
9.3	18.8	690	223
10.9	21.3	920	283
12.5	23.8	1180	341
14.2	25.3	1470	406
15.9	27.5	1777	470
17.5	29.7	2100	540
20.2	33.0	2708	651
26.3	35.9	3371	752

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal. No. of strands and strand diameter
	mm²		mm
HYDROFIRM (T) including a green/yellow earth core	3G1.5	5DH1 352	30 x 0.25
	3G2.5	5DH1 353	50 x 0.25
	3G4	5DH1 354	56 x 0.30
	3G6	5DH1 644	84 x 0.30
	3G10	5DH1 645	80 x 0.40
	4G1.5	5DH1 362	30 x 0.25
	4G2.5	5DH1 363	50 x 0.25
	4G4	5DH1 364	56 x 0.30
	4G6	5DH1 365	84 x 0.30
	4G10	5DH1 366	80 x 0.40
	4G16	5DH1 367	126 x 0.40
	4G25	5DH1 368	196 x 0.40
	4G35	5DH1 370	276 x 0.40
	4G50	5DH1 371	396 x 0.40
	4G70	5DH1 372	546 x 0.40
	4G95	5DH1 373	724 x 0.40
	4G120	5DH1 374	926 x 0.40
	7 G 1.5	5DH1 402	30 x 0.25
	7 G 2.5	5DH1 412	50 x 0.25
	7 G 4	5DH1 422	56 x 0.30

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Spaced 
mm	mm	kg/km	A
1.6	10.1	140	20
2.1	12.0	200	27
2.6	13.9	285	36
3.2	15.3	370	46
4.2	20.4	655	66
1.6	11.0	175	20
2.1	13.0	250	27
2.6	15.0	355	36
3.2	16.8	475	46
4.2	22.3	825	66
5.3	27.3	1250	87
6.6	32.5	1800	116
7.8	37.0	2360	144
9.3	43.0	3250	182
10.9	48.3	4300	230
12.6	52.6	3250	275
14.2	57.1	4300	327
1.6	15.2	353	20
1.9	17.2	494	27
2.5	20.7	714	36

Selection and ordering data

HYRDOFIRM (T), four-core design, with earth conductor, FLAT

	No. of cores x conductor size	Part No.	Nominal. No. of strands and strand diameter
	mm^2		mm
HYDROFIRM (T) FLAT including a green/yellow earth core	4 G 1.5	5DH1 522	30 x 0.25
	4 G 2.5	5DH1 523	50 x 0.25
	4 G 4	5DH1 524	56 x 0.30
	4 G 6	5DH1 525	84 x 0.30
	4 G 10	5DH1 526	80 x 0.40
	4 G 16	5DH1 527	126 x 0.40
	4 G 25	5DH1 528	196 x 0.40
	4 G 35	5DH1 530	276 x 0.40
	4 G 50	5DH1 531	396 x 0.40
	4 G 70	5DH1 532	546 x 0.40
	4 G 95	5DH1 533	724 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Spaced 
mm	mm	kg/km	A
1.6	6.8 x 17.3	167	20
2.1	7.8 x 20.1	240	27
2.6	8.8 x 24.0	337	36
3.2	10.0 x 27.3	448	46
4.2	13.5 x 34.8	791	66
5.3	15.8 x 42.8	1162	87
6.6	18.8 x 51.3	1698	116
7.8	20.8 x 50.8	2293	144
9.3	23.8 x 68.0	3054	182
10.9	26.5 x 75.3	4200	230
12.6	28.5 x 80.0	5260	275

HYDROFIRM (T) SCREENED

Flexible cables for use underwater and for submersible pumps



APPLICATION

- Submersible pumps in boreholes, mining, irrigation dams, reticulation systems
- Ponds and fountains
- For fresh, salt & lightly polluted water (60°C)
- Underwater and marine installations
- Sub zero installations (-50°C)
- De-watering & drainage systems
- Pumps with thermistors
- Flexible marina power supplies
- Suitable for depths up to 500 mts

DESIGN

HYDROFIRM (T) screened cables consist of finely stranded copper conductors laid up to provide a flexible design. R-EP-90 elastomer insulation enables improved current capacities and a specially compounded EPR sheath inhibits water absorption.

A hand stripable bond between insulation and inner sheath stops any moisture migration along the insulated conductors should the sheath be damaged. Between the inner and outer EPR sheaths there is an overall copper screen. HYDROFIRM (T) is suitable for water temperatures up to 60°C and is designed and approved for use in drinking water eg., mineral spring and spa pumps. For particularly aggressive liquids refer to OZOFLEX (PLUS) and PROTOMONT HD. The sheath colour is blue for identification. Designed in accordance with the Australian Standard AS/NZS 5000-1, AS/NZS 3191 and AS/NZS 3008.1.1:2009.

OPERATING TEMPERATURE

- Minimum permissible ambient temperature -50°C
- Maximum permissible conductor temperature 90°C
- Maximum permissible short circuit temperature 250°C (max 5sec)
- Minimum ambient temperature for optimum fully flexible operation -50°C

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following factors. For HYDROFIRM (T) the water temperature should be considered as the ambient depending on the % of cable submerged.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

TENSILE STRENGTH

The maximum allowable tensile stress is 15 N/mm^2.

This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.2kV
  - DC operation *Uo/U* = 0.9/1.8kV
- AC test voltage = 2kV

HYDROFIRM (T) SCREENED

CORE COLOUR IDENTIFICATION

4 core	–	brown, black, grey and **green/yellow** earth
Pilot core	–	black

Selection and ordering data

Number of cores and conductor size	Part No.	Nominal number and strand diameter	Nominal diameter of bare conductor
mm^2		mm	mm
4G1.5	**5DH5 631**	30 x 0.25	1.6
4G2.5	**5DH5 632**	50 x 0.25	2.1
4G4	**5DH5 633**	56 x 0.30	2.6
4G6	**5DH5 634**	84 x 0.30	3.2
4G10	**5DH5 635**	80 x 0.40	4.2
4G16	**5DH5 636**	126 x 0.40	5.3
4G25	**5DH5 637**	196 x 0.40	6.6
4G35	**5DH5 638**	276 x 0.40	7.8
4G50	**5DH5 640**	396 x 0.40	9.3
4G70	**5DH5 641**	546 x 0.40	10.9
4G95	**5DH5 642**	724 x 0.40	12.2
4G120	**5DH5 643**	926 x 0.40	13.2

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of cable	Approx. net cable weight	Unenclosed Spaced 	Unenclosed Touching 
mm	kg/km	A	A
14.0	260	20	19
16.8	396	27	26
18.8	525	36	34
20.8	665	46	43
24.8	970	66	61
29.3	1400	87	81
34.3	2030	116	108
37.8	2610	144	135
43.8	3610	182	170
48.3	4710	230	214
55.8	6340	275	256
59.8	7470	327	308

PROTOMONT HD

Heavy duty flexible for aggressive environments

HD Rubber Flexible Cables for use in Mining and Industry



APPPLICATION

- Extra heavy duty flexible
- Stackers & reclaimer cabling
- Draglines, shovels & hoists
- Conveyors
- Open cut mine trailing cable
- Heavy industry & construction sites
- Submersion in polluted liquids
- Single core for festoon cranes
- Suitable for hazardous locations

DESIGN

PROTOMONT HD heavy duty elastomer flexible cables are designed for aggressive environments in open cut mining and quarries, industry and construction sites as well as agricultural use where heavy mechanical stresses occur.

PROTOMONT HD cables consist of finely stranded tinned copper conductors laid up to provide a flexible design.

R-EP-90 elastomer insulation enables improved current capacities and a specially compounded XHD-PCP-90 outer sheath resists hard and abrasive surfaces. Designed in accordance with the Australian Standard AS 1125, AS/NZS 5000-1, AS 3191 and DIN VDE 0250 pt 812 for NSSHoeu. Flame retardant to VDE and MSHA.

OPERATING TEMPERATURE

- Minimum permissible ambient temperature -40°C
- Maximum permissible conductor temperature 90°C
- Maximum permissible short circuit temperature 250°C
- Minimum ambient temperature for optimum fully flexible operation -25°C

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on a continuous operating ambient temperature of 40°C. At other temperatures, these values must be converted using the following table

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz. Touching a surface, two or three cores loaded, multi-core cables all cores loaded.

TENSILE STRENGTH

The maximum allowable tensile stress is 15 N/mm^2.

This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.2kV
  - DC operation *Uo/U* = 0.9/1.8kV
- AC test voltage = 3kV

Selection and Ordering Data

	No. of cores x conductor size	Part No.	Nominal of strands and strand diameter
	mm²		mm
PROTOMONT with black core insulation	1 x 16	5DL1 112	126 x 0.40
	1 x 25	5DL1 113	196 x 0.40
	1 x 35	5DL1 114	276 x 0.40
	1 x 50	5DL1 115	396 x 0.40
	1 x 70	5DL1 116	546 x 0.40
	1 x 95	5DL1 117	724 x 0.40
	1 x 120	5DL1 118	926 x 0.40
	1 x 150	5DL1 120	1156 x 0.40
	1 x 185	5DL1 121	1406 x 0.40
	1 x 240	5DL1 122	1862 x 0.40
	1 x 300	5DL1 123	1456 x 0.50
PROTOMONT including green/ yellow earth core	3 x 1.5*	5DL1 304	30 x 0.25
	3 x 2.5*	5DL1 305	50 x 0.25
	3 x 4*	5DL1 306	56 x 0.30
	3 x 6*	5DL1 307	84 x 0.30

CORE COLOUR IDENTIFICATION

Single core:	-	black
3 core	-	blue, brown and **green/yellow**
4 core	-	blue, brown, black and **green/yellow**
5 core	-	blue, brown, black, **green/yellow** and black
Multi core:	-	black insulation sequentially numbered including a **green/yellow** earth core

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal of diameter conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Spaced 	Unenclosed Touching 
mm	mm	kg/km	A	A
5.3	11.2	231	106	85
6.6	13.4	349	142	114
7.8	14.5	443	177	141
9.3	16.4	601	223	178
10.9	18.5	814	283	225
12.6	20.5	1041	341	271
14.2	23.0	1325	406	332
15.9	25.2	1615	470	372
17.5	28.3	1997	540	427
20.2	31.5	2575	651	514
22.3	35.7	3244	752	591
1.6	11.9	185	20	19
2.1	13.0	235	27	26
2.6	16.2	380	36	34
3.2	17.6	447	46	43

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal of strands and strand diameter
	mm²		mm
PROTOMONT including green/ yellow earth core	4 x 1.5*	5DL1 404	30 x 0.25
	4 x 2.5*	5DL1 405	50 x 0.25
	4 x 4*	5DL1 406	56 x 0.30
	4 x 6*	5DL1 407	84 x 0.30
	4 x 10*	5DL1 410	80 x 0.40
	4 x 16*	5DL1 412	126 x 0.40
	4 x 25*	5DL1 413	196 x 0.40
	4 x 35*	5DL1 414	276 x 0.40
	4 x 50*	5DL1 415	396 x 0.40
	4 x 70*	5DL1 416	546 x 0.40
	4 x 95*	5DL1 417	724 x 0.40
	4 x 120*	5DL1 418	926 x 0.40
	4 x 150*	5DL1 420	1156 x 0.40
	4 x 185*	5DL1 421	1406 x 0.40
	4 x 240*	5DL1 422	1862 x 0.40
	3 x 50/25*	5DL1 715	396 x 0.40
	3 x 70/35*	5DL1 716	546 x 0.40
	3 x 95/50*	5DL1 717	724 x 0.40
	3 x 120/95*	5DL1 718	926 x 0.40
	3 x 150/70*	5DL1 722	1156 x 0.40
	3 x 185/95*	5DL1 721	1406 x 0.40

*This construction can be used for submersion in aggressive liquids

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal of diameter conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed	
			Spaced 	Touching 
mm	mm	kg/km	A	A
1.6	12.6	215	20	19
2.1	15.1	319	27	26
2.6	16.7	411	36	34
3.2	17.9	508	46	43
4.2	22.1	803	66	61
5.3	26.7	1181	87	81
6.6	31.3	1721	116	108
7.8	34.2	2176	144	135
9.3	39.6	3022	182	170
10.9	43.6	3939	230	214
12.6	50.2	5335	275	256
14.2	56.6	6758	327	303
15.9	62.8	8021	375	348
17.5	69.3	10154	428	396
20.2	75.7	10621	511	472
9.3	39.9	2874	182	170
10.9	43.8	3714	230	214
12.6	50.1	4899	275	256
14.2	56.6	6482	327	303
15.9	62.0	7568	375	348
17.5	69.3	9328	428	396

Selection and ordering data

	No. of cores x conductor size	Part No.	Nominal of strands and strand diameter
	mm²		mm
PROTOMONT including green/yellow earth core	5 x 1.5	5DL1 504	30 x 0.25
	5 x 2.5	5DL1 505	50 x 0.25
	5 x 4	5DL1 506	56 x 0.30
	5 x 6	5DL1 507	84 x 0.30
	5 x 10	5DL1 510	80 x 0.40
	5 x 16	5DL1 512	126 x 0.40
	5 x 25	5DL1 513	196 x 0.40
	5 x 35	5DL1 514	276 x 0.40
	6 x 1.5*	5DL1 945	30 x 0.25
	7 x 1.5*	5DL1 933	30 x 0.25
	8 x 1.5*	5DL1 931	30 x 0.25
	10 x 1.5*	5DL1 879	30 x 0.25
	11 x 1.5*	5DL1 903	30 x 0.25
	7 x 2.5	5DL1 911	50 x 0.25
	10 x 2.5*	5DL1 748	50 x 0.25
	12 x 2.5	5DL1 755	50 x 0.25
	12 x 2.5*	5DL1 923	50 x 0.25
	18 x 2.5	5DL1 937	50 x 0.25
	24 x 2.5	5DL1 842	50 x 0.25
	7 x 4	5DL1 750	56 x 0.30
	12 x 4	5DL1 957	56 x 0.30
	14 x 4	5DL1 892	56 x 0.30

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal of diameter conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Spaced	Unenclosed Touching
				
mm	mm	kg/km	A	A
1.6	13.5	250	20	19
2.1	16.2	363	27	26
2.6	28.0	482	36	34
3.2	20.1	633	46	43
4.2	24.0	956	66	61
5.3	28.9	1396	87	81
6.6	33.9	2051	116	108
7.8	38.4	2743	144	135
1.6	14.5	315	20	19
1.6	16.2	364	20	19
1.6	17.6	419	20	19
1.6	18.7	476	20	19
1.6	20.0	516	20	19
2.1	18.4	497	27	26
2.1	22.0	671	27	26
2.1	22.2	735	27	26
2.1	22.2	765	27	26
2.1	26.0	1034	27	26
2.1	29.8	1300	27	26
2.6	21.5	698	36	34
2.6	27.1	1070	36	34
2.6	27.2	1130	36	34

PROTOMONT SCREENED

Heavy duty / extra heavy duty flexible cables



APPLICATION

- Flexible pump cable
- Heavy duty construction site leads
- Oil rigs
- Generator supply cables
- Suitable for submersible application
- Suitable for hazardous locations

For flexible use and fixed installation in underground mining applications, tunnel building applications, open-cast mining applications, in quarries, on construction sites and similar applications, with heavy mechanical stresses. The cables can be used indoors as well as outdoors, in explosion-hazard areas, in industry and in agriculture.

They can be used permanently in waste water up to 40 °C. Owing to the various (and frequently changing) substances of which the contaminated water is made up, the cables may be used only in easily accessible areas that can be inspected (installation depth of approximately 10 m, as customarily encountered in sewage water tanks).

The cables can also be used in industrial water, cooling water, surface water, rainwater and mixed water – and in groundwater and seawater to a more limited extent. The requirements for accessibility and inspection are less stringent in such cases at depths greater than 10 m up to 500 m.

If the water concerned is aggressive or composed of special substances, the cable's resistance properties should be examined.

DESIGN

PROTOMONT heavy duty elastomer flexible cables are designed for aggressive environments in open cut mining and quarries, industry and construction sites as well as agricultural use where heavy mechanical stresses occur.

PROTOMONT cables consist of finely stranded tinned copper conductors laid up to provide a flexible design. Between the elastomer inner and outer sheaths there is an overall tinned copper screen.

R-EP-90 elastomer insulation enables improved current carrying capacities and a specially compounded XHD-PCP-90 outer sheath resists hard and abrasive surfaces. Designed in accordance with the Australian Standard, AS/NZS 5000-1, AS 3191.

OPERATING TEMPERATURE

- Maximum permissible operating temperature at conductor — 90 °C
- Maximum permissible short circuit temperature at conductor — 250 °C (max. 5 s)
- Minimum permissible temperatures
  - when in motion — -25 °C
  - when stationary — -40 °C
- Maximum permissible water temperature — 40 °C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz. Touching a surface, two or three cores loaded, multi-core cables all cores loaded.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.15kV
  - DC operation *Uo/U* = 0.9/1.73kV
- AC test voltage = 3kV

***** The cable is designated 450/750V in accordance with VDE/IEC and meets or exceeds the Australian Standard AS 5000.1 for the voltage rating of 0.6/1kV.

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

Note: For force guided and reeling applications please refer to Siemens CORDAFLEX (K) information.

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2. This ensures no conductor damage will occur in operation.

CORE COLOUR IDENTIFICATION

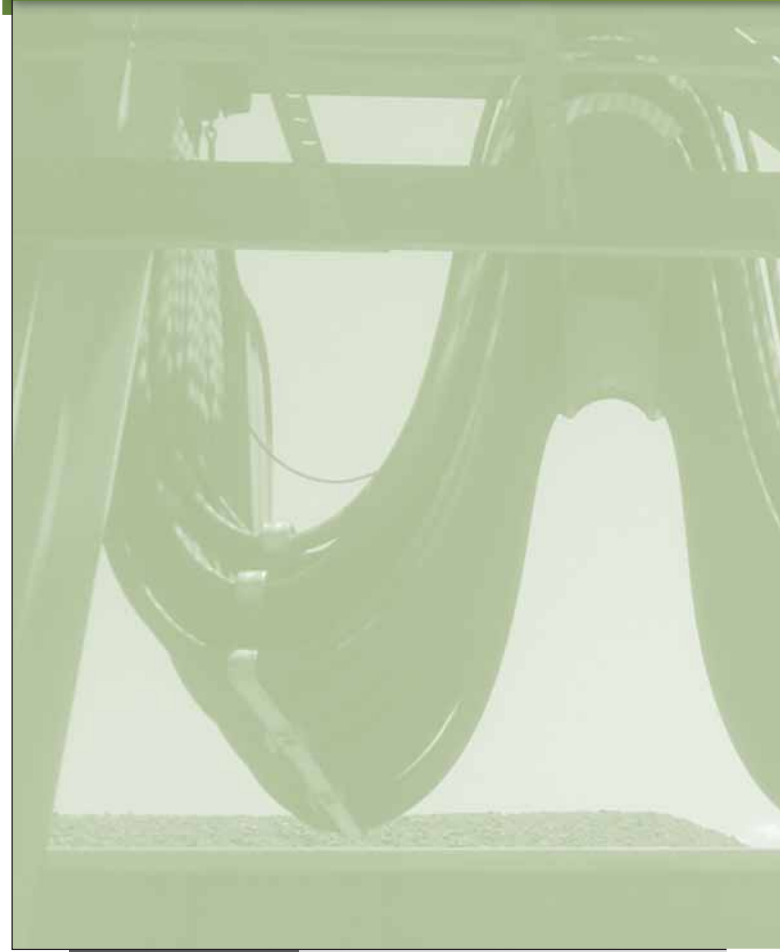
4 core	blue, brown, black, **green/yellow**
5 core	red, white, blue, black, **green/yellow**

Selection and ordering data
5 CORE OVERALL PROTOMONT SCREENED (F)

	Number of cores x conductor size	Part No.	Nominal strands and strand diameter
	mm^2		mm
PROTOMONT Screened	5 x 2.5/2.5	5DL2 710	50 x 0.25
	5 x 4/4	5DL2 811	56 x 0.30
	5 x 6/6	5DL2 712	84 x 0.30
	5 x 10/10	5DL2 713	80 x 0.40
	5 x 16/16	5DL2 714	126 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal of diameter conductor	Nominal cable diameter	Approx net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
2.1	15.8	540	26
2.6	18.8	680	34
3.2	20.4	910	43
4.2	24.6	1320	61
5.3	30.0	1955	81



HIGH TEMPERATURE CABLES

SINOTHERM 180°C	5DR3	PAGE 96
SINOTHERM Multicore	5DR5	PAGE 102
SINOTHERM Glass Fibre Braid	5DR4	PAGE 103
SINOTHERM 110°C	5DR7	PAGE 104
EVA 125 FLEX	5DR7	PAGE 110
TECSUN (PV)	5DH9	PAGE 114

SINOTHERM 180°C

High temperature 180°C silicone flexible cables



APPLICATION

- Switchboard & cubical wiring
- Transformer and capacitor cabling
- High output floodlights
- Chemical & ceramic industry
- Injection moulding & extruders
- Steelworks / hot strip rolling mills
- Foundries & cooking plants
- Heating appliances
- Motor rewinders
- For internal wiring in switchgear, distribution boards, electric cookers, electrical machines, heating appliances and luminaries.
- In conduits which are either surface mounted, embedded on or in or under plaster, or enclosed within electrical installation ducts or within equipment housings.
- By virtue of their increased heat resistance, these cables are particularly suitable for use in ambient temperatures of over 55 °C.
- Since silicone rubber is malleable and less durable than other insulating materials, these cables are not suitable for high mechanical stress, e.g. when cables laid across sharp edges.

DESIGN

SINOTHERM cables consist of fine stranded copper conductors laid up to provide a flexible design.

Silicone insulation offers high resistance to increased ambient temperatures, however with a low mechanical resistance to cuts and tearing.

OPERATING TEMPERATURE

■ Minimum and maximum permissible ambient temperature	-55°C +180°C
■ Maximum permissible conductor temperature	180°C
■ Maximum permissible short circuit temperature	350°C (max. 5 s)
■ Minimum ambient temperature for optimum fully flexible operation	-40°C

RESISTANCE TO CHEMICALS

Occasional slight exposure to oil and grease is permitted but the cables must not lie continually in oil or grease. They must be protected against fuels and solvents by suitable insulation. Designed in accordance with ASNZS/5000.1 the single core 0.6/1kV SINOTHERM.

MINIMUM BENDING RADII

The following minimum bending radii must be observed to ensure operating reliability.
These are applicable for both sub-zero and elevated temperatures.

- Fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

The values are valid for a cable in permanent operation with DC or AC with 50 up to 60 Hz at 150 °C ambient temperature, free in air.

Current ratings are based on continous operation at an ambient temperature of 150°C per the following table when installed unenclosed and touching.

Conductor Size	0.75	1.0	1.5	2.5	4	6	10	16	25	35	50	70	95
Amps	15	19	24	32	42	54	73	98	129	158	198	245	292

At other temperatures these values must be converted using the following table.

Ambient temp. up to °C	150	155	160	165	170	175	180
Current capacity as a % of values above	100	91	82	71	58	41	23

Current ratings are based on continous operation at an ambient temperature of 40°C per the following table when installed unenclosed and touching.

Conductor Size	0.75	1.0	1.5	2.5	4	6	10	16	25	35	50	70	95
Amps	18	21	27	38	51	65	92	123	163	202	294	364	433

At other temperatures these values must be converted using the following table.

°C	40	45	50	55	60	65	70	75
Factor	1.0	0.98	0.95	0.93	0.90	0.88	0.85	0.83

VOLTAGE RATING

- Rated voltage:
- Single core *Uo/U* = 0.6/1kV
- Multi core & glass braided *Uo/U* = 300/500V

CORE COLOUR IDENTIFICATION

2 core - blue, brown
3 core - blue, brown, **green/yellow**
4 core - blue, brown, black, **green/yellow**
5 core - blue, brown, black, **green/yellow,** black

A single core 660V is available in a range of colours for control wiring in black, red, pink, **green/yellow**, blue, orange, brown, white and grey.

Coloured Sinotherm Conductors tinned to AS/NZS 1125.

SINOTHERM 180°C



Selection and ordering data

No. of cores x conductor size	Part No.	Nominal No. of strands and strand diameter
mm^2		mm
1 x 1.5	5DR3 514	30 x 0.25
1 x 2.5	5DR3 515	50 x 0.25
1 x 4	5DR3 516	56 x 0.30
1 x 6	5DR3 517	84 x 0.30
1 x 10	5DR3 518	80 x 0.40
1 x 16	5DR3 520	126 x 0.40
1 x 25	5DR3 521	196 x 0.40
1 x 35	5DR3 522	276 x 0.40
1 x 50	5DR3 523	396 x 0.40
1 x 70	5DR3 524	360 x 0.50
1 x 95	5DR3 525	475 x 0.50

Nominal diameter conductor	Nominal cable diameter	Approx. net cable weight
mm	mm	kg/km
1.6	3.4	20
2.1	4.1	30
2.6	4.7	50
3.2	5.8	65
4.2	7.1	115
5.3	8.3	180
6.6	10.1	275
7.8	11.7	365
9.3	13.6	520
10.9	15.7	710
14.5	17.7	930

MULTICORE SINOTHERM FLEXIBLE CABLES (0.6/1KV)



Selection and ordering data

No. of cores x conductor size	Part No.	Nominal No. of strands and strand	Nominal conductor diameter	Nominal cable diameter	Approx. net cable weight
mm^2		mm	mm	mm	kg/km
2 x 0.75	5DR5 228-4	24 x 0.20	1.2	6.6	52
2 x 1	5DR5 238-4	32 x 0.20	1.3	7.1	59
2 x 1.5	5DR5 248-4	30 x 0.25	1.6	8.3	81
2 x 2.5	5DR5 258-4	50 x 0.25	2.1	9.8	125
2 x 4	5DR5 268-4	56 x 0.30	2.6	11.0	180
3 x 0.75	5DR5 328-4	24 x 0.20	1.2	7.2	62
3 x 1	5DR5 338-4	32 x 0.20	1.3	7.5	77
3 x 1.5	5DR5 348-4	30 x 0.25	1.6	8.8	98
3 x 2.5	5DR5 358-4	50 x 0.25	2.1	10.6	150
3 x 4*	5DR5 368-4	56 x 0.30	2.6	12.0	225
4 x 0.75	5DR5 428-4	24 x 0.20	1.2	7.8	80
4 x 1*	5DR5 438-4	32 x 0.20	1.3	8.2	94
4 x 1.5	5DR5 448-4	30 x 0.25	1.6	9.8	125
4 x 2.5	5DR5 458-4	50 x 0.25	2.1	11.5	185
4 x 4	5DR5 468-4	56 x 0.30	2.6	13.0	290
5 x 1.5	5DR5 548-4	30 x 0.25	1.6	10.7	155
7 x 1.5	5DR5 793-4	30 x 0.25	1.6	11.6	195
12 x 1.5*	5DR5 794-4	30 x 0.25	1.6	14.5	315

SINGLE CORE SINOTHERM WITH GLASS FIBRE BRAID (500V)



Selection and ordering data

No. of cores x conductor size	Part No.	Nominal No. of strands and strand	Nominal conductor diameter	Nominal cable diameter	Approx. net cable weight
mm^2		mm	mm	mm	kg/km
1 x 0.75	**5DR4 021-5**	24 x 0.20	1.2	3.1	17
1 x 1	**5DR4 031-5**	32 x 0.20	1.3	3.3	20
1 x 1.5	**5DR4 041-5**	30 x 0.25	1.6	3.8	27
1 x 2.5	**5DR4 051-5**	50 x 0.25	2.1	4.4	39
1 x 4	**5DR4 061-5**	56 x 0.30	2.6	5.0	54
1 x 6	**5DR4 071-5**	84 x 0.30	3.2	5.5	75
1 x 10	**5DR4 101-5**	80 x 0.40	4.2	7.1	130
1 x 16	**5DR4 121-5**	126 x 0.40	5.3	8.9	200
1 x 25	**5DR4 131-4**	196 x 0.40	6.6	10.9	305
1 x 35	**5DR4 141-4**	276 x 0.40	7.8	12.3	420
1 x 50	**5DR4 151-4**	396 x 0.40	9.3	14.8	595
1 x 70	**5DR4 161-4**	360 x 0.50	10.9	16.8	825
1 x 95*	**5DR4 171-4**	475 x 0.50	14.3	19.4	1075

SINOTHERM 110°C

High temperature 110°C silicone flexible cables



APPLICATION

These cables are intended for use as fixed wiring, or wiring where limited flexing in operation is encountered.

- For internal wiring in switchgear, distribution boards, electric cookers, electrical machines, heating appliances and luminaires
- In conduits which are either surface mounted, embedded on or in or under plaster, or enclosed within electrical installation ducts or within equipment housings
- By virture of their increased heat resistance, these cables are particularly suitable for use in ambient temperatures of over 55°C
- Suitable for protected installation in, or on, lightning or controlgear for voltages up to 1000 V a.c. or, up to 750 V d.c. to earth.

INSULATION

Heat resistant, cross-linked elastomeric special compound

DESIGN

SINOTHERM cables consist of fine stranded copper conductors laid up to provide a flexible design.

Silicone insulation offers high resistance to increased ambient temperatures, however with a low mechanical resistance to cuts and tearing.

OPERATING TEMPERATURE

■ Maximum permissible operating temperature at conductor	110°C
■ Maximum permissible short-circuit temperature at conductor	250°C (max. 5 s)
■ Minimum permissible temperatures	
when in motion	-25°C
when stationary	-40°C

MECHANICAL CHARACTERISTICS

Permissible pulling force	max 15 N/mm²

RESISTANCE TO CHEMICALS

Occasional slight exposure to oil and grease is permitted but the cables must not lie continually in oil or grease. They must be protected against fuels and solvents by suitable insulation.

MINIMUM BENDING RADII

The following minimum bending radii must be observed to ensure operating reliability.
These are applicable for both sub-zero and elevated temperatures.

- Fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

The values are valid for a cable in permanent operation with DC or AC with 50 up to 60 Hz at 150 °C ambient temperature, free in air.

Current ratings are based on continous operation at an ambient temperature of 150°C per the following table when installed unenclosed and touching.

Conductor Size	0.75	1.0	1.5	2.5	4	6	10	16	25	35	50	70	95
Amps	15	19	24	32	42	54	73	98	129	158	198	245	292

At other temperatures these values must be converted using the following table.

Ambient temp. up to °C	150	155	160	165	170	175	180
Current capacity as a % of values above	100	91	82	71	58	41	23

Current ratings are based on continous operation at an ambient temperature of 40°C per the following table when installed unenclosed and touching.

Conductor Size	0.75	1.0	1.5	2.5	4	6	10	16	25	35	50	70	95
Amps	18	21	27	38	51	65	92	123	163	202	294	364	433

At other temperatures these values must be converted using the following table.

°C	40	45	50	55	60	65	70	75
Factor	1.0	0.98	0.95	0.93	0.90	0.88	0.85	0.83

For other ambient temperatures, the current-carrying capacities must be converted with the following factors:

°C	55	60	65	70	75	80	85	90	95	100	105
f	1.35	1.29	1.22	1.15	1.08	1.00	0.91	0.82	0.71	0.58	0.41

VOLTAGE RATING

■ Rated AC voltage	*Uo/U*	= 0.6/1kV
■ AC test voltage (test duration)	*Uo/U*	= 2.5kV (15min)

Selection and ordering data

No. of cores x conductor size	Insulation colour	Part No.	Nominal strands and strand diameter
mm²			mm
1 x 0.50	black	5DR7 050-5	16 x 0.20
1 x 0.75	black	5DR7 051-5	24 x 0.20
1 x 1	black	5DR7 052-5	32 x 0.20
1 x 1.5	black	5DR7 053-5	30 x 0.25
1 x 2.5	black	5DR7 054-5	50 x 0.25
1 x 4	black	5DR7 055-5	56 x 0.30
1 x 6	black	5DR7 056-5	84 x 0.30
1 x 10	black	5DR7 057-5	80 x 0.40
1 x 16	black	5DR7 060-5	126 x 0.40
1 x 25	black	5DR7 061-5	196 x 0.40
1 x 35	black	5DR7 062-5	276 x 0.40
1 x 50	black	5DR7 063-5	396 x 0.40
1 x 70	black	5DR7 064-5	546 x 0.40
1 x 95	black	5DR7 065-5	724 x 0.40
1x 120	black	5DR7 066-5	926 x 0.40
1 x 150	black	5DR7 067-5	1156 x 0.40
1 x 185	black	5DR7 068-5	1406 x 0.40
1 x 240	black	5DR7 070-5	1862 x 0.40

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
0.94	2.2	8	12
1.2	2.4	11	15
1.3	2.5	13	19
1.6	3.3	21	24
2.1	3.8	30	32
2.6	4.5	47	42
3.2	5.0	64	54
4.2	6.5	110	73
5.3	7.9	164	98
6.6	9.3	256	129
7.8	10.5	339	158
9.3	12.3	489	198
10.9	14.1	663	245
14.2	16.1	869	292
15.9	18.8	1165	344
17.5	20.7	1435	391
20.2	22.6	1754	448
24.6	26.3	2306	528

EVA 125 FLEX

High temperature 125°c flame retardant



APPLICATION

- Switchboard cabling
- Coil & transformer wiring
- High thermal stress resistant
- Chemical & ceramic industry
- Steelworks

DESIGN

EVA 125 is a flexible elastomer insulated cable with improved thermal characteristics due to special cross linking together with an excellent resistance to oils, chemicals, abrasion and mechanical damage.

EVA 125 Flex cables consist of finely stranded tinned copper conductors laid up to provide a flexible design with a specially compounded R-EVA-125 synthetic rubber insulation for operation in elevated ambient temperatures. Designed in accordance with the Australian Standards AS 1125, AS/NZS 5000-1. The special Ethylene Vinyl Acetate compound is halogen free and exhibits low smoke generation in the event of fire and has a high resistance to absorption of oils and grease.

TEMPERATURE

Minimum and maximum permissible ambient temperature	-40°C to +110°C
Maximum permissible conductor temperature	125°C
Maximum permissible short circuit temperature	250°C

MINIMUM BENDING RADII

The following minimum recommended bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on a continuous operating ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

TENSILE STRENGTH

The maximum allowable tensile stress on the conductors is 15N/mm^2. This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.15kV
  - DC operation *Uo/U* = 0.9/1.73kV
- AC test voltage = 2.5kV

The cable is designated 450/750V in accordance with VDE/IEC and designed to the Australian Standard AS/NZS 5000.1 for the voltage rating 0.6/1kV

CORE COLOUR IDENTIFICATION

The cable is available in either black or orange as standard. Variations are available subject to manufacture length.

EVA 125 FLEX

Selection and ordering data

No. of cores conductor size	Part No.	Nominal strands and strand diameter
mm^2		mm
1 x 4	**5DR7 490-5**	56 x 0.3
1 x 10	**5DR7 493-5**	80 x 0.4
1x 16	**5DR7 492-5**	126 x 0.4
1 x 50	**5DR7 491-5**	396 x 0.4

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter of conductor	Nominal cable diameter	Approx. net cable weight	Unenclosed Touching 
mm	mm	kg/km	A
2.6	4.9	60	45
4.2	7.0	130	80
5.3	8.1	210	105
9.3	13.6	595	217

TECSUN (PV)

SOLAR 120˚C Single and twin cables



APPLICATION

TECSUN (PV) Solar cables are intended for use in photovoltaic power supply systems and are suitable in applications where the cable will be free moving, hanging, fixed installation or buried underground.

PV-Wires TECSUN DUO (PV) PV1-F and TECSUN DUO (PV) S are intented for use in Photovoltaic Power Supply Systems: Indoor and/or outdoor, in explosion hazard areas, in industrial and agriculture fields. They are suitable for applications in/at equipment with protective insulation (Protecting Class II).

Installation in cable trays, conduits, on and in walls is available.

DESIGN

The cables can be used indoor, outdoor and in explosion hazardous areas and is suitable for applications in/at equipment with protective insulation (protecting class II).

The special EVA sheath (Ethylene Vinyl Acetate) is halogen free and exhibits low smoke generation in the event of fire and has high resistance to absorption of oils and grease.

Tecsun cables consist of multi-stranded tinned copper conductors that are designed to resist corrosion and reduce annealing of the conductors due to the constant current in DC systems.

Tecsun Cables meet and exceed IEC 61215 and 61646, IEC64/1123/CD and AS4777.1.2.3:2005.

Approvals: DKE/VDE AK 411.2.3, VDE-Reg, No. 7985, TUV 2 PFG 1169/08.2007, Cert. – No. R 60013989

THERMAL PARAMETERS

- Minimum permissible temperature -40°
  (stationary and in motion)
- Maximum permissible operating temperature of the conductor +120°C;
  Interpretation according to IEC 60216
- Short-circuit temperature +250°C
  (at the conductor max .5 sec.)

TENSILE STRENGTH

The maximum allowable tensile stress on the conductors is 15N/mm^2, and 50N/mm^2 during insulation.

ELECTRICAL PARAMETERS

- Rated voltage AC 0.6/1kV
  TECSUN DUO (PV)* Power Cable 600/1000V
  TECSUN DUO (PV) S Signal Cable 300/500V
- Maximum PV-System voltage DC up to 2.0 kV possible
- Maximum AC operating voltage 0.7/1.2kV
- Maximum DC operating voltage 0.9/1.8kV

COLOUR IDENTIFICATION

Single Core Sheath	Black, Blue, Red
Twin Sheath	Black
Twin Cores	Black, Red

TECSUN (PV)

No. of cores x conductor size	Insulation colour	Part No.	Nominal conductor diameter	Nominal cable diameter
mm^2			mm	mm
1 x 1.5	Black	5DH9 3011	1.6	4.6
1 x 2.5	Black	5DH9 3021	2.1	4.9
1 x 4	Black	5DH9 3031	2.6	5.4
1 x 6	Black	5DH9 3041	3.2	5.9
1 x 10	Black	5DH9 3051	4.2	7.0
1 x 16	Black	5DH9 3061	5.3	8.7
1 x 1.5	Blue	5DH9 3012	1.6	4.6
1 x 2.5	Blue	5DH9 3022	2.1	4.9
1 x 4	Blue	5DH9 3032	2.6	5.4
1 x 6	Blue	5DH9 3042	3.2	5.9
1 x 1.5	Red	5DH9 3013	1.6	4.6
1 x 2.5	Red	5DH9 3023	2.1	4.9
1 x 4	Red	5DH9 3033	2.6	5.4
1 x 6	Red	5DH9 3043	3.2	5.9

Nominal cross-section and colour	Order No.	Nominal conductor diameter	Nominal cable diameter
Tecsun Duo (PV)		mm	mm
2 x 4 Black	5DH9 903	2.6	5.4
2 x 6 Black	5DH9 904	3.2	5.9

Approx. net cable weight	Min bending radius	Max permissible tensile load	Current carrying capacity at 60°C	Permissible short circut current
kg/km	mm	N m	A	kA
29	13.8	23	29	0.19
43	14.7	38	41	0.32
58	16.2	60	55	0.50
76	17.7	90	70	0.76
120	21.0	150	98	1.26
178	34.8	240	132	2.01
29	13.8	23	29	0.19
43	14.7	38	41	0.32
58	16.2	60	55	0.50
76	17.7	90	70	0.76
29	13.8	23	29	0.19
43	14.7	38	41	0.32
58	16.2	60	55	0.50
76	17.7	90	70	0.76

Approx. net weight Twin Cable	Min bending radius	Max permissible tensile load	Current carrying capacity at 60°C ambient temperature (free in air)	Permissible short circuit current (1s)
kg/km	mm	N m	A	kA
116	16.2	120	44	0.50
152	17.7	180	56	0.76

SECTION 3



PVC DATA AND CONTROL CABLES

PROTOFLEX PVC Unscreened	5DE7	PAGE 120
PROTOFLEX PVC Screened	5DE7	PAGE 129
PROTOFLEX-EMV-FC	5DE6	PAGE 132
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PROTOFLEX PVC

PVC control cables



APPLICATION

PROTOFLEX® PVC control cables are specifically suitable for use as flexible control cables.

- Fans and air-conditioning systems
- Machine tools
- Production and processing machines
- Industrial robots

DESIGN

PROTOFLEX® PVC control cables consist of finely stranded copper conductors with V75 PVC insulation. The high grade PVC sheath is resistant to oil, grease and chemicals.

PROTOFLEX® PVC screened control cables have a PVC inner and outer sheath with a copper braided shield between the sheaths which serves to avoid electromagnetic interference (EMC) in building systems and were equipment is in environments where Electromagnetic interference would be unacceptable.

Designed for moderate mechanical loading, in dry, damp and wet areas and in hazardous areas. Outdoor use is possible, provided that the cables are protected from direct sunlight and are permanently installed.

SPECIAL FEATURES

Suitable for use	Burning behavior in accordance with DIN
in hazardous areas	VDE 0472 Part 804, Test B (IEC 332-1)
Low transfer impedance	The cable has a concentric copper braided shield to restrict electromagnetic interference (max 250 Ω /km at 30 MHz).
Voltages	300/500 V Rated voltage
	– 3 phase and single phase operation
	– in DC operation
	2 kV Test voltage
Certification	VDE Reg. No. 7042
Standards	Based on DIN VDE 0281-13

SHIELD CONNECTION

In order to obtain optimum shielding quality, the shield must be connected around its entire circumference and over an ample surface area at both ends of the cable.

Twisting the shielding strands together into a pigtail or exclusive use of a sheath wire is not sufficient.

TECHNICAL INFORMATION

Cable construction is based on DIN VDE 0281-13

- Finely-stranded bare copper conductors according to VDE 0295 Class 5
- Insulation of special polyvinyl chloride (PVC)
- PVC inner sheath over laid-up cores in shielded versions
- Braided shield of tinned copper wires over inner sheath
- Grey PVC outer sheath, largely resistant to oil and chemicals

CONTINUOUS TENSILE LOAD

The maximum allowable tensile stress for operation of cables with mobile equipment is 15 N per mm^2.

The maximum allowable tensile stress is 50 N mm^2 for fixed installations.

PERMISSIBLE TEMPERATURE

At conductor:	free-flexing	+5°C to + 70°C
	fixed	- 40°C to + 70°C
Bending radii:	fixed	4 d
	free-flexing	7.5 d

d= outer diameter of cable

CURRENT CARRYING CAPACITY

The current carrying capacities are based on a continuous operating temperature of 40°C. At other temperatures these values must be converted using the following factors

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

VOLTAGE RATINGS

- Rated voltage: *Uo/U* = 300/500V
- AC test voltage = 2kV

*The cable is designated 300/500V in accordance with VDE/IEC.

CORE COLOUR IDENTIFICATION

All control cores are black, sequentially numbered and include a **green/yellow** earth core.

PVC control cables, unscreened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 0.5	5DE7 026	16 x 0.20	4.8	8
3 x 0.5	5DE7 001	16 x 0.20	5.1	8
4 x 0.5	5DE7 002	16 x 0.20	5.6	8
5 x 0.5	5DE7 003	16 x 0.20	6.2	8
7 x 0.5	5DE7 004	16 x 0.20	6.8	8
12 x 0.5	5DE7 005	16 x 0.20	9.2	8
18 x 0.5	5DE7 010	16 x 0.20	10.8	8
25 x 0.5	5DE7 012	16 x 0.20	13.1	8
32 x 0.5	5DE7 014	16 x 0.20	14.2	8
40 x 0.5	5DE7 016	16 x 0.20	16.1	8
52 x 0.5	5DE7 027	16 x 0.20	17.7	8

PVC control cables, unscreened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm²		mm	mm	A
2 x 0.75	5DE7 040	24 x 0.20	5.2	10
3 x 0.75	5DE7 041	24 x 0.20	5.6	10
4 x 0.75	5DE7 042	24 x 0.20	6.2	10
5 x 0.75	5DE7 043	24 x 0.20	6.8	10
7 x 0.75	5DE7 044	24 x 0.20	7.5	10
12 x 0.75	5DE7 045	24 x 0.20	10.0	10
18 x 0.75	5DE7 050	24 x 0.20	12.0	10
25 x 0.75	5DE7 052	24 x 0.20	14.5	10
34 x 0.75	5DE7 055	24 x 0.20	16.5	10
42 x 0.75	5DE7 057	24 x 0.20	17.9	10
50 x 0.75	5DE7 058	24 x 0.20	19.6	10

Current ratings are based on AS/NZS 3008.1.1:2009.

PVC control cables, unscreened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 1.0	**5DE7 080**	32 x 0.20	5.7	13
3 x 1.0	**5DE7 081**	32 x 0.20	6.1	13
4 x 1.0	**5DE7 082**	32 x 0.20	6.7	13
5 x 1.0	**5DE7 083**	32 x 0.20	7.4	13
7 x 1.0	**5DE7 084**	32 x 0.20	8.3	13
12 x 1.0	**5DE7 085**	32 x 0.20	10.9	13
18 x 1.0	**5DE7 090**	32 x 0.20	13.1	13
25 x 1.0	**5DE7 093**	32 x 0.20	15.9	13
34 x 1.0	**5DE7 096**	32 x 0.20	18.1	13
41 x 1.0	**5DE7 098**	32 x 0.20	19.6	13
50 x 1.0	**5DE7 102**	32 x 0.20	21.5	13

PVC control cables, unscreened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 1.5	5DE7 120	30 x 0.25	6.3	16
3 x 1.5	5DE7 121	30 x 0.25	6.7	16
4 x 1.5	5DE7 122	30 x 0.25	7.4	16
5 x 1.5	5DE7 123	30 x 0.25	8.3	16
7 x 1.5	5DE7 124	30 x 0.25	9.1	16
12 x 1.5	5DE7 125	30 x 0.25	12.1	16
18 x 1.5	5DE7 128	30 x 0.25	14.5	16
25 x 1.5	5DE7 133	30 x 0.25	17.7	16
34 x 1.5	5DE7 135	30 x 0.25	19.9	16
42 x 1.5	5DE7 136	30 x 0.25	21.6	16
50 x 1.5	5DE7 137	30 x 0.25	23.8	16

Current ratings are based on AS/NZS 3008.1.1:2009.

PVC control cables, unscreened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 2.5	**5DE7 160**	50 x 0.25	7.7	21
3 x 2.5	**5DE7 161**	50 x 0.25	8.3	21
4 x 2.5	**5DE7 162**	50 x 0.25	9.2	21
5 x 2.5	**5DE7 163**	50 x 0.25	10.1	21
7 x 2.5	**5DE7 164**	50 x 0.25	11.2	21
12 x 2.5	**5DE7 165**	50 x 0.25	15.2	21
18 x 2.5	**5DE7 170**	50 x 0.25	18.1	21
25 x 2.5	**5DE7 172**	50 x 0.25	22.1	21
34 x 2.5	**5DE7 175**	50 x 0.25	25.0	21
50 x 2.5	**5DE7 178**	50 x 0.25	30.0	21

PVC control cables, screened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 0.5	**5DE7 626**	16 x 0.20	6.8	8
3 x 0.5	**5DE7 601**	16 x 0.20	7.0	8
4 x 0.5	**5DE7 602**	16 x 0.20	7.5	8
5 x 0.5	**5DE7 603**	16 x 0.20	8.2	8
7 x 0.5	**5DE7 604**	16 x 0.20	8.7	8
12 x 0.5	**5DE7 605**	16 x 0.20	10.9	8
18 x 0.5	**5DE7 610**	16 x 0.20	12.8	8
25 x 0.5	**5DE7 612**	16 x 0.20	15.4	8
32 x 0.5	**5DE7 614**	16 x 0.20	16.7	8
40 x 0.5	**5DE7 616**	16 x 0.20	18.3	8

Current ratings are based on AS/NZS 3008.1.1:2009.

PVC control cables, screened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 0.75	**5DE7 640**	24 x 0.20	7.4	10
3 x 0.75	**5DE7 641**	24 x 0.20	7.7	10
4 x 0.75	**5DE7 642**	24 x 0.20	8.2	10
5 x 0.75	**5DE7 643**	24 x 0.20	9.0	10
7 x 0.75	**5DE7 644**	24 x 0.20	9.5	10
12 x 0.75	**5DE7 645**	24 x 0.20	12.0	10
18 x 0.75	**5DE7 650**	24 x 0.20	14.2	10
25 x 0.75	**5DE7 652**	24 x 0.20	17.0	10
34 x 0.75	**5DE7 655**	24 x 0.20	19.0	10
42 x 0.75	**5DE7 657**	24 x 0.20	20.3	10

PVC control cables, screened

Selection and ordering data

No. of cores x conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Approx. cable diameter	Unenclosed Touching 
mm^2		mm	mm	A
2 x 1.0	**5DE7 680**	32 x 0.20	7.8	13
3 x 1.0	**5DE7 681**	32 x 0.20	8.1	13
4 x 1.0	**5DE7 682**	32 x 0.20	8.9	13
5 x 1.0	**5DE7 683**	32 x 0.20	9.5	13
7 x 1.0	**5DE7 684**	32 x 0.20	10.3	13
12 x 1.0	**5DE7 685**	32 x 0.20	13.3	13
18 x 1.0	**5DE7 690**	32 x 0.20	15.6	13
25 x 1.0	**5DE7 693**	32 x 0.20	18.4	13
34 x 1.0	**5DE7 696**	32 x 0.20	20.8	13
41 x 1.0	**5DE7 698**	32 x 0.20	22.3	13

Current ratings are based on AS/NZS 3008.1.1:2009.

PROTOFLEX-EMV-FC – UV Stabilised

UV Stabilised



APPLICATION

Specifically designed low capacitance screened cable for connection between AC variable speed drives and motors. Suitable for fixed installation and occasional freely flexing applications in dry damp and wet conditions.

U.V stabilised for indoor/outdoor use.

Especially for frequency converter controlled AC drives. As well as outdoors, for medium mechanical stress.

Not suitable for direct installation into the ground or submersion in water. Suitable for hazardous locations.

DESIGN

Electromagnetic compatibility (EMC) is the ability of electrical or electronic equipment to function normally in an environment without being effected by (EMI) electromagnetic and (RFI) radio frequency interferences or in turn disturbing the environment by transmitting EMI or RFI.

The Siemens PROTOFLEX -EMV screened power cable consists of finely stranded copper conductors with Cross Linked Poly Ethylene (XLPE) insulation covered with a tinned copper braided screen and a PVC orange, transparent sheath.

For cable cross sections 16mm^2 or greater the earth conductor is divided evenly into 3 seperate cores and uniformally located in the interstitial gaps around the power cores. This achieves a truly concentric design in accordance with the EMC standards.

The overall tinned copper braid screen is specifically designed for optimum Electromagnetic Compatibility (EMC) by taking into account the percentage coverage, braid fan angle, and wire gauge which all results in a very low transfer resistance. The screen offers a low DC resistance affording protection from low frequency interference such as AC harmonics.

Design in accordance with AS 1125 for the conductors and AS/NZS 5000.1 for the sheath. Fire performance is according to IEC 06332- 1

OPERATING TEMPERATURE

■ Minimum permissible ambient temperature	-40°C
■ Maximum permissible conductor temperature	90°C
■ Maximum permissible short circuit temperature	250°C (max. 5 s)
■ Mimnimum permissible temperature	
when in motion	-5°C
when stationary	-40°C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The current-carrying capacity values in the selection table are valid for one cable, installed on a surface, ambient temperature 40 °C.

MINIMUM BENDING RADII.

For recommended bending radii refer to the selection and ordering data tables.

CORE COLOUR IDENTIFICATION

4 core – brown, black, grey, **green/yellow earth** (could be multiple earth)

VOLTAGE RATING

■ Rated AC voltage:	*Uo/U*	= 0.6kV/1kV
■ AC test voltage:		= 5kV
■ Max. permissible peak AC voltage		=2.4kV
■ For connection on frequency converter		U max. 690 V

UV stabilised

Selection and ordering data

No. of cores and conductor cross-section	Part No.	Nominal No. of strands and strand diameter	Operating capacitance	Nominal diameter over screen
mm²		mm	nF/Km	mm
4 x 1.5	5DE6 600	30 x 0.25	130	8.4
4 x 2.5	5DE6 601	50 x 0.25	145	9.4
4 x 4	5DE6 602	56 x 0.30	145	11.6
4 x 6	5DE6 603	84 x 0.30	160	12.8
4 x 10	5DE6 604	80 x 0.40	185	15.3
3 x 16 + 3 x 2.5	5DE6 605	126 x 0.40	235	16.2
3 x 25 + 3 x 4	5DE6 606	196 x 0.40	245	19.8
3 x 35 + 3 x 16/3	5DE6 607	276 x 0.40	270	22.5
3 x 50 + 3 x 25/3	5DE6 608	396 x 0.40	270	26.7
3 x 70 + 3 x 35/3	5DE6 610	546 x 0.40	295	30.6
3 x 95 + 3 x 50/3	5DE6 611	724 x 0.40	300	35.1
3 x 120 + 3 x 50/3	5DE6 612	926 x 0.40	315	39.6
3 x 150 + 3 x 70/3	5DE6 613	1156 x 0.40	315	44.3
3 x 185 + 3 x 95/3	5DE6 614	1406 x 0.40	315	48.9
3 x 240 + 3 x 120/3	5DE6 615	1862 x 0.40	320	55.8
3 x 300 + 3 x 150/3	5DE6 616	1456 x 0.50	330	62.9

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal cable diameter	Min bending radii when STATIONARY	Min bending radii when IN MOTION	Approx. net cable weight	Unenclosed Touching 
mm	mm	mm	kg/km	A
11.5	69	92	150	19
13.0	100	125	205	26
15.5	124	155	320	34
17.0	136	170	410	43
19.5	156	195	600	61
21.0	168	210	770	81
24.5	196	245	1110	108
28.0	224	280	1510	135
33.0	264	330	2140	170
37.0	296	370	2860	214
42.0	336	420	3740	256
46.5	372	465	4810	303
51.5	412	515	5850	348
57.0	456	570	7100	396
64.5	516	645	9500	472
72.0	576	720	11680	539

PROTOFLEX EMC



APPLICATION

Specifically designed low capacitance screened cable for connection between AC variable speed drives and motors. Suitable for fixed installation and occasional freely flexing applications in dry damp and wet conditions.

No. of cores x conductor size	Part No.	Nominal No. of strands and strand diameter	Nominal diameter over screen
mm^2		mm	mm
3 x 1.5	5EMC 3015	30 x 0.25	8.4
3 x 2.5	5EMC 3025	50 x 0.25	9.9
4 x 1.5	5EMC 4015	30 x 0.25	9.7
4 x 2.5	5EMC 4025	50 x 0.25	10.9
4 x 4	5EMC 4040	56 x 0.30	12.25
3 x 6 + 3 x 1.5	5EMC 4060	84 x 0.30	14.00
3 x 10 + 3 x 1.5	5EMC 4100	80 x 0.40	15.80
3 x 16 + 3 x 2.5	5EMC 4160	126 x 0.40	18.80
3 x 25 + 3 x 4	5EMC 4250	196 x 0.40	22.00
3 x 35 + 3 x 6	5EMC 4350	276 x 0.40	28.40
3 x 50 + 3 x 10	5EMC 4550	396 x 0.40	32.20
UV Stablized			
3 x 1.5	5EMV 3015	30 x 0.25	8.4
3 x 2.5	5EMV 3025	50 x 0.25	9.9
4 x 1.5	5EMV 4015	30 x 0.25	9.7

DESIGN

Electromagnetic compatibility (EMC) is the ability of electrical or electronic equipment to function normally in an environment without being affected by electromagnetic (EMI) and radio frequency interferences (RFI) or in turn disturbing the environment by transmitting EMI or RFI.

VOLTAGE RATING

- Rated AC voltage: *Uo/U* = 0.6kV/1kV

Nominal cable diameter	Min bending radii when STATIONARY	Min bending radii when IN MOTION	Approx. net cable weight	Unenclosed Touching 
mm	mm	mm	kg/km	A
10.5	54.0	105	173	19
12.0	62.5	120	240	26
10.5	69.0	90	203	19
12.6	100.0	126	289	26
14.7	110.0	147	373	34
16.8	140.0	166	532	43
19.0	158.0	186	720	61
23.00	184.0	207	1006	81
26.00	208.0	247	1454	108
33.00	264.0	313	2085	135
37.00	296.0	350	2980	170
10.5	54.0	105	173	19
12.0	62.5	120	240	26
10.5	69.0	90	203	19

EMC CABLE GLANDS



EMC Cable Glands from Siemens are the perfect complement to PROTOFLEX-EMV screen cables providing an efficient shield connection that meets the requirements of both AS/NZS CISPR-11 and EN 55011.

Consisting of a few components they are quick and easy to install. Tightening the pressure nut causes the insert to press against two taper rings which, in turn, press on an endless spring washer, making its diameter taper, thus permanently bonding the screen braid of the threaded cable. The result is a low resistance connection between the cable screen and the housing of the electrical equipment via the gland body.

In order to conform with the radio interference suppression requirements set forth in EN 55011, the shield must be connected around its entire circumference and over an ample surface area at both ends of the cable.

ADVANTAGES

- Easily assembled
- 360° bonding on screen
- Large sealing ranges
- IP68
- High attenuation
- Sheath can still be continued on into the equipment housing

THE EARTHING PROBLEM

The paint on cubicles and equipment housings has to be removed so the metal gland body is in direct contact with the bare metal of the equipment to ensure the earth bonding circuit is compliant.

THE SOLUTION

The 6 teeth of the lock nut are for equipotential bonding and scrape into the insulating layers of paint or powder to create a vibration-resistant contact.

- No surface corrosion
- Very low-ohm transition; gland/housing
- No need to clean contact surface
- Increases the installed vibration-resistance through frictional connection

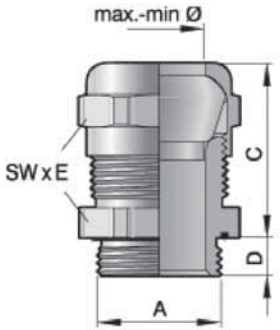
EMC CABLE GLANDS

Cable cross section	Cable part No.	Nominal cable diameter	Approx. diameter over screen	Glands part No.
mm^2		mm	mm	
4 x 1.5	5EMC 4015	11.20	9.70	100210999
4 x 2.5	5EMC 4025	13.30	10.90	100210999
4 x 4	5EMC 4040	15.50	12.25	100210738
3 x 6 + 3 x 1.5	5EMC 4060	17.50	14.00	100206872
3 x 10 + 3 x 1.5	5EMC 4100	19.60	15.80	100206872
3 x 16 + 3 x 2.5	5EMC 4160	23.00	18.80	100206246
3 x 25 + 3 x 4	5EMC 4250	26.00	22.00	100207312
4 x 1.5	5DE6 600	11.00	8.40	100210368
4 x 2.5	5DE6 601	12.50	9.40	100210999
4 x 4	5DE6 602	15.50	11.60	100210738
4 x 6	5DE6 603	17.50	12.80	100210738
4 x 10	5DE6 604	19.50	15.30	100206872
3 x 16 + 3 x 2.5	5DE6 605	21.00	16.20	100206246
3 x 25 + 3 x 4	5DE6 606	24.50	19.80	100207312
3 x 35 + 3 x 6	5DE6 607	28.00	22.50	100208193
3 x 50 + 3 x 10	5DE6 608	33.00	26.70	100208574
3 x 70 + 3 x 10	5DE6 610	37.00	30.60	100209510
3 x 95 + 3 x 16	5DE6 611	42.00	35.10	100209202
3 x 120 + 3 x 16	5DE6 612	46.50	39.60	100209598
3 x 150 + 3 x 25	5DE6 613	51.50	44.30	100209276
3 x 185 + 3 x 35	5DE6 614	57.00	48.90	100210042
3 x 240 + 3 x 42.5	5DE6 615	64.50	55.80	100200893

Connection thread / length	Sealing range		Screen diameter range		Lock nut part No.
mm	Max	Min	Max	Min	
M 25 x 1.5	14.00	10.00	13.50	8.00	100204211
M 25 x 1.5	14.00	10.00	13.50	8.00	100204211
M 25 x 1.5	18.00	14.00	16.50	9.50	100204211
M 25 x 1.5	20.00	17.00	17.50	12.50	100204211
M 25 x 1.5	20.00	17.00	17.50	12.50	100204211
M 32 x 1.5	23.00	19.00	21.00	15.00	100206391
M 32 x 1.5	26.00	22.00	21.00	15.00	100206391
M 20 x 1.5	11.00	8.00	8.50	4.00	100203808
M 25 x 1.5	14.00	10.00	11.50	6.50	100204211
M 25 x 1.5	18.00	14.00	16.50	9.50	100204211
M 25 x 1.5	18.00	14.00	16.50	9.50	100204211
M 25 x 1.5	20.00	17.00	17.50	12.50	100204211
M 32 x 1.5	23.00	19.00	21.00	15.00	100206391
M 32 x 1.5	26.00	22.00	21.00	15.00	100206391
M 40 x 1.5	29.00	25.00	25.00	22.00	100207739
M 40 x 1.5	35.00	30.00	30.50	24.00	100207739
M 50 x 1.5	41.00	37.00	33.00	29.00	100209917
M 63 x 1.5	45.00	40.00	42.00	34.00	100210718
M 63 x 1.5	51.00	45.00	48.00	40.00	100210718
M 75 x 1.5	55.00	51.00	48.00	42.00	100210735
M 75 x 1.5	58.00	54.00	54.00	47.00	100211073
M 80 x 2.0	70.00	63.00	56.00	47.00	100200894



- Highest protection rate IP68 up to 15 bar
- Wide sealing range means one gland body for several cable O.D's
- Highest strain relief (EN 50262 Class B)



Gland selection data based on cable O.D

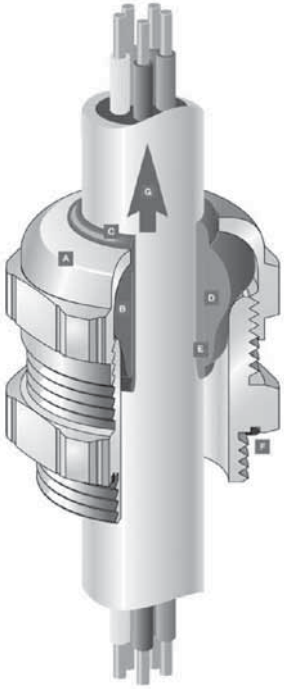
Thread	M12	M16	M20	M25	M32	M40	M50	M63
Cable O.D range mm	2 - 8	4 - 11	5 - 14	11 - 20	15 - 25	20 - 32	31 - 42	41 - 54
Max. strain Class B	75N	120N	130N	140N	250N	350N	350N	400N

Part number and gland dimensions

Brass Nickel Plated	Connection thread/ length mm		Range max/min. ø	Sealing range without insert max/min. ø		Spanner width SW x E
Part No	A	D	mm	mm	C	mm
bg8**12** ms	M12x1,5	15	2 - 8	5 - 8	21	17x18,9
bg8**16** ms	M16x1,5	15	4 - 11	7 - 11	25	20x22,2
bg8**20** ms	M20x1,5	15	5 - 14	9 - 14	29	24x26,5
bg8**25** ms	M25x1,5	15	11 - 20	16 - 20	29	30x33
bg8**32** ms	M32x1,5	15	15 - 25	20 - 25	32	36x39,5
bg8**40** ms	M40x1,5	15	20 - 32	26 - 32	35	45x48
bg8**50** ms	M50x1,5	15	31 - 42	35 - 42	35	57x61
bg8**63** ms	M63x1,5	15	41 - 54	46 - 54	38	68x74

*blue*globe® CABLE GLANDS

KEY BENEFITS



A **blueglobe ® Gland body**
Brass nickel plated & metric thread

B **Temperature range**
-40°C up to +130°C
Sealing insert
Blue elastic TPE
High UV-stability
Halogen and plasticiser free

C **Highest IP rating**
Up to 15 bar and above at IP 68

D **Symmetric radial design**
Patented "globe" sealing system
Large surface area with elastic sealing
Zero cable damage from notching or strangling
No insert folding with small cable O.D's

E **Removable insert**

F **Connection thread**
O-ring groove with O-ring in flange surface
Metric connection thread

G **Strain relief**
Highest strain relief in accordance with EN 50262 Class B

INSTALLATION INSTRUCTIONS

Small cable diameter





Insert cable with IP 68 Installations globemarker on the outside.... or remove the marker.

INSTALLATION INSTRUCTIONS

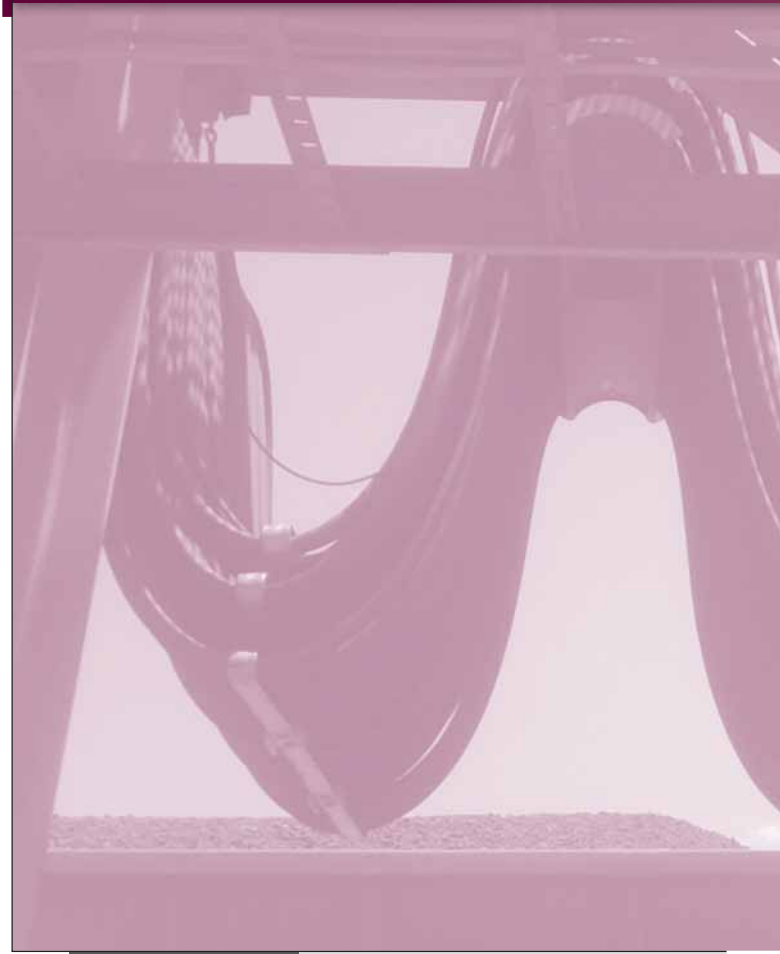
Large cable diameter





For a larger cable diameter remove the insert by inserting a screw driver into the seam... and lift out the insert.

SECTION 4

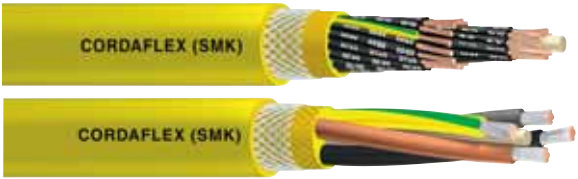


CRANE, REELING AND HOIST CABLES

CORDAFLEX (SMK)	5DH3	PAGE 148
RONDOFLEX	5DG6	PAGE 160
RONDOFLEX (C) – FC	5DG6	PAGE 166
RONDOFLEX-CHAIN	5DG4	PAGE 172
PLANOFLEX	5DG5	PAGE 184
OPTOFLEX (M)	5DG8	PAGE 196
OPTOFLEX (F.O)	5DG8	PAGE 200
SPREADERFLEX	5DE5	PAGE 204
PENDANTFLEX	5DE5	PAGE 208

CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

Flexible reeling and crane cables



APPLICATIONS

CORDAFLEX (SMK) cables are specifically designed to withstand high and **very high mechanical stresses** associated with **cable reelers, festoon systems** and **force guided applications** where high dynamic and static forces are induced into the cable.

CORDAFLEX (SMK) is designed for all types of mobile equipment such as ship loaders, gantry cranes, stackers and reclaimers, inclinators, hoists, spreader and magnet cranes, in steelworks, smelters and sub-zero environments.



CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

- selection table -

Cable Type	Application					
	Festoon System	Spring reeler without guides	Motor driven reeler without cable guide	Mono-spiral with multiroller guides	Drum reeler force guided	Reeler for vertical cable run
						
CORDAFLEX SMK max = 30 N/mm²	M	M	M	M	M	M

M = Main field of application

DESIGN

CORDAFLEX (SMK) cables consist of extra finely stranded tinned copper conductors with a short length of lay to provide an extremely flexible conductor assembly with greater mechanical strength.

Designed in accordance with the Australian Standards, AS/NZS 5000-1, AS 3191 and AS/NZS 3008.1.1.2009.

Type	CORDAFLEX (SMK)
Conductor (refer also to DIN VDE 0295	Electrolytic copper tinned, very finely stranded class "F"
Conductor (refer also to DIN VDE 0207, Part 20)	PROTOLON MS Newly developed special compound based on high-quality EPR (at least 3GI3); improved mechanical and electrical characteristics
Shield for individually shielded cores and twisted and shielded	Braid screen made of tinned copper wires. Transfer impedance optimized at 30 MHz Surface covered: at least 60% for shielded cores at least 80% for twisted and shielded pairs
Core identification	Optimal identification as a result of light insulation with numbers printed in black for power and control cables, protective-earth conductor green-yellow
Core arrangement	Laid-up in a maximum of 3 layers, Length of lay 5 x D (core diameter)
Support element	Central aramide support element to increase the loading capability for special designs; the kN value designates the breaking load of the support element.
Sheath System	**PROTOFIRM special: First sheath** Newly developed special compound based on PCP, colour: yellow **Anti-torsion braid** Reinforced braid made of polyester threads, in a vulcanized bond between the sheaths. Resulting in a high strength of the sheath system. **PROTOFIRM: Third sheath** A sheath system with a unique combination of flexibility and robustness has been achieved through the use of a new structure. Abrasion and tear-proof special rubber compound based on PCP, colour: yellow. PROTOFIRM sandwich construction (2 sheaths) for wall thickness 3mm and more. Refer also to PROTOLON (SMK)
Marking	CORDAFLEX (SMK) (N)SHTÖU-J/-O (number of cores) x (cross section)

THERMAL PARAMETERS

- Ambient temperature
  - Fully flexible operation: -35°C to +80°C
  - Fixed installaton: -50°C to +80°C
- Maximum permissible operating temperature of the conductor: 90°C
- Short-circuit temperature of the conductor: 250°C SMK
- Short-circuit temperature of the conductor: 200°C SMK-V

MECHANICAL PARAMETERS

In all cases, the cable reeler manufacturer should be consulted.

- Tensile load: Up to 30 N/mm^2
- Torsional stresses: $\pm$ 50°/m
- Min. distance with S-type directional changes: 20 x D

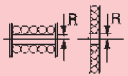
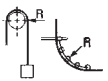
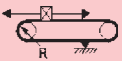
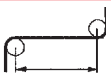
MINIMUM BENDING RADII

If the bending radii are smaller than those permitted, a reduced service life can be expected depending on the stress conditions. The values given in the following table should be taken as a basis.

The minimum bending radii are shown as the product of the overall diameter of the cable and a factor, which is dependent on the diameter of the cable (e.g. 3x d).

The minimum permissible bending radii are valid within the specified ambient temperature range (see thermal parameters subject to the provision that the permissible tensile loads are not exceeded .

Minimum bending radii

Flexible Cables		CORDAFLEX, PLANOFLEX, RONDOFLEX, SPREADERFLEX, Lift control cable			
Rated voltage *Uo/U* Up to 0.6/1 kV					
Maximum overall diameter of the cable ormaximium thickness of the flat cable (mm)		Up to 8	Above 8 to 12	Above 12 to 20	Above 20
	Fixed installation	3 x d	3 x d	4 x d	4 x d
	Fully flexible operation	3 x d	4 x d	5 x d	5 x d
	For the entry, e.g. at a centre feed point	3 x d	4 x d	5 x d	5 x d
	For forced guidance with reeling operation	5 x d	5 x d	5 x d	6 x d
	For forced guidance with festoon operation	4 x d	4 x d	5 x d	5 x d
	For forced guidand with power tracks	4 x d	4 x d	5 x d	5 x d
	For forced guidance with sheaves	7.5 x d	7.5 x d	7.5 x d	7.5 x d
	For forced guidance with cable tenders	7.5 x d	7.5 x d	7.5 x d	7.5 x d
	Minimum distance with double or S-type directionalchanges	20 x d	20 x d	20 x d	20 x d

CHEMICAL PARAMETERS

Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and mositure
Water compatibility and resistance to oil	Given and verified in long-term tests

CURRENT CARRYING CAPACITY

If, after all selection criteria have been taken into account, the type of flexible electric cable to be used for cranes and material handling equipment has been decided on, the necessary cross-section of the conductor can be determined either from the current to be transmitted or from the power. Installation conditions (stretched laying, suspended freely in the air, reeled), variations in ambient temperature, grouping, type of operation (continuous duty, intermittent periodic duty) and the use of multi-core cables are to be taken into account.

De-rating factors for varying ambient temperatures

Ambient temperature °C °C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

AS PER AS/NZS 3008.1.1:2009 – 3.5.2.8

Where layers of flexible cables are wound on a cylindrical-type drum or reel, the current-carrying capacity of the cable shall be derated by the appropriate factor, as follows:

Number of layers:	**1**	**2**	**3**	**4**
Derating factor:	**0.85**	**0.65**	**0.45**	**0.32**

TENSILE STRENGTH

CORDAFLEX has a maximum safe reeling tensile strength of 30N/mm^2. This ensures that no conductor deformation will occur in operation. Dynamic tensile stresses such as start-up, braking and centre feed pass-over should be taken into account.

VOLTAGE RATING

■ Rated voltage:	*Uo/U*	=	0.6/1kV
■ Maximum operating voltages in:			
3 phase AC operation	*Uo/U*	=	0.7/1.2kV
DC operation	*Uo/U*	=	0.9/1.8kV
■ AC test voltage			Power cores 3.5kv 5min Control cores 3.5kv 5min

TRAVEL SPEED

At high speeds close attention to other parameters eg bending radii, cable tension and temperature must be adhered to.

■ Gantry (reeling operation)	No restriction. It is recommended to consult the manufacturer for speeds beyond 240m/min
■ Trolley (festoon operation)	Trolley (festoon operation) Up to 240 m/min

VERTICAL SUSPENSION

When CORDAFLEX cables are vertically suspended care must be taken to terminate the cable at the point of suspension. This can be done by either stress relief drums with 21/2 turns of cable around the drum, cable stockings correctly sized for the diameter and weight or cable clamps. CORDAFLEX (SMK) control cables for vertical reeling operations with 20 kN support element.

For CORDAFLEX steel core hangers or rope thimbles should be employed to ensure correct tensile load bearing on the steel support rope. If the cable is to pass or be guided over a roller sheave then this shall be specifically dimensioned for the cable and shall have a minimum bending radius of 18 x cable diameter to distribute the tensile stress and compressive forces over as wide a surface area as possible. The support element must be terminated at the reeler.

Selection and ordering data

Part No.	Number of cores and nominal cross-section mm²	Nominal main conductor diameter mm
Power Cables, Four-core Design		
5DH3 132	4 x 4	3.0
5DH3 133	4 x 6	3.6
5DH3 134	4 x 10	4.6
5DH3 135	4 x 16	5.6
5DH3 136	4 x 25	7.3
Power Cables, Five-core Design		
5DH3 151	5 x 4	3.0
5DH3 152	5 x 6	3.6
5DH3 153	5 x 10	4.6
5DH3 154	5 x 16	5.6
5DH3 155	5 x 25	7.3
Power Cables, Three-core Design with Protective-earth Conductor split into 3		
5DH3 121	3 x 35 + 3 x 16/3	8.4/3.5
5DH3 122	3 x 50 + 3 x 25/3	10.3/4.2
5DH3 123	3 x 70 + 3 x 35/3	12.0/5.0
5DH3 124	3 x 95 + 3 x 50/3	14.0/6.0
5DH3 125	3 x 120 + 3 x 70/3	15.8/7.2
5DH3 126	3 x 150 + 3 x 70/3	17.5/7.2
5DH3 127	3 x 185 + 3 x 95/3	19.4/8.1
5DH3 128	3 x 240 + 3 x 120/3	22.5/9.3
Control Cables for Vertical Reeling Operation, with 20 kN Support Element (SMK-V CONTROL CABLES)		
5DH3 291	49 x 1.0 (20 kN)	1.3
5DH3 295	24 x 2.5 (20 kN)	2.0
5DH3 296	30 x 2.5 (20 kN)	2.0
5DH3 298	44 x 2.5 (20 kN)	2.0
5DH3 290	56 x 2.5 (20 kN)	2.0

Nominal diameter of cable mm	Approx. net cable weight kg/km	Maximum permissible tensile force N
17.0	455	480
18.4	575	720
22.6	905	1200
25.2	1240	1920
30.0	1850	3000
18.4	430	600
20.0	690	900
24.4	1080	1500
27.6	1500	2400
35.1	2350	3750
30.0	2160	3150
36.0	2850	4500
41.2	3920	6300
45.8	4960	8550
53.0	6630	10800
55.9	7560	13500
60.9	9310	16650
69.4	12200	21600
28.0	1260	3200
27.7	1340	3600
30.9	1680	4100
35.6	2280	5100
41.6	3030	6000

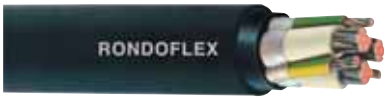
Selection and ordering data

Part No.	Number of cores and nominal cross-section mm^2	Nominal main conductor diameter mm
Control Cables		
5DH3 130	4 x 1.5	1.6
5DH3 140	5 x 1.5	1.6
5DH3 142	7 x 1.5	1.6
5DH3 161	12 x 1.5	1.6
5DH3 162	18 x 1.5	1.6
5DH3 163	24 x 1.5	1.6
5DH3 164	30 x 1.5	1.6
5DH3 165	36 x 1.5	1.6
5DH3 166	44 x 1.5	1.6
5DH3 167	56 x 1.5	1.6
5DH3 111	3 x 2.5	2.0
5DH3 131	4 x 2.5	2.0
5DH3 141	5 x 2.5	2.0
5DH3 143	7 x 2.5	2.0
5DH3 171	12 x 2.5	2.0
5DH3 172	18 x 2.5	2.0
5DH3 173	24 x 2.5	2.0
5DH3 174	30 x 2.5	2.0
5DH3 175	36 x 2.5	2.0
5DH3 176	44 x 2.5	2.0
5DH3 177	56 x 2.5	2.0
Bus Cables		
5DH3 186	3 x (2 x 1)C	1.3
5DH3 187	6 x (2 x 0.5)C	0.9
5DH3 188	6 x (2 x 1)C	1.3
5DH3 206	12 x (2 x 1)C	1.3
5DH3 183	12 x 1(C)	1.3
Combined Control Cables		
5DH3 184	12 x 2.5 + 12 x 1 (C)	2.0/1.3
5DH3 180	19 x 2.5 + 5 x 1 (C)	2.0/1.3
5DH3 181	25 x 2.5 + 5 x 1 (C)	2.0/1.3

Nominal diameter of cable mm	Approx. net cable weight kg/km	Maximum permissible tensile force N
13.0	240	180
13.8	280	225
16.2	385	315
22.4	710	540
22.3	760	810
25.3	990	1080
28.1	1220	1350
28.0	1260	1620
31.0	1530	1980
36.4	2050	2520
13.5	280	225
14.0	305	300
15.0	355	375
17.6	510	525
24.4	920	900
24.3	1005	1350
27.7	1320	1800
30.9	1660	2250
31.8	1720	2700
35.6	2230	3300
41.6	2940	4200
23.0	755	180
24.1	885	360
30.4	1330	360
39.1	2170	720
24.4	865	360
27.7	1230	900
27.7	1290	1575
30.9	1620	2025

RONDOFLEX – Round festoon cable

Rubber sheathed festoon cable



APPLICATION

Flexible power and control cable, for use on festoon systems machine tools, material handling equipment, associated with high mechanical stresses and frequent bending during operation, also suitable for light duty reeling applications.

DESIGN

RONDOFLEX cables consist of electrolytic copper, tinned finely stranded conductors. The insulation is a PROTOLON MS which is a newly developed special compound based on high quality EPR which provides improved mechanical and electrical characteristics. For individually shielded cores and twisted and shielded pairs the overall braided screen consists of tinned copper wires. The transfer impedance is optimised at 30 MHz and the surface area covered is approx 60% for shielded cores and 80% for twisted and shielded pairs. The inner sheath is EPR, the outer sheath is PCP. RONDOFLEX remains flexible at sub zero temperatures and high ambient temperatures. The construction is in accordance with the Australian Standards AS/NZS 1125, AS/NZS 5000.1, AS/NZS 3191.

CHEMICAL PARAMETERS

Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture
Water compatibility and resistance to oil	Given and verified in long-term tests

ELECTRICAL PARAMETERS

■ Rated voltage	*Uo/U*	= 0.6/1kV
■ Max permissible operating voltage in AC systems	*Uo/U*	= 0.7/1.2kV
voltage in DC systems	*Uo/U*	= 0.9/1.8kV
■ AC test voltage		2.5 kV over 5 min

THERMAL PARAMETERS

■ Ambient temperature	
Fully flexible operation	-35°C to +80°C
Fixed installation	-50°C to +80°C
■ Max permissible operating temperature of the conductor	90°C
■ Short-circuit temperature of the conductor	250°C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

De-rating factors for varying ambient temperatures

Ambient temperature °C													
°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

MECHANICAL PARAMETERS

Tensile load	Up to 15 N/mm^2
Torsional stresses	± 25°/m
Minimum bending radii	See min bending radii at start of Corda flex SMK chapter
Minimum distance for S-type directional changes	20 X D

Travel speed

- Gantry (reeling operation) 60 m/min
- Trolley (festoon system) up to 240 m/min
- For speeds above 240m/min consult the manufacturer

CORE COLOUR INDENTIFICATION

Control and power conductors are light coloured with numbers printed in black for easy indentification and include a **green/yellow** earth conductor.

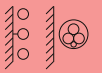
Selection and ordering data

	Number of cores & nominal area mm²	Part No.
Power cables SINGLE-CORE DESIGN	1 x 25	5DG6 610
	1 x 35	5DG6 611
	1 x 50	5DG6 612
	1 x 70	5DG6 613
	1 x 95	5DG6 614
	1 x 120	5DG6 615
	1 x 150	5DG6 616
	1 x 185	5DG6 617
Power cables FOUR AND FIVE-CORE DESIGN	4 x 2.5	5DG6 664
	4 x 4	5DG6 642
	4 x 6	5DG6 643
	4 x 10	5DG6 644
	4 x 16	5DG6 645
	4 x 25	5DG6 646
	4 x 35	5DG6 647
	4 x 50	5DG6 648
	5 x 4	5DG6 652
	5 x 6	5DG6 653
	5 x 10	5DG6 654
	5 x 16	5DG6 655
	5 x 25	5DG6 656

CORE ARRANGEMENT

Laid-up in a maximum of 3 layers.
Length of lay 10 x D.

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal conductor diameter	Nominal cable diameter	Approx. net cable weight	Maximum permissible tensile force	Unenclosed Spaced 
mm	mm	kg/km	N m	A
6.8	12.0	330	375	142
8.1	13.1	430	525	177
9.6	15.8	625	750	223
11.2	17.5	835	1050	283
13.2	19.9	1070	1425	341
14.9	21.8	1340	1800	406
16.6	23.9	1650	2250	470
18.0	26.3	2010	2775	540
2.0	13.5	300	150	27
3.0	14.7	350	240	36
3.2	16.9	475	360	46
4.2	19.2	680	600	66
5.7	23.9	1070	960	87
6.8	28.4	1600	1500	116
8.1	31.6	2090	2100	144
9.6	37.2	2970	3000	182
3.0	16.7	450	300	36
3.2	18.5	575	450	46
4.2	21.8	865	750	66
5.7	26.1	1300	1200	87
6.8	31.0	1940	1875	116

Selection and ordering data

	Number of cores & nominal area mm²	Part No.
Power cables Three-core design with protective-earth conductor split into 3	3 x 35 + 3 x 16/3	5DG6 631
	3 x 50 + 3 x 25/3	5DG6 632
	3 x 70 + 3 x 35/3	5DG6 633
Control cables	12 x 1.5	5DG6 662
	18 x 1.5	5DG6 663
	24 x 1.5	5DG6 664
	30 x 1.5	5DG6 665
	36 x 1.5	5DG6 666
	12 x 2.5	5DG6 672
	18 x 2.5	5DG6 673
	24 x 2.5	5DG6 674
	30 x 2.5	5DG6 675
	36 x 2.5	5DG6 676
Bus cables	3 x (2 x 1) C	5DG6 891
	6 x (2 x 0.5)	5DG6 693
	6 x (2 x 1) C	5DG6 694
	9 x (2 x 0.5) C	5DG6 691
	9 x (2 x 1) C	5DG6 692
	12 x 1(C)	5DG6 681
	12 x (2 x 0.5) C	5DG6 521

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal conductor diameter	Nominal cable diameter	Approx. net cable weight	Maximum permissible tensile force	Unenclosed Spaced 
mm	mm	kg/km	N m	A
8.1	29.2	1800	1575	144
9.7	34.0	2540	2250	182
11.2	40.6	3570	3150	230
1.6	17.2	440	270	20
1.6	19.7	615	405	20
1.6	23.1	805	540	20
1.6	24.3	930	675	20
1.6	26.1	1090	810	20
2.0	18.9	580	450	27
2.0	22.5	865	675	27
2.0	25.5	1110	900	27
2.0	27.9	1330	1125	27
2.0	29.9	1550	1350	27
1.3	21.8	685	90	16
0.9	23.6	850	90	12
1.3	29.6	1250	80	16
0.9	29.8	1340	135	12
1.3	37.4	2010	270	16
1.3	19.0	590	180	16
0.9	31.6	1540	360	12

RONDOFLEX (C) – FC OVERALL SCREENED

Shielded EMC Festoon Power Cables



APPLICATION

For use on festoon systems, eg, on gantry cranes, hall gantry cranes, rack material handling equipment, transportation systems or machine tools, in particular for applications where there is a danger of interference to data transmission systems from power cables. The cables are used for high mechanical stresses and frequent bending, also suitable for use as a flexible motor power supply cable.

DESIGN

The RONDOFLEX (C) – FC cable consists of electrolytic copper, thinned finely stranded conductors. The insulation is a PROTOLON MS which is a newly developed special compound based on high quality EPR providing improved mechanical and electrical characteristics. The overall braid screen is made of tinned copper wires with a surface coverage of greather than 80%. The inner sheath is SBR, the black outer sheath is PCP allowing it to remain flexible at sub zero temperatures and also withstand extremely high ambients. The construction is in accordance with the Australian Standards AS/NZS 5000-1, AS3191 and VDE certificate with VDE Reg No. 9809.

CHEMICAL PARAMETERS

Weather resistance	Unrestricted use outdoors and indoors, resistant to ozone, UV and moisture
Water compatibility and resistance to oil	Given and verified in long-term tests

ELECTRICAL PARAMETERS

- Rated voltage *Uo/U* = 0.6/1kV
- Max permissible operating
  voltage in AC systems *Uo/U* = 0.7/1.2kV
  voltage in DC systems *Uo/U* = 0.9/1.8kV
- AC test voltage 5kV over 5 min
- For connection on frequency converters *Umax* 690V

THERMAL PARAMETERS

- Ambient temperature
  Fully flexible operation -35°C to +80°C
  Fixed installation -50°C to +80°C
- Max permissible operating temperature of the conductor 90°C
- Short-circuit temperature of the conductor 250°C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

MECHANICAL PARAMETERS

Tensile load	Up to 15 N/mm^2
Torsional stresses	No application
Minimum bending radii	See min bending radii at start of Corda flex SMK chapterTravel speed

- Gantry (reeling operation) 60 m/min
- Trolley (festoon system) – up to 240 m/min, the travel speed is determined by a number of factors and can thus not be precisely defined. Influence factors are, eg, space requirement, cable weight, loop sag, number of the festoon systems etc.
- For speeds above 240 m/min consult the manufacturer.

CORE COLOUR IDENTIFICATION

Black, blue, brown with **green/yellow** earth conductor.

Selection and ordering data

Number of cores & nominal cross-section	Part No.	Shield cross-section diameter	Nominal conductor of cable
mm²	mm²	mm	
4x4	**5DG6 682**	8.0	2.45
4x6	**5DG6 683**	10.7	2.93
4x10	**5DG6 684**	12.7	3.90
3x16+3x2,5	**5DG6 685**	13.3	5.72
3x25+3x4	**5DG6 686**	15.9	6.75
3x35+3x6	**5DG6 687**	21.4	8.05
3x50+3x10	**5DG6 688**	24.9	9.60
3x70+3x10	**5DG6 690**	29.8	11.50
3x95+3x16	**5DG6 679**	36.9	14.00
3x120+3x16	**5DG6 680**	45.9	15.80
3x150+3x25	**5DG6 650**	53.3	17.80

CORE ARRANGEMENT

Three main conductors laid-up (10 x D) with protective-earth conductor split into 3 in the outer filler

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal diameter	Approx. net weight	Maximum permissible tensile force	Unenclosed Spaced 
mm	kg/km	N	A
16.3	485	240	36
18.7	700	300	46
21.2	925	600	66
23.7	1150	720	87
26.8	1610	1125	116
30.8	2160	1575	144
36.5	3090	2250	182
42.4	4100	3150	230
45.7	5040	4275	275
50.2	5900	5400	327
56.1	7620	6750	375

Selection and ordering data

Number of cores & nominal cross-section mm^2	Part No.	Conductor resistor at 20°C Ω/km	Inductance (core/core) at 10 kHz μ Henry/km
4x4	5DG6 682	4.95	550
4x6	5DG6 683	3.30	530
4x10	5DG6 684	1.91	510
3x16+3x2,5	5DG6 685	1.21	480
3x25+3x4	5DG6 686	0.78	450
3x35+3x6	5DG6 687	0.55	430
3x50+3x10	5DG6 688	0.39	410
3x70+3x10	5DG6 690	0.27	390
3x95+3x16	5DG6 679	0.21	375
3X120+3X16	5DG6 680	0.16	360

Current ratings are based on AS/NZS 3008.1.1:2009.

Capacitance	Transfer impedance		
(core/shield) at 1 kHz n Farrads/km	at 1 MHz mΩ/m	at 10 MHz mΩ/m	at 30 MHz mΩ/m
180	follows	follows	follows
190	follows	follows	follows
230	0.4	1.3	3.5
225	0.2	0.6	1.5
275	0.2	0.4	1.3
325	0.1	0.4	0.9
400	0.1	0.2	0.7
475	0.1	0.2	0.5
600	0.1	0.2	0.4
700	0.1	0.1	0.3

RONDOFLEX-CHAIN

High Flexible Cable for Energy Chain Systems



APPLICATION

All chain systems (e.g. container cranes, stacking cranes, indoor cranes, material-handling equipment). Specifically designed for outdoor energy chain applications with long travel distances at high travel speeds. Key benefits are reliability, abrasion resistance and a long lifetime.

DESIGN

The power and control conductors in RONDOFLEX (CHAIN) cables consist of Class 5 finely stranded electrolytic copper. The earth conductors consist of very finely stranded electrolytic copper exceeding Class 5. The insulation compound is Protolon MS (refer also DIN VDE 0207) which is a high grade insulation compound based on EPR (at least. 3GI3) with improved mechanical and electrical performance; alternative for control cables: ETFE. The inner sheath is a black special compound based on EPR GM1b. The overall shield consists of a tinned copper wire braided screen with greater than 80% coverage. The outer sheath is a high grade compound based on EVA with excellent abrasion and aging characteristics. Core identification is a light coloured compound with black number prints, yellow-green earth.

CHEMICAL PARAMETERS

Weather resistance	Unrestricted use indoors and outdoors, resistant to ozone, UV and moisture.
Water compatibility and resistance to oil	Given and verified in long-term tests

ELECTRICAL PARAMETERS

■ Rated voltage	*Uo/U*	= 0.6/1kV
■ Max permissible operating voltage in AC systems	*Uo/U*	= 0.7/1.2kV
voltage in DC systems	*Uo/U*	= 0.9/1.8kV
■ AC test voltage		3.5 kV over 5 min

THERMAL PARAMETERS

Ambient temperature

■ Fully flexible operation	-35°C to +80°C
■ Fixed installation	-50°C to +80°C
Max permissible operating temperature of the conductor	90°C
Short-circuit temperature of the conductor	250°C

MECHANICAL PARAMETERS

Tensile load	Up to 15 N/mm^2
Torsional stresses	No application
Minimum bending radii	See min bending radii at start of Corda flex SMK chapterTravel speed
Travel speed	
■ Trolley	As a guide up to 300 m/min as tested on factory test rig
■ Other	As per all other recommended chain application speeds

TRAVEL SPEED

Trolley	As a guide up to 300 m/min as tested on factory test rig.
Other	As per all other recommended chain application speeds.

CORE COLOUR INDENTIFICATION

Control and power conductors are light coloured with numbers printed in black for easy indentification and include a **green/yellow** earth conductor.

Selection and ordering data

	Number of cores & nominal cross-section	Part No.	Nomial conductor diameter
	mm²		mm
Power cable single core design	1x16	5DG4 011	5.7
	1x25	5DG4 012	7.1
	1x35	5DG4 013	8.3
	1x50	5DG4 014	9.8
	1x70	5DG4 015	11.6
	1x95	5DG4 016	13.8
	1x120	5DG4 017	14.9
	1x150	5DG4 018	17.2
	1x185	5DG4 019	18.0
	1x240	5DG4 020	22.5

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal cable diameter	Approx. net cable weight	Maximum permissible tensile force	Unenclosed Spaced 	Unenclosed Touching 
mm	kg/km	N	A	A
8.7	210	240	106	87
11.6	325	375	142	116
13.1	445	525	177	144
14.9	605	750	223	182
16.9	830	1050	283	230
20.1	1120	1425	341	275
21.8	1390	1800	406	327
24.5	1740	2250	470	375
27.3	2130	2775	540	428
31.4	2830	3600	651	511

Selection and ordering data

	Number of cores & nominal cross-section	Part No.	Nomial conductor diameter
	mm²		mm
Power cable, single core design, screened	1x16C	5DG4 211	5.7
	1x25C	5DG4 212	7.1
	1x35C	5DG4 213	8.3
	1x50C	5DG4 214	9.8
	1x70C	5DG4 215	11.6
	1x95C	5DG4 216	13.8
	1x120C	5DG4 217	14.9
	1x150C	5DG4 218	17.2
	1x185C	5DG4 219	18.0
	1x240C	5DG4 220	22.5
Power cable, 3/4 – core design	4x4	5DG4 111	2.9
	4x6	5DG4 112	3.6
	4x10	5DG4 113	4.6
	4x16	5DG4 114	5.9
	4x25	5DG4 115	7.2
	3x35+3x16/3	5DG4 116	8.1
	3x50+3x25/3	5DG4 117	10.0

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal cable diameter	Approx. net cable weight	Maximum permissible tensile force	Unenclosed Spaced 	Unenclosed Touching 
mm	kg/km	N	A	A
11.0	320	240	106	85
13.8	450	375	142	114
14.9	555	525	177	141
16.7	745	750	223	178
19.7	1090	1050	283	225
21.8	1330	1425	341	271
23.8	1580	1800	406	322
27.1	2000	2250	470	372
29.3	2330	2775	540	427
33.4	3130	3600	651	514
13.7	325	240	36	34
15.2	435	360	46	43
17.6	650	600	66	61
21.0	960	960	87	81
27.4	1580	1500	116	108
28.2	1770	1575	144	135
33.0	2510	2250	182	170

Selection and ordering data

	Number of cores & nominal cross-section	Part No.	Nomial conductor diameter
	mm²		mm
Power cable, 3/4/5 – core design overall screened	4x2,5C	5DG4 240	1.9
	4x4C	5DG4 241	2.9
	4x6C	5DG4 242	3.6
	4x10C	5DG4 243	4.6
	3x16+3x2,5C	5DG4 254	5.9
	3x25+3x4C	5DG4 255	7.2
	3x35+3x6C	5DG4 256	8.1
	3x50+3x10C	5DG4 257	10.0
	3x70+3x10C	5DG4 258	11.8
	5x16C	5DG4 264	5.9
Power cable, 5/7 – core design	7x4	5DG4 171	2.9
	5x6	5DG4 122	3.6
	5x10	5DG4 123	4.6
	5x16	5DG4 124	5.9

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal cable diameter	Approx. net cable weight	Maximum permissible tensile force	Unenclosed Spaced 	Unenclosed Touching 
mm	kg/km	N	A	A
12.3	390	150	27	26
16.7	505	240	36	34
18.0	650	360	46	43
20.7	930	600	66	61
21.4	1070	720	87	81
27.3	1810	1125	116	108
30.1	2220	1575	144	135
36.5	3090	2250	182	170
41.3	4100	3150	230	214
26.7	1610	1200	87	81
17.7	535	420	36	34
16.8	535	450	46	43
20.7	850	750	66	61
23.8	1220	1200	87	81

Selection and ordering data

	Number of cores & nominal cross-section	Part No.	Nomial conductor diameter
	mm²		mm
Control cable, overall screened	12x1.5C	5DG4 252	1.5
	5x2.5C	5DG4 260	1.9
Control cable	12x1.5	5DG4 152	1.5
	24x1.5	5DG4 154	1.5
	7x2.5	5DG4 141	1.9
	12x2.5	5DG4 190	1.9
	18x2.5	5DG4 191	1.9
	24x2.5	5DG4 192	1.9

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal cable diameter	Approx. net cable weight	Maximum permissible tensile force	Unenclosed Spaced 	Unenclosed Touching 
mm	kg/km	N	A	A
15.7	440	270	20	19
13.7	435	188	27	26
12.7	305	270	20	19
18.1	705	540	20	19
12.3	290	263	27	26
14.6	485	450	27	26
17.9	760	675	27	26
23.5	1010	900	27	26

Selection and ordering data

	Number of cores & nominal cross-section	Part No.
Fibre optic cable	6xG62,5/125µ	5DG4 290
	12xG62,5/125µ	5DG4 291
	6xE9/125µ	5DG4 292
Bus cable	1x(2x0.5)C	5DG4 ---
	4x(2x0.5)C	5DG4 280
	(4x2x0.5)C	5DG4 ---
	6x(2x0.5)C	5DG4 ---
	6x(2x1)C	5DG4 ---

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal Conductor diameter	Nominal diameter cable	Approx. net cable weight	Maximum permissible tensile force
mm	mm	kg/km	N
NA	15	260	500
NA	15	260	500
NA	15	260	500
0.9	9.0	135	15
0.9	20.0	625	60
0.9	20.2	605	60
0.9	21.2	730	90
1.3	27.8	1120	180

PLANOFLEX

Flat festoon crane cables





APPLICATION

- Festoon gantry cranes
- Wharf & port facilities
- Mine sites & cold stores
- Container cranes
- Timber & refuse cranes
- Rubber tyred gantries
- Trippers
- Steelworks & ladle cranes
- Suitable for submersible application

Flexible power and control cable, for use on festoon systems and for connecting moveable parts of machine tools, material handling equipment, etc., associated with high mechanical stresses and frequent bending during operation and for bending in one plane only.

DESIGN

PLANOFLEX cables consist of extra finely stranded copper conductors with a short length of lay to provide a high degree of flexibility.

Up to 25mm^2 class 6 conductors greater than 25mm^2, class 5 conductor.

PROTOLON elastomer R-EP-90 insulation provides improved current carrying capacities and the cable is sheathed overall with HD-PCP-90 Polychloroprene which is oil resistant and flame retardant, remaining flexible at sub-zero temperatures, and withstands high ambient tempretures. Designed in accordance with the Australian Standards AS 5000.1, AS/NZS 5000-1, AS/NZS 3191 and AS/NZS 3008.1.1:2009.

OPERATING TEMPERATURE

- Ambient temperature
  - Fully flexible operation 35°C to +80°C
  - Fixed installation 50°C to +80°C
- Maximum permissible conductor temperature 90°C
- Maximum permissible short circuit temperature 250°C
- Minimum ambient temperature for optimum fully flexible operation -35°C

MINIMUM BENDING RADII

The recommended minimum bending radii is dependent on the cable thickness and should be observed to ensure operating reliability.

Cables up to **8mm** diameter thickness **MIN 3 x cable diameter**

Cables up to **12mm** diameter thickness **MIN 4 x cable diameter**

Cables up to **12mm** diameter thickness **MIN 5 x cable diameters**

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

De-rating factors for varying ambient temperatures

Ambient temperature °C °C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2.

This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated voltage:
  - (multicore control) *Uo/U* = 380/660V
  - (power) *Uo/U* = 0.6/1kV
- AC test voltage = 2.5kV, 5 min

* The cable is designated 300/500V in accordance with VDE/IEC, and compliant to the Australian Standard AS/NZS 5000-1 for the stated voltage ratings.

SCREENED CONTROL/DATA CORES

Individually screened and twisted screened pair constructions have been developed to enable interference free data/PLC transmission. Screens consist of tinned copper wire braid with 95% coverage with an extruded polymer skin to bond the screen to the insulation and enable greater internal screen protection. Attenuation data for these screened cores at various transmission rates is listed in tables 6.8 and 6.9 at the end of the catalogue.

CORE COLOUR IDENTIFICATION

Control cables (up to incl. 2.5mm2)	–	black cores sequentially numbered, including a **green/yellow earth**
4 Core	–	blue, brown, black and **green/yellow**
7 Core	–	black cores sequentially numbered, including a **green/yellow** earth core

NOTES

The 7 core design permits two three phase supplies to be incorporated within a single cable, each circuit sharing the full size earth.

For the system design the length of cable required for a festoon is approximately +10% on the total trolley length.

For large or fast moving systems the stronger power cables should have a shorter loop depth than the lighter control cables. These types of festoons must always be fitted with tow ropes to limit whiplash and conductor stress on acceleration and braking.

Selection and ordering data

	Number of cores x conductor size	Part No.	Nominal diameter of conductor
	mm^2		mm
PLANOFLEX Control Cable	3 x 1.5	5DG5 751	1.5
	4 x 1.5	5DG5 711	1.5
	5 x 1.5	5DG5 712	1.5
	7 x 1.5	5DG5 714	1.5
	8 x 1.5	5DG5 715	1.5
	10 x 1.5	5DG5 717	1.5
	12 x 1.5	5DG5 718	1.5
	24 x 1.5	5DG5 720	1.5
	4 x 2.5	5DG5 721	2.0
	5 x 2.5	5DG5 722	2.0
	7 x 2.5	5DG5 724	2.0
	8 x 2.5	5DG5 725	2.0
	10 x 2.5	5DG5 727	2.0
	12 x 2.5	5DG5 728	2.0
	24 x 2.5	5DG5 730	2.0

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal overall cable dimension Thickness x Width	Approx. net cable weight	Max permissile tensile force	Unenclosed Spaced 
mm	kg/km	N	A
6.2 x 17.0	126	68	20
5.7 x 15.8	171	90	20
6.2 x 17.0	214	113	20
5.7 x 25.8	292	158	20
5.7 x 29.0	325	180	20
6.4 x 37.0	455	225	20
6.4 x 43.0	550	270	20
12.5 x 53.0	1050	540	20
7.2 x 20.3	257	150	27
7.8 x 21.5	332	188	27
7.2 x 33.8	454	263	27
7.2 x 37.5	510	300	27
7.8 x 39.5	660	375	27
7.8 x 56.0	810	450	27
16.0 x 69.0	1730	900	27

Selection and ordering data

	Number of cores x conductor size	Part No.	Nominal diameter of conductor
	mm^2		mm
PLANOFLEX Power Cable	4 x 4	5DG5 731	2.8
	4 x 6	5DG5 741	3.5
	4 x 10	5DG5 765	4.5
	4 x 16	5DG5 766	5.6
	4 x 25	5DG5 767	6.6
	4 x 35	5DG5 768	8.1
	4 x 50	5DG5 770	9.7
	4 x 70	5DG5 771	11.2
	4 x 95	5DG5 772	13.1
	4 x 120	5DG5 773	15.0
	5 x 4	5DG5 732	2.8
	5 x 6	5DG5 742	3.5
	5 x 10	5DG5 687	4.5
	5 x 16	5DG5 776	5.6

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal overall cable dimension Thickness x Width	Approx. net cable weight	Max permissile tensile force	Unenclosed Spaced 
mm	kg/km	N	A
8.7 x 24.5	402	240	36
9.4 x 27.0	510	360	46
11.0 x 38.3	770	600	66
13.0 x 39.0	1160	960	87
14.8 x 46.8	1560	1500	116
17.0 x 54.0	2100	2100	144
19.8 x 62.8	2930	3000	182
22.3 x 72.0	3910	4020	230
25.0 x 81.8	5120	5700	275
25.6 x 81.2	6110	7200	327
8.8 x 30.0	510	300	36
9.4 x 35.5	640	450	46
10.9 x 40.2	960	750	66
12.4 x 46.4	1370	1200	87

Selection and ordering data



	Number of cores x conductor size mm²	Part No.	Nominal diameter of conductor mm
PLANOFLEX 7 Core Cable	7 x 4	5DG5 734	2.8
	7 x 6	5DG5 744	3.5
	7 x 10	5DG5 865	4.5
	7 x 16	5DG5 866	5.6
	7 x 25	5DG5 867	6.6
	7 x 35	5DG5 868	8.1



Controled Cables with individually shielded cores	4 x 1 (c)	5DG5 673	1.3
	12 x 1 (c)	5DG5 670	1.3
	4 x 1.5 (c)	5DG5 880	1.5
	8 x 1.5 (c)	5DG5 884	1.5
	12 x 1.5 (c)	5DG5 888	1.5

(c) indicates individually screened cores or twisted screened pairs

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal overall cable dimension Thickness x Width	Approx. net cable weight	Max permissile tensile force	Unenclosed Spaced 
mm	kg/km	N	A
8.7 x 40.0	720	420	36
9.4 x 44.8	910	630	46
11.5 x 56.3	1370	1050	66
13.5 x 67.6	1990	1680	87
16.0 x 80.5	2730	2625	116
17.5 x 91.8	3820	3675	144
5.7 x 16.8	150	120	16
6.9 x 49.9	653	180	16
7.2 x 19.0	250	90	20
7.2 x 36.5	510	180	20
7.8 x 54.0	820	270	20

Selection and ordering data

	Number of cores x conductor size	Part No.	Nominal diameter of conductor
	mm^2		mm
Bus cables	4 x (2x1) (c)	5DG5 890	1.3
	6 x (2x2.5) (c)	5DG5 898	2.0
	7 x (2x1) (c)	5DG5 893	1.3
Power cables with individual screens	4 x 1.5 (c)	5DG5 880	1.5
	4 x 4 (c)	5DG5 4857	2.8
	4 x 6 (c)	5DG5 4857	3.5
	4 x 10 (c)	5DG5 4867	4.5
	4 x 16 (c)	5DG5 4877	5.6
	4 x 25 (c)	5DG5 4887	6.6
	4 x 35 (c)	5DG5 4897	8.1
	4 x 50 (c)	5DG5 4907	9.7
	4 x 70 (c)	5DG5 4917	11.2
	4 x 95 (c)	5DG5 4927	13.1

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal overall cable dimension Thickness x Width	Approx. net cable weight	Max permissile tensile force	Unenclosed Spaced 
mm	kg/km	N	A
12.0 x 35.1	663	120	16
15.6 x 65.0	1800	450	27
11.4 x 56.0	1100	210	16
7.5 x 19.0	250	90	20
9.7 x 27.8	550	240	36
10.3 x 30.3	665	360	46
12.5 x 37.5	1060	600	66
13.6 x 41.7	1360	960	87
15.8 x 48.6	1980	1500	116
17.9 x 55.4	2590	2100	144
20.5 x 64.0	3590	3000	182
22.9 x 71.8	4630	4200	230
25.6 x 81.4	5950	5700	275

OPTOFLEX (M)

Flexible rubber sheathed fibre optic cable



APPLICATION

For optical signal and data transmission in open-pit mining applications, for use on material handling equipment and for fixed installation alongside conveyor belts (including mobile conveyor belts).

DESIGN

The fibres are enclosed in buffering tube filled with an EFTE natural coloured compound type: 7YI1. The fibres and buffering tube are colour coded for identification of the fibre type. Core arrangement of the six buffering tubes is one layer, specially laid-up around a GFK supporting element (GFK = Glass fibre reinforced plastic). The core arrangement is covered by a special braid consisting of Kevlar threads in a longitudinal lay to increase tensile-strength covering approx. 80% of the surface. The orange outer sheath consists of a 5GM5 PCP compound.

FIBRE-OPTICS

The fibre elements are available in the following constructions –

50/125 Micron – Graded index fibre

62.5/125 Micron – Graded index fibre

E9/125 Micron – Mono mode fibre

The inner core diameter of the fibres: 50µm, 62.5µm or 9µm,

Diameter over cladding: 125µm. Diameter over coating: 250µm.

CHEMICAL PARAMETERS

Weather resistance – Unrestricted use indoors and outdoors, resistant to ozone, UV and moisture.

ATTENUATION DATA

Type	OPTOFLEX(M) LWL
Type designation	6 x ... x ... /125 Micron
Approvals/ standards	Based on DIN VDE 0888, MSHASC 1891, FDDI, ...
Application (refer also to DIN VDE 0298 Part 3)	For optical signal and data transmission in opencast mining applications, for use on material handling equipment and for laying alongside conveyor belts (including shiftable conveyor belts)

Transmission data of the fibre	Gradedindex	Gradedindex	Monomode
Fibre	50/125 62,	5/125	E9/125
Attenuation at wavelength 850 nm	2,8 dB/km	3,3 dB/km	–
Attenuation at wavelength 1310 nm	0,8dB/km	0,9 dB/km	0,4 dB/km
Attenuation at wavelength 1550 nm	–	–	0,3 dB/km
Bandwidth at 850 nm	>=400 MHz	>=400 MHz	–
Bandwidth at 1300 nm	>1200 MHz	>600 MHz	–
Numerical aperture	0,200 +/0,02	0,275 +/0,02	0,14 +/0,02
Dispersion value at 1300 nm	–	–	<3,5 ps/nm km
Dispersion value at 1550 nm	–	–	<18 ps/nm km

OPTOFLEX (M)

THERMAL PARAMETERS

Ambient temperature

- Fully flexible operation -30°C to +60°C
- Fixed installation -40°C to +80°C

MECHANICAL PARAMETERS

Tensile load	Max. 2000 N
Torsional stresses	Max. 100°/m
Minimum bending radius	50mm

Selection and ordering data

Number of fibres & fibre type	Part No.	Maximum overall diameter	Bending radius for fixed installation	Fibre attenuation on at 850nm	Fibre attenuation on at 1300nm
		mm	mm	dBb/km	dB/km
Multi Mode					
6x G50/125	5DG8 028	10	50	2.8	0.8
12x G50/125	5DG8 030	10	50	2.8	0.8
18x G50/125	5DG8 027	10	50	2.8	0.8
6x G62,5/125	5DG8 021	10	50	3.3	0.9
12x G62,5/125	5DG8 022	10	50	3.3	0.9
18x G62,5/125	5DG8 024	10	50	3.3	0.9
Mono Mode					
6x E9/125	5DG8 031	10	50	-	0.4
12x E9/125	5DG8 032	10	50	-	0.4
18x E9/125	5DG8 033	10	50	-	0.4
24x E9/125	5DG8 034	10	50	-	0.4

APPROVALS/ STANDARDS

Based on DIN VDE 0888, MSHA-SC 189-1, FDDI, (refer also to DIN VDE 0298, Part 3). Additional mechanical tests – Tensile load test, transverse pressure test, reversed bending test, roller bending test, torsional stress test, water compatibility according to HD 22.16

Fibre attenuation at 1550nm	Numerical aperature	Band width at 1300nm	Approx. net weight	Maximum permissible tensile force
dB/km		MHz	kg/km	N
-	0,2 +/- 0,02	>1200	100	2000
-	0,2 +/- 0,02	>1200	100	2000
-	0,2 +/- 0,02	>1200	100	2000
-	0,275 +/- 0,02	>600	100	2000
-	0,275 +/- 0,02	>600	100	2000
-	0,275 +/- 0,02	>600	100	2000
0.3	-	-	100	2000
0.3	-	-	100	2000
0.3	-	-	100	2000
0.3	-	-	100	2000

OPTOFLEX (F.O)

Fibre optic reeling and festoon cable



APPLICATION

Flexible fibre optic cable for signal and data transmission on cranes and material handling equipment; suitable for cable handling systems, such as reels, festoon systems, cable tenders, etc. High data rates at a large bandwidth have absolute immunity to electromagnetic interference.

DESIGN

The fibres are enclosed in a buffering tube filled with an EFTE natural coloured compound type: 7YI1. For identification the fibres and buffering tube are colour coded for identification of the fibre type The six buffering tubes are specially laid-up in one layer around a GFK supporting element (GFK = Glass fibre reinforced plastic). The core arrangement is covered by a special braid consisting of polyester threads covering approx. 80% of the surface. The black outer sheath consists of a 5GM5 PCP compound with a wall thickness of 2.6 mm.

FIBRE-OPTICS

The fibre elements are available in the following constructions –

50/125 Micron – Graded index fibre

62.5/125 Micron – Graded index fibre

E9/125 Micron – Mono mode fibre

The inner core diameter of the fibres: 50µm, 62.5µm or 9µm,

Diameter over cladding: 125µm. Diameter over coating: 250µm.

CHEMICAL PARAMETERS

Resistance to oil – Given to DIN VDE 0473, Part 811-2-1 Para.10

Weather resistance – Unrestricted use indoors and outdoors, resistant to ozone, UV and moisture.

ATTENUATION DATA

Transmission data of the fibreoptics	Gradedindex fibre 50/125	Gradedindex fibre 62.5/125	Monomode fibre E9/125
Max. attenuation at wavelength 850 nm	2.8 dB/km	3.3 dB/km	–
Max. attenuation at wavelength 1300 nm	0.8 dB/km	0.9 dB/km	0.4 dB/km
Max. attenuation at wavelength 1550 nm	–	–	0.3dB/km
Bandwidth at 850 nm	> 400 MHz	> 400 MHz	–
Bandwidth at 1300 nm	> 1200 MHz	> 600 MHz	–
Numerical aperture	0.200 +/0.200	0.275+/0.02	0.14+/0.02
Chromatic dispersion at 1300 nm	–	–	<3.5 ps/nm km
Chromatic dispersion at 1550 nm	–	–	<3.5 ps/nm km

THERMAL PARAMETERS

Ambient temperature

- Fully flexible operation -20°C to +80°C
- Fixed installation -40°C to +80°C

MECHANICAL PARAMETERS

Tensile load	Max. 500 N
Torsional stresses	Max. 50°/m
Minimum bending radius fixed installation and festoon system.	125 mm
On reels and cable tenders.	250 mm
Minimum distance with S-type directional changes (D=cable diameter)	20 x D

TRAVEL SPEED

Gantry (reeling operation)	Up to 120 m/min (no random wound reel, cylindrical reel)
Trolley (festoon systems)	Up to 240 m/min (festoon, cable tender)
Hoist	No application.

Selection and ordering data

Number of fibres & fibre type	Part No.
Multi Mode	
6G50/125 micron	5DG8 004
6G62.5/125 micron	5DG8 002
12G50/125 micron	5DG8 036
12G62.5/125 micron	5DG8 035
18G50/125 micron	5DG8 014
18G62.5/125 micron	5DG8 012
Mono Mode	
6E9/125 micron	5DG8 023
12E9/125 micron	5DG8 037
18E9/125 micron	5DG8 010

APPROVALS/ STANDARDS

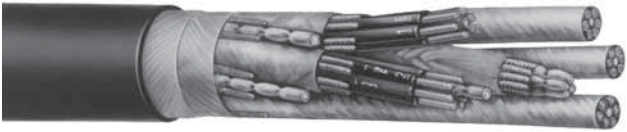
Based on FDDI, ISO/IEC 9314 Part 3, DIN VDE 0888, MSHA-SC 189-1

Additional tests – Bending and reversed bending test.

Minimum overall diameter mm	Maximum overall diameter mm	Approx. net weight kg/km	Maximum permissible tensile force N
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500
14.9	16.9	280	500

SPREADERFLEX – Spreader Basket Cable

Container crane spreader cables



APPLICATION

- Container crane spreaders
- Timber cranes
- Mobile booms

Feeder cable for loadlifting equipment, e.g. spreader with high mechanical stress in gravityfed collector basket operation.

Cable must be laid into the basket in a counterclockwise direction. Detailed installation instructions available upon request.

DESIGN

This advanced cable design is used for vertical free-fall operation in outdoor marine environments that require cable self coiling and uncoiling in a collector basket. This design allows for a heavy construction which greatly improves the coiling performance while giving a small cable diameter, reducing the wind effect on the cable.

Extra finely stranded copper conductors are insulated with PROTODUR cold resistant PVC. Conductors are grouped in bundles around lead beaded weight element cords. The bundles are textile taped and laid up around the central supporting element that consists of multiple lead beaded cords with a KEVLAR reinforcing braid. Additional lead beaded weight element cords and textile fillers complete the conductor assembly. A black polyurethane sheath which is resistant to oil, grease, abrasion, and cold temperature is extruded overall.

The cable should not be used for applications employing force guiding devices such as reelers, guide rollers or sheaves.

Optimal identification as a result of black insulation with lightprinted numbers, protective earth conductor **green/ yellow.**

OPERATING TEMPERATURE

- Ambient temperature
  - Fully flexible operation -20°C to + 60°C
  - Fixed installation 20°C to + 60°C
- Maximum permissible conductor temperature 70°C
- Maximum permissible short circuit temperature 150°C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

VOLTAGE RATING

The cable is designated 300/500V in accordance with VDE/IEC.

- Rated Voltage: *Uo/U* = 300/500V
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 318/550V
  - DC operation *Uo/U* = 413/825V
- AC test voltage = 2kV (5 min)

OPERATING SPEEDS

SPREADERFLEX is suitable for hoist speeds up to 160 m/per minute.

SUSPENSION LENGTH

The KEVLAR braided reinforcement messenger is rated to provide a safety factor of five when the cable is suspended vertically for 50 metres.
Note: Installation instructions are available on request

CORE COLOUR IDENTIFICATION

All control cores are black, sequentially numbered and include a **green/yellow** earth core.

Selection and ordering data

	No. of cores x conductor size	Part No.	Conductor diameter
	mm^2		mm
Control cables with intergated fibre optics	30 x 2.5+6x1 LWL	5DE5 775	2.0
	32 x 2.5+4x3 LWL	5DE5 756	2.0
	36 x 2.5+6x1 LWL	5DE5 758	2.0
	42 x 2.5+6x1 LWL	5DE5 753	2.4
	52 x 2.5+2x3 LWL	5DE5 767	2.0
Control cables	48 x 1.0	5DE5 797	1.5
	24 x 2.5	5DE5 725	2.0
	30 x 2.5	5DE5 798	2.0
	36 x 2.5	5DE5 788	2.0
	42 x 2.5	5DE5 790	2.0
	48 x 2.5	5DE5 760	2.0
	54 x 2.5	5DE5 767	2.0
	7 x 4.0	5DE5 768	2.5
Control cables with bus element	24 x 2.5+1x(2x1) (c)	5DE5 754	2.0
	24 x 2.5+4x(2x1) (c)	5DE5 761	2.0
	36 x 2.5+2x(2x1) (c)	5DE5 757	2.0

Nominal cable diameter	Approx. net weight	Exposed to Sun
mm	kg/km	A
37.1	2300	22
36.5	2360	22
39.0	3060	22
49.6	4150	22
48.2	3460	22
32.4	1860	13
29.6	1600	22
32.8	2010	22
35.8	2330	22
38.2	3020	22
42.8	3420	22
47.2	3460	22
19.2	750	29
33.1	2090	22
43.6	3100	22
43.8	3700	22



PENDANTFLEX – Lift control cables

Flexible pendant station and lift control cables with support element



APPLICATION

- Vertical suspension up to 50 mts
- Hoists
- Elevators
- Pendant control stations
- Special design for 150 mtr suspension plus

DESIGN

The cables construction is in accordance with the AS/NZS 1972 and VDE 0250.

Conductors are finely stranded copper with high grade PROTODUR PVC insulation. The conductors are arranged in concentric layers around the central suspension strand and bound overall with a textile binder and low temperature resistant PVC sheath. The overall screened version employs a tinned copper braided screen for interference suppression between the inner and outer sheath and two individually screened communication cores.

OPERATING TEMPERATURE

Minimum permissible ambient temperature	-30°C
Maximum permissible conductor temperature	75°C
Maximum permissible short circuit temperature	150°C
Minimum ambient temperature for optimum fully flexible operation	-5°C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following factors.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

SUSPENSION LENGTH

The suspension element is able to support the cables weight for the maximum distance stated in the table with a safety factor of five.

Termination of the central support rope should be via steel core hangers or rope thimbles or alternatively with cable stocking supports.

When used on pendant controls the support should be terminated within the pushbutton enclosure.

NOTE: For installation instructions a detailed leaflet is available on request. "Installation of Lift Control Cables"

VOLTAGE RATINGS

- Rated voltage: *Uo/U* = 300/500V
- Maximum operating voltages in:
  DC operation *Uo/U* = 413/825V
- AC test voltage = 2kV (5 min)

CORE COLOUR IDENTIFICATION

All control cores are black sequentially numbered and include a **green/yellow** earth core.

Selection and ordering data

	No. of cores x conductor size	Part No.	Suspension length	Travelling speed
	mm^2		mts	m/sec
PENDANTFLEX	7 x 1	5DE5 803	up to 50	up to 1.5
	12 x 1	5DE5 823		
	18 x 1	5DE5 833		
	24 x 1	5DE5 843		
	30 x 1	5DE5 864		
	28 x 1 + 2 x 0.5FM (c)	5DE5 715	up to 150	up to 10
Overall Screened	28 x 1 + 2 x 0.5FM (c)	5DE5 720		

FM (c) indicates individually screened control – telephone cores

Nominal No. of strands and strand diameter	Nominal conductor diameter	Nominal cable diameter	Approx. net cable weight	Unenclosed Spaced 
mm	mm	mm	kg/km	A
32 x 0.20	1.3	12.5	190	13
		16.9	340	13
		17.0	370	13
		20.0	540	13
		22.3	680	13
32 x 0.20	1.3	26.0	780	13
32 x 0.20	1.3	27.2	910	13

SECTION 5



MINING AND HIGH VOLTAGE REELING CABLES

PROTOMONT XHD	5DM4	PAGE 214
PROTOMONT 241.1	5DM6	PAGE 222
MINING MSR	5DM4	PAGE 228
PROTOLON	5DK8	PAGE 232
PROTOLON (SB) TYPE 450	5DK8	PAGE 236
SINGLE CORE HIGH VOLTAGE FLEX	5DK4 5DK5 5DK8	PAGE 242

PROTOMONT XHD – Rubber-Sheathed Flexible Cable

Extra heavy duty flexible mining cables



APPLICATION

- Above ground mining of coal, iron ore and uranium
- Quarries
- Construction & heavy industry
- Drills, pumps & cutters
- Conveyors
- Suitable for submersible application

The cables are suitable for fixed installation and flexible operation as power supply cables to motors, distribution boards, etc., for underground mining applications, for tunnel building applications, for opencast mining applications, for use in quarries and similar applications.

DESIGN

PROTOMONT heavy duty cables combine flexibility with toughness to provide long service life in aggressive operating conditions.

Finely stranded tinned copper conductors are rope laid to form a flexible construction. R-EP-90 elastomer insulation offers a high insulation resistance and excellent current carrying capacity. Each power core has a concentric screen of tinned copper wires and the entire conductor assembly is bound together with a textile tape. Both the elastomer inner sheath and heavy duty PCP outer sheath protect the cable from mechanical damage. Control cores, when required, are laid up in the three interstices outside the screens.

OPERATING TEMPERATURES

- Ambient temperature
  - Fully flexible operation 25°C to +80°C
  - Fixed installation 40°C to +80°C
- Maximum permissible conductor temperature 90°C
- Maximum permissible short circuit temperature 250°C

MINIMUM BENDING RADII

The following minimum recommended bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on a continuous operating ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

Accordance with AS/NZS 3008.1.1.2009.

TENSILE STRENGTH

The maximum allowable tensile stress on the conductors is 15N/mm^2. This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated Voltage: *Uo/U* = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 0.7/1.2kV
  - DC operation *Uo/U* = 0.9/1.8kV
- AC test voltage = 3kV (5 min)

CORE COLOUR IDENTIFICATION

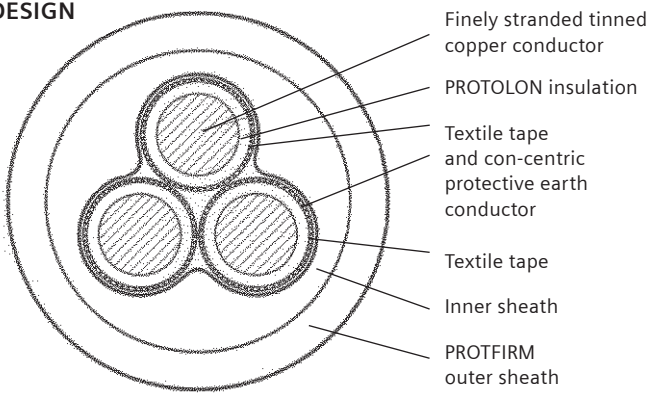
3 core : blue, brown & black
Pilots : blue, brown & black
5 core : black, blue, black, brown, black

CABLE DESCRIPTION

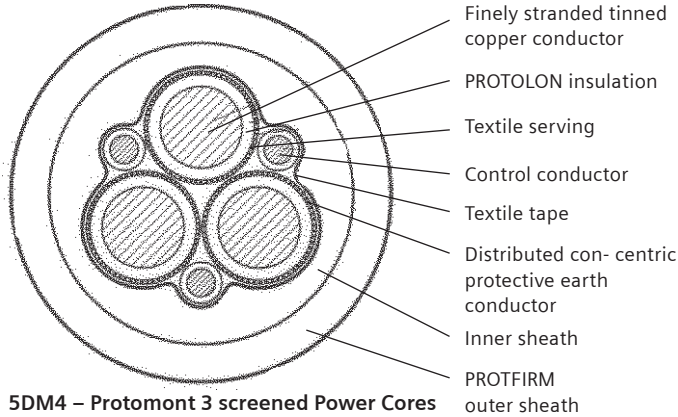
Protomont has a particular description to detail its construction fully.
eg., 3 x 25 + 3 x 16/3E indicates 3 power cores each
25 mm2 and 3 split earth screens (one over each power core)
totaling 16 mm^2.
+ 3 x 2.5 indicates 3 insulated control cores.

Conductor size	Reactance at 50Hz	Impedance at 90°C	Inductance	Capacitance
mm^2	Ω/km	Ω/km	mH/km	µF/km
4	0.1080	6.310	0.290	0.380
6	0.1030	4.310	0.270	0.440
10	0.0936	2.440	0.370	0.480
16	0.0887	1.540	0.250	0.570
25	0.0871	0.995	0.250	0.600
35	0.0839	0.707	0.240	0.690
50	0.0832	0.493	0.240	0.720
70	0.0800	0.348	0.230	0.840
95	0.0796	0.264	0.230	0.860
120	0.0774	0.207	0.230	0.960
150	0.0775	0.167	0.230	1.110
185	0.0771	0.138	0.230	1.190
240	0.0764	0.106	0.225	1.33
300	0.0761	0.086	0.223	1.44

DESIGN



5DM4 – Protomont 3 screened Power Cores



5DM4 – Protomont 3 screened Power Cores including 3 control cores

Selection and ordering data

	No. of cores conductor size mm²	Part No.
PROTOMONT Untinned 3 Screened Power Cores	3 x 1.5 + 3 x 1.5/3E	5DM4 604
	3 x 2.5 + 3 x 2.5/3E	5DM4 605
	3 x 4 + 3 x 4/3E	5DM4 606
	3 x 6 + 3 x 6/3E	5DM4 607
	3 x 10 + 3 x 10/3E	5DM4 610
	3 x 16 +3 x 16/3E	5DM4 612
	3 x 25 + 3 x 16/3E	5DM4 613
	3 x 35 + 3 x 16/3E	5DM4 614
	3 x 50 + 3 x 25/3E	5DM4 615
	3 x 70 + 3 x 35/3E	5DM4 616
	3 x 95 + 3 x 50/3E	5DM4 617
	3 x 120 + 3 x 70/3E	5DM4 618
	3 x 150 + 3 x 70/3E	5DM4 620
	3 x 185 + 3 x 95/3E	5DM4 627
PROTOMONT Control Cores Overall Screeed	1 x (2 x 1.5)C	5DL4 052

PROTOMONT XHD – Rubber-Sheathed Flexible Cable

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal No. of strands and strand diameter	Nominal conductor diameter guidance	Nominal cable diameter	Approx. cable weight	Current carrying capacity	
				free in air	touching a surface
					
mm	mm	mm	kg/km	A	A
30 x 0.25	1.6	13.3	250	20	19
50 x 0.25	2.1	14.4	345	27	26
56 x 0.30	2.6	17.1	466	36	34
84 x 0.30	3.2	18.4	560	46	43
80 x 0.40	4.2	21.3	751	66	61
126 x 0.40	5.3	24.9	1100	87	81
196 x 0.40	6.6	29.2	1565	116	108
276 x 0.40	7.8	31.6	1935	144	135
396 x 0.40	9.3	38.0	2725	182	170
546 x 0.40	10.9	42.1	3725	230	214
724 x 0.40	12.6	47.0	4725	275	256
926 x 0.40	14.2	53.9	5905	327	303
1156 x 0.40	15.9	58.2	7275	375	348
1406 x 0.40	17.5	64.8	9025	428	396
30 x 0.25	1.6	12.3	166	20	19

Selection and ordering data

	No. of cores conductor size mm²	Part No.
PROTOMONT Untinned 3 Screened Power Cores including 3 Control Cores	3 x 2.5 + 3 x 2.5/3E + 3 x 1.5 ST	5DM4 624
	3 x 4 + 3 x 4/3E + 3 x 1.5 ST	5DM4 626
	3 x 6 + 3 x 6/3E + 3 x 1.5 ST	5DM4 630
	3 x 10 + 3 x 10/3E + 3 x 2.5 ST	5DM4 631
	3 x 16 + 3 x 16/3E + 3 x 2.5 ST	5DM4 632
	3 x 25 + 3 x 16/3E + 3 x 2.5 ST	5DM4 633
	3 x 35 + 3 x 16/3E + 3 x 2.5 ST	5DM4 634
	3 x 50 + 3 x 25/3E + 3 x 2.5 ST	5DM4 635
	3 x 70 + 3 x 35/3E + 3 x 2.5 ST	5DM4 636
	3 x 95 + 3 x 50/3E + 3 x 2.5 ST	5DM4 637
	3 x 120 + 3 x 70/3E + 3 x 2.5 ST	5DM4 638
	3 x 150 + 3 x 70/3E + 3 x 2.5 ST	5DM4 642
	3 x 185 + 3 x 95/3E + 3 x 2.5 ST	5DM4 644
PROTOMONT Tinned 3 Screened Power Cores including 3 Control Cores	3 x 2.5 + 3 x 2.5/3E + 3 x 1.5 ST	5DM4 724
	3 x 4 + 3 x 4/3E + 3 x 1.5 ST	5DM4 726
	3 x 6 + 3 x 6/3E + 3 x 1.5 ST	5DM4 730
	3 x 10 + 3 x 10/3E + 3 x 2.5 ST	5DM4 731
	3 x 16 + 3 x 16/3E + 3 x 2.5 ST	5DM4 732
	3 x 25 + 3 x 16/3E + 3 x 2.5 ST	5DM4 733
	3 x 35 + 3 x 16/3E + 3 x 2.5 ST	5DM4 734
	3 x 50 + 3 x 25/3E + 3 x 2.5 ST	5DM4 735
	3 x 70 + 3 x 35/3E + 3 x 2.5 ST	5DM4 736
	3 x 95 + 3 x 50/3E + 3 x 2.5 ST	5DM4 737
	3 x 120 + 3 x 70/3E + 3 x 2.5 ST	5DM4 738
	3 x 150 + 3 x 70/3E + 3 x 2.5 ST	5DM4 742
	3 x 185 + 3 x 95/3E + 3 x 2.5 ST	5DM4 744

PROTOMONT XHD – Rubber-Sheathed Flexible Cable

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal No. of strands and strand diameter	Conductor diameter guidance (max value)	Nominal cable diameter	Approx. cable weight	Current carrying capacity	
				free in air	touching a surface
					
mm	mm	mm	kg/km	A	A
50 x 0.25	2.1	18.1	510	27	26
56 x 0.30	2.6	18.8	552	36	34
84 x 0.30	3.2	19.4	628	46	43
80 x 0.40	4.2	23.1	934	66	61
126 x 0.40	5.3	24.9	1175	87	81
196 x 0.40	6.6	29.2	1640	116	108
273 x 0.40	7.8	31.6	2010	144	135
396 x 0.40	9.3	38.0	2800	182	170
546 x 0.40	10.9	42.1	3800	230	214
724 x 0.40	12.6	47.0	4800	275	256
926 x 0.40	14.2	53.9	5980	327	303
1156 x 0.40	15.9	58.2	7350	375	348
1406 x 0.40	17.5	64.8	9100	428	396
50 x 0.25	2.1	19.0	520	27	26
56 x 0.30	2.6	19.8	600	36	34
84 x 0.30	3.2	20.5	670	46	43
80 x 0.40	4.2	24.5	1010	66	61
126 x 0.40	5.3	28.0	1290	87	81
196 x 0.40	6.6	32.0	1780	116	108
273 x 0.40	7.8	36.0	2300	144	135
396 x 0.40	9.3	42.0	3200	182	170
546 x 0.40	10.9	45.5	4010	230	214
724 x 0.40	12.6	52.0	5100	275	256
926 x 0.40	14.2	57.5	6510	327	303
1156 x 0.40	15.9	63.5	7600	375	348
1406 x 0.40	17.5	68.5	9400	428	396

PROTOMONT 241.1

Extra heavy duty semi conductive screened cable for mining applications including supply cable for underground cutting machines and pumping.





APPLICATION

The 241.1 cable is specifically engineered for the Australian mining industry and manufactured in accordance with AS 1802. It is an extra heavy duty semi conductive screened cable for mining applications including supply cable for underground cutting machines and pumping

DESIGN

The Protomont 241.1 cable is for aggressive environments in mining where high mechanical stresses occur from reeling and trailing. A semi conductive cradle separator encapsulates the central pilot core and interstitial earth conductors. The semi conductive layer ensuring a high conductivity low resistance earth circuit. The conductors consist of very finely stranded tinned copper wires, rope laid to maximise flexibility.

The power cores have an inner semi-conductive layer around their conductors. A reinforced polyester braid is embedded between the inner and outer sheaths forming a vulcanised bond protecting against the effects of torsional forces during operation. The specially compounded CPE outer sheath resists damage from hard and abrasive surfaces protecting the cable from mechanical damage.

OPERATING TEMPERATURE

■ Maximum permissible operating temperature at conductor	90 °C
■ Maximum permissible short circuit temperature at conductor	250 °C (max. 5 s)
■ Minimum permissible temperatures	
when in motion	-25 °C
when stationary	-40 °C
■ Maximum permissible water temperature	40 °C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

The values are valid for permanent operation with DC or AC with 50 up to 60 Hz. Touching a surface, two or three cores loaded, multi-core cables all cores loaded.

VOLTAGE RATING

- Rated voltage: *Uo/U* = 1.1kV
- Maximum operating voltages in:
  - 3 phase AC operation *Uo/U* = 1.1/1.1kV
  - DC operation *Uo/U* = 0.9/1.8kV
- AC test voltage = 3kV

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability.

- For fixed installation 4 x cable diameter
- When freely flexing 5 x cable diameter

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2. This ensures no conductor damage will occur in operation.

CORE COLOUR IDENTIFICATION

Power core	Red, White & Blue
Central pilot	Grey
Semi conductive earth	Black

KEY FEATURES AND BENEFITS

- **Designed for Australia's extreme mining conditions**

  Specifically engineered product derived from extensive research and development to maximise the installations performance and reliability.

- **Extensive Industry Knowledge**

  Experience & knowledge derived from decades of heavy involvement in the Global and Australian mining markets. Our factory specialises in both underground and open cut cables

- **Quality Control**

  Exceptional quality is achieved through stringent quality control and continuous improvement processes.

- **Exceptional Flexibility**

  Constructed with premium grade very finely stranded copper wire. Short length of lay to maximise flexibility ensuring a user friendly product.

- **Compact Robust Construction**

  Exceptionally tough. Our specifically designed CPE outer sheath resists damage from tearing, notching & abrasion yet provides extreme flexibility. Reinforced polyester braid embedded between the inner and outer CPE sheaths protects against the effects of torsional forces during operation.

- **Return on Investment**

  Don't risk expensive cable downtime.
  Specify reliability. Specify Siemens 241.1

PROTOMONT 241.1

Selection and ordering data

	No. of cores and nominal conductor size mm²	Part No.
PROTOMONT 241.1	3 x 6 + 3 x 3 /3E + pilot	5DM6 209
	3 x 10 + 3 x 5 /3E + pilot	5DM6 ---
	3 x 16 + 3 x 8 /3E + pilot	5DM6 ---
	3 x 25 + 3 x13/3E + pilot	5DM6 ---
	3 x 35 + 3 x18/3E + pilot	5DM6 201

Current ratings are based on AS/NZS 3008.1.1:2009.

Nominal No. of strands and strand diameter	Nominal cable diameter	Approx. cable weight	Unenclosed Spaced 
mm	mm	kg/km	A
84 x 0.30	31	1130	46
80 x 0.40	32	1200	66
126 x 0.40	34	1450	87
196 x 0.40	39	1800	116
304 x 0.30	42	2780	144

MINING MSR

Twisted pair data signal and control cables for mining installations



APPLICATION

- Along conveyor routes
- On board data cabling
- Stackers & reclaimers
- Freely flexing (non reeling) conditions
- PLC, data & still video transmission

Control, signalling and bus cables with the necessary transmission characteristics used for electric and electronic equipment, such as for measured value and process data processing and automation units in opencast mining applications. Suitable for laying alongside conveyor belts and on material handling equipment.

DESIGN

MINING MSR cables consist of finely stranded copper conductors laid up to provide a flexible design. High grade Polyethylene insulation offers improved capacitance values. The cores are twisted in pairs with alternate length of lay to minimise cross talk, they exhibit excellent transmission characteristics even at high data transmission rates.

An overall copper braid screen between the inner and outer sheath provides protection against the external interferences of EMI, RFI and high voltage fields.

The elastomer inner and outer sheath offers high mechanical strength, is UV stabilised and moisture resistant.

OPERATING TEMPERATURES

- Ambient temperature
  - Fully flexible operation -25°C to +60°C
  - Fixed installation -40°C to +60°C
- Maximum permissible conductor temperature 60°C
- Maximum permissible short circuit temperature 150°C

MINIMUM BENDING RADII

The following minimum recommended bending radii should be observed to ensure operating reliability

- For fixed installations 4 x cable diameter
- When freely flexing 5 x cable diameter

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following factors.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm^2.

This ensures no conductor damage will occur in operation.

VOLTAGE RATING

- Rated voltage: = 250/250V
- Maximum operating voltages: = 350V (Peak)
- AC test voltage = 1.5kV (3 min)

TRANSMISSION DATA

Attenuation: 1dB/km at 800 Hz
3dB/km at 100kHz

Capacitance: 65 nF/km (max) at 800 Hz

CORE COLOUR IDENTIFICATION

All cores are black and sequentially numbered.

NOTE: Mining MSR is also available with twisted pairs and quads with a flexible steel wire armour. PE insulated with a PVC inner and outer sheath, this design is subject to manufacture.

Selection and ordering data

No. of pairs x Conductor size	Part No.	Nominal No. of strands and strand diameter	Nominal conductor diameter
mm^2	mm	mm	mm
2 x (2 x 1.0)	**5DM4 995**	32 x 0.20	1.5
5 x (2 x 1.0)	**5DM4 996**	32 x 0.20	1.5
10 x (2 x 1.0)	**5DM4 997**	32 x 0.20	1.5
20 x (2 x 1.0)	**5DM4 998**	32 x 0.20	1.5

Other conductor sizes and core numbers are available subject to manufacture.



Nominal cable diameter	Approx. cable net weight	Unenclosed Spaced 	Unenclosed Touching 
mm	kg/km	A	A
12.0	245	16	15
17.3	420	16	15
21.4	660	16	15
26.6	1030	16	15

High voltage reeling and trailing cables



	Reeler without guides	Reeler with roller guides	Reeler with plane angle deflection
PROTOLON	M	M	+
PROTOLON (SM)-R	+	M	M
PROTOLON (SB)	-	-	-
PROTOLON (SMK)	+	M	M
PROTOLON (ST)	-	-	-

M	+	-
Main field of application	Suitable	Not designed for this application

APPLICATION

PROTOLON reeling and trailing cables are available in various types of constructions are specifically designed to withstand the forces of reeling and forced guidance systems on today's mobile equipment.

A range of designs are available to suit all applications including stackers, reclaimers,shiploders,cranes, shovels, dredges, elctric drills and draglines.

DESIGN

Protolon cables are suitable for voltages 3.3/3.3kV to 33/33kV and are designed in accordance with the Australian Mining Standard AS/NZS 2802.

A complete catalogue on Siemens Protolon is available detailing all constructions, their application and design.

Trailing and draglines	Fixed installation	Festoon Systems
-	M	M
-	-	+
M	+	-
-	-	+
-	-	-

PROTOLON











PROTOLON (N) for stackers and reclaimers, shiploaders, tripper cars, stockpilers and festoons for medium mechanical stresses.

PROTOLON (SMK) for high speed,tensile stress applications characterised by dynamic load peaks eg., braided screen high mount container cranes, hoisting equipment, mining machines.

Note: Latest generation compounds allowing for reduced OD.

PROTOLON (SM-R) incorporating integrated fibre optics for high speed, high volume data transfer, voice video and digital drive control. This eliminates the need for a separate control reeler.

PROTOLON Single Core designed for voltages up to 22kV for power supply interconnections, transformer drop cable, mobile sustations, over head service line connections and H.V switchboards.

PROTOLON (SB) dragline cable with extra heavy duty sheath and copper wire core screens to withstand the agressive operating conditions of open cut mining.

Protolon (SB) Type 450 Trailing Cable

High voltage trailing cable

APPLICATION

PROTOLON (SB) Type 450 high voltage trailing cable is designed for power supply to large mining machines operating at voltages up to 33/33kV. The cable is constructed to withstand the harsh operating conditions of open-cut mining of coal and iron ore, quarries and tunnel boring such as rough terrain, tensile stresses associated with draglines, rock falls and compressive forces from trucks etc. Typical applications include draglines, jumbo drills, excavators and electric shovels.

DESIGN

The Protolon insulation provides high electrical characteristics. The Semi Conductive Insulation together with the braided screen controls the Electric Field and helps to prevent 'partial discharge', improving the longevity of the cable. This in turn maintains the High Electrical insulation characteristics of this cable.

The Open Mesh Tape surrounding the cable; together with the outer Extra Heavy Duty XHD-90-PCP provides the Necessary Reinforcement of which Siemens cables' are renowned for.

The Copper wire Screens are in accordance with AS2802:2000 with the Mechanical Electrical properties in which abrasion and chaffing stresses are to be expected in the trailing operation.

The cables has been tested over and above the requirements under Australian standards with the test results recorded well above the minimum in order to prove the cable's resistance to high mechanical requirements extending the longevity of the cable. It's characteristics remain even after extremely high mechanical stresses when other cable designs have already failed.

Protolon (SB) Type 450 Trailing Cable



Protolon (SB) Type 450 Trailing Cable

OPERATING TEMPERATURE

■ Maximum permissible operating temperature at conductor	90 °C
■ Maximum permissible short circuit temperature at conductor	250 °C (max. 5 s)
■ Minimum permissible temperatures	
when in motion	-20 °C
when stationary	-40 °C
■ Minimum permissible ambient	-45 °C





CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34



Protolon (SB) Type 450 Trailing Cable

Selection and ordering data

No of cores and nominal cross section	Earth core (total size) split into 2	Pilot core
mm²	mm²	mm²
PROTOLON (SB) 3.3/3.3 kV		
3x25 + 2x25/2 + 1x10ST	25	10
3x35 + 2x25/2 + 1x10ST	25	10
3x50 + 2x25/2 + 1x10ST	25	10
3x70 + 2x35/2 + 1x16ST	35	16
3x95 + 2x50/2 + 1x25ST	50	25
3x120 + 2x70/2 + 1x35ST	70	35
3x150 + 2x70/2 + 1x35ST	70	35
3x185 + 2x95/2 + 1x50ST	95	50
3x240 + 2x120/2 + 1x60ST	120	60
PROTOLON (SB) 6.6/6.6 kV		
3x25 + 2x25/2 + 1x10ST	25	10
3x35 + 2x25/2 + 1x10ST	25	10
3x50 + 2x25/2 + 1x10ST	25	10
3x70 + 2x35/2 + 1x16ST	35	16
3x95 + 2x50/2 + 1x25ST	50	25
3x120 + 2x70/2 + 1x35ST	70	35
3x150 + 2x70/2 + 1x35ST	70	35
3x185 + 2x95/2 + 1x50ST	95	50
3x240 + 2x120/2 + 1x60ST	120	60

Current ratings are based on AS/NZS 3008.1.1:2009.
NOTE: For other cable sizes please discuss with Siemens.

Selection and ordering data

No of cores and nominal cross section	Earth core (total size) split into 2	Pilot core
mm²	mm²	mm²
PROTOLON (SB) 11/11 kV		
3x25 + 2x25/2 + 1x10ST	25	10
3x35 + 2x25/2 + 1x10ST	25	10
3x50 + 2x25/2 + 1x10ST	25	10
3x70 + 2x35/2 + 1x16ST	35	16
3x95 + 2x50/2 + 1x25ST	50	25
3x120 + 2x70/2 + 1x35ST	70	35
3x150 + 2x70/2 + 1x35ST	70	35
3x185 + 2x95/2 + 1x50ST	95	50
3x240 + 2x120/2 + 1x60ST	120	60
PROTOLON (SB) 22/22 kV		
3x25 + 2x25/2 + 1x10ST	25	10
3x35 + 2x25/2 + 1x10ST	25	10
3x50 + 2x25/2 + 1x10ST	25	10
3x70 + 2x35/2 + 1x16ST	35	16
3x95 + 2x50/2 + 1x25ST	50	25
3x120 + 2x70/2 + 1x35ST	70	35
3x150 + 2x70/2 + 1x35ST	70	35
3x185 + 2x95/2 + 1x50ST	95	50
3x240 + 2x120/2 + 1x60ST	120	60

Current ratings are based on AS/NZS 3008.1.1:2009.
NOTE: For other cable sizes please discuss with Siemens.

SINGLE CORE HIGH VOLTAGE FLEX

Flexible high voltage cable for high mechanical stresses



APPLICATION

- Power supply cubicle interconnections
- Transformer dropper cable
- Mobile substations
- Pumps and motors
- Overhead line connections
- High voltage switchboards
- Suitable for 6.6kV, 11kV and 22kV applications

DESIGN

Finely stranded tinned copper conductors laid up with a short length of lay to provide a flexible and robust conductor assembly. The PROTOLON R-EP-90 insulation provides high electrical characteristics and is manufactured using a triple extrusion process together with the semi-conductive EPR conductor and insulation screen. The semi-conductive screening combined with the overall braided copper wire screen controls the electric field and prevents partial discharge. The overall copper wire braid screen is in accordance with AS 2802. The flame retardant heavy duty XHD-90-PCP sheath has a high resistance to abrasion, tearing, lubricants, chemicals and weathering. The PROTOLON sheath is coloured red for high voltage designation.

OPERATING TEMPERATURE

Minimum permissible ambient temperature fixed	-25°C
Minimum permissible ambient temperature flexing	-40°C
Maximum permissible conductor temperature	90°C
Maximum permissible short circuit temperature	250°C

CURRENT CARRYING CAPACITY

Current ratings are based on continuous operation at an ambient temperature of 40°C. At other temperatures these values must be converted using the following table.

°C	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Factor	1.26	1.20	1.15	1.10	1.05	1.00	0.94	0.88	0.81	0.73	0.65	0.57	0.47	0.34

VOLTAGE RATINGS

Rated voltage	6/10kV	*Uo/U* =	6.9/12 kV
AC test voltage			17 kV
Rated voltage	12/20kV	*Uo/U* =	13.9/24 kV
AC test voltage			29 kV

MINIMUM BENDING RADII

The following minimum bending radii should be observed to ensure operating reliability where d = cable O.D.

- For fixed installation — 6 x cable O.D
- When freely flexing — 10 x cable O.D

SINGLE CORE HIGH VOLTAGE FLEX

Number of cores and conductor cross-section	Part No.	Nominal diameter conductor
mm^2		mm
Selection and ordering data – 6/10kV flex		
1 x 25/25 KON	5DK4 113	6.6
1 x 35/16 KON	5DK4 114	7.8
1 x 50/16 KON	5DK4 115	9.3
1 x 70/16 KON	5DK4 116	10.9
1 x 95/16 KON	5DK4 117	12.6
1 x 120/16 KON	5DK4 118	14.2
1 x 150/25 KON	5DK4 120	15.9
1 x 185/25 KON	5DK4 121	17.5
1 x 240/25 KON	5DK4 122	20.2
Selection and ordering data – 12/20kV flex		
1 x 25/16 KON	5DK5 562	6.6
1 x 35/16 KON	5DK5 564	7.8
1 x 50/16 KON	5DK5 566	9.3
1 x 70/16 KON	5DK5 568	10.9
1 x 95/16 KON	5DK5 571	12.6
1 x 120/16 KON	5DK5 573	14.2
1 x 150/25 KON	5DK5 575	15.9
1 x 185/25 KON	5DK5 577	17.5
1 x 240/25 KON	5DK5 580	20.2
1 x 300/25 KON	5DK5 581	22.3
1 x 400/25 KON	5DK5 582	25.7

Nominal outer diameter	Approx. Net weight	Maximum permissible tensile force	Unenclosed Touching 
mm	kg/km	N	A
22.4	860	375	114
23.1	960	525	141
24.6	1140	750	178
27.1	1410	1050	225
28.9	1660	1425	271
31.5	2010	1800	322
33.3	2400	2250	372
36.6	2840	2775	427
38.9	3420	3600	514
26.9	1100	375	114
28.0	1230	525	141
29.1	1430	750	178
32.3	1760	1050	225
34.0	2030	1425	271
35.7	2320	1800	322
38.5	2830	2250	372
40.1	3170	2770	427
43.1	3810	3600	514
46.9	4730	4500	591
50.1	5620	6000	709

SINGLE CORE HIGH VOLTAGE FLEX

Number of cores and conductor cross-section	Part No.	Nominal diameter conductor
mm^2		mm
Selection and ordering data – 11/11kV flex		
1 x 16/16 KON	5DK8 542	5.3
1 x 25/16 KON	5DK8 543	6.6
1 x 35/16 KON	5DK8 544	7.8
1 x 50/16 KON	5DK8 545	9.3
1 x 70/16 KON	5DK8 546	10.9
1 x 95/16 KON	5DK8 547	12.6
1 x 120/16 KON	5DK8 548	14.2
Selection and ordering data – 22/22kV flex		
1 x 185/25 KON	5DK8 555	17.5
1 x 300/25 KON	5DK8 557	22.3

Nominal outer diameter	Approx. Net weight	Maximum permissible tensile force	Unenclosed Touching 
mm	kg/km	N	A
24.0	900	240	85
25.5	1040	375	114
26.6	1170	525	141
28.1	1360	750	178
29.9	1620	1050	225
32.7	1960	1425	271
34.3	2240	1800	322
43.9	3440	2775	427
50.1	4780	4500	591

SECTION 6



TECHNICAL TABLES AND FORMULAE

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MOTOR CURRENTS

The Line Amps per phase are approxiamte and for standard AC induction motors assuming a Power Factor of 0.8 and Efficiency of 0.9.

Power kW	Horse power HP	Full load current Line Amps
0.75	1.0	1.8
1.1	1.5	2.6
1.5	2.0	3.4
2.2	2.9	5.0
3.0	4.0	6.5
4.0	5.3	8.0
5.5	7.3	11
7.5	10	15
11	15	22
15	20	28
18.5	25	36
22	29	39
30	40	52
37	49	69
45	60	79
55	73	96
75	100	125
90	120	156
110	147	189
132	176	255
150	200	285
160	213	275
185	247	310
200	267	325
220	293	360
250	333	410
315	420	520
355	473	580
400	533	650
450	600	730
500	667	800

THREE PHASE FORMULAE

$$kW = \frac{\text{Line Amps} \times \text{Line Volts} \times 1.732 \times \text{P.F}}{1000}$$

$$kVA = \frac{\text{Line Amps} \times \text{Line Volts} \times 1.732}{1000}$$

$$kW = kVA \times \text{P.F (Power Factor)}$$

ELECTRIC MOTORS

$$\text{Power Output} = \text{Power Input} \times \text{Efficiency}$$

$$\text{kW Output} = \text{kW Input} \times \text{Efficiency}$$

$$\text{kW Output} = \frac{1.732 \times \text{Line Volts} \times \text{Line Amps} \times \text{P.F} \times \text{Efficiency}}{1000}$$

$$\text{kVA Input} = \frac{1.732 \times \text{Line Volts} \times \text{Line Amps}}{1000}$$

$$\text{Line Current (Input)} = \frac{1000 \times \text{kW Output}}{\text{Line Volts} \times 1.732 \times \text{P.F} \times \text{Efficiency}}$$

$$\text{Line Current (Input)} = \frac{1000 \times \text{kVA Input}}{\text{Line Volts} \times 1.732}$$

Permissible short circuit temperature and the prospective fault level for cables and their insulation

Based on the final (permissible) short circuit temperature of a fault duration of 1 sec, the values for calculating the prospective fault are listed below.

Insulation	Permissible rated operating temperature	Permissible short circuit temperature
°C	°C	
Silicone	180	350
PVC	75	160
EPR Untinned conductor	90	250
Tinned conductor	90	200
EVA	125	250
Tinned conductor	-	200
Soldered joint	-	160

Table 6.2

Conductor temperature at the beginning of the short circuit in °C												
180	165	150	135	120	105	90	80	70	60	50	40	30
J_{thr} for 1 sec in A/mm²												
132	139	146	153	160	166	173	178	182	187	191	196	201
-	-	-	-	-	-	-	-	109	117	124	131	138
-	-	-	-	-	-	143	148	154	159	165	170	176
						122	128	135	141	147	153	159
-	-	-	-	126	135	143	148	154	159	165	170	176
49	65	79	91	102	112	122	128	136	141	147	153	159
-	-	36	58	74	87	100	107	115	122	129	136	143

FORMULA

For fault level I_{thr} of a cable

I_{thr} = J_{thr} x conductor size in mm^2

Example: A 4 x 25mm^2 EPR/CSP fully loaded UNTINNED and therefore having a continuous conductor operating temperature of 90°C

I_{thr} = 143 x 25

= 3.58 kA (1 second)

For fault durations up to 5 sec or below 1 sec the following equation is applicable (example is for 0.2 sec fault).

$$I_{thz} = I_{(1s)} \times (3.58) \times \frac{1 \text{ sec}}{\sqrt{0.2 \text{ sec}}}$$

CABLE SUSPENSION

The maximum free suspension height in metres for reeling cables that must be vertically suspended shall be calculated utilising the following.This formula protects the copper conductors from deformation past their elastic limit. Conductor deformation leads to cork screws and possible core breakages.

$$\text{Height} = \frac{C \times CSA \times N}{W \times 9.81}$$

C = Number of Conductors in the cable

CSA = Conductor Cross Section in mm^2

N = Max. Tensile limit in N/mm^2 of the cable
i.e. Cordaflex (SMK) Page 24 Mechanical Parameters
Tensile load: up to 30N/mm^2

W = Cable Weight in kg/mtr

Example: Cordaflex (SMK) 5DH3 121 (3x35+3x16/3)

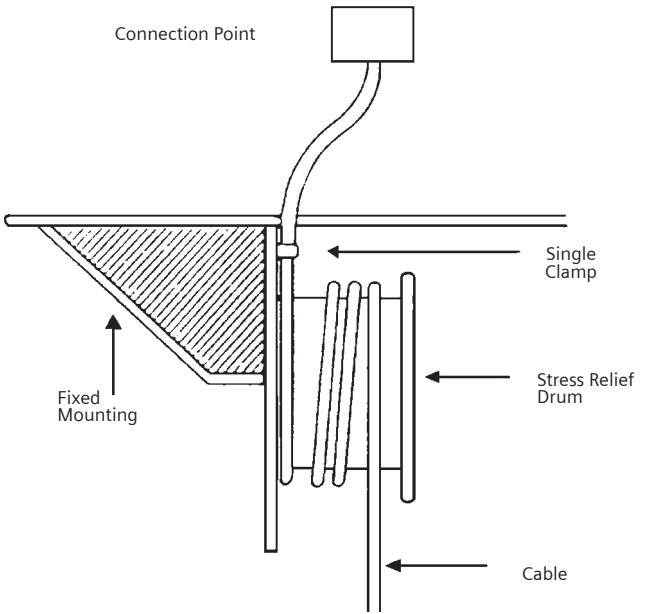
$$= \frac{3 \times 35 \times 30}{2.16 \times 9.81} = \frac{3150}{21.19} = 148.65 \text{ mtrs}$$

maximum suspension height

SUPPORT FOR VERTICALLY SUSPENDED CABLES

The anchoring of cables is best achieved with a stress relief drum. The open ended construction facilitates installation and replacement while affording better stress relief and jacket protection than cable grips. At least 2 $^{1}/_{2}$ cable turns should be wound around the drum. Refer to the minimum Bending Radii data for each cable type to determine the stress relief drum diameter.

Suggested stress relief drum design



CHEMICAL RESISTANCE OF DIFFERENT CABLES

Chemical	PCP 3.3kV Flex	PCP Planoflex Protolon (SM) Cordaflex (SMK) Protomont Rondoflex	CSP/CPE Ozoflex	CPE Mining MSR
	Neoprene 1	Neoprene 2	Hypalon	Chlorinated Polyethylene
Acetic acid	P	P	F	F
Benzene	F	F	F	F
Bitumous tar	G	G	G	G
Bleach (NaCLO2)	VG	VG	VG	VG
Coke oven gas	VG	VG	VG	VG
Diesel oil	F	F	VG	VG
Ethylene glycol	VG	VG	VG	VG
Gasoline	G	G	G	G
Hydraulic oil	VG	VG	VG	VG
Hydrochloric acid (21%)	E	E	E	E
Hydrogen sulphide	E	E	VG	E
Kerosene	G	G	G	G
Methanol	E	E	E	E
Methyl ethyl keton	G	G	G	G
Nitric acid (10%)	G	G	E	E
Phosphoric acid (60%)	VG	VG	E	E
Picric acid (10%)	E	E	E	E
Potassium chloride	E	E	E	E
Sodium hydroxide (25%)	E	E	E	E
Sulphuric acid (50%)	E	E	E	E
Transformer oil	G	VG	G	VG
Trichlorethylene	P	P	P	P
Vegetable oils & fats	VG	VG	VG	VG
UV resistance	E	E	E	E
Ozone resistance	VG	VG	VG	VG
Water resistance	E	E	E	VG
Tear & notch resistance	VG	E	G	VG
Low temp. flexibility	E	VG	VG	G
Abrasion resistance	VG	VG-E	VG	G-VG

Table 6.3 E = Excellent VG = Very Good G = Good

The results tabled are generic for each particular sheath compound and should be used as such. For a more exact evaluation, the chemical concentration, duration of attack, temperature and contact contamination should be known.

PU Spreaderflex	EPR Hydrofirm	EVA EVA125	SI Sinotherm	PVCPU EPR Protoflex Pendantflex
Polyurethane	**Ethylene Propylene**	**Ethylvinyl Acetate**	**Silicone**	**Polyvinyl Chloride**
F	P	F	VG	P
P	P	P	P	F
G-VG	P	P	F	G
F	E	P	VG	VG
VG	VG	G	F	VG
VG	F	G	P	VG
F	E	F	E	G
E	F	G	P	F
E	P	VG	E	VG
F	P	F	P	VG
P	E	G	P	VG
VG	F	G	P	F
F	E	P	E	G
G	E	P	P	P
F	E	P	P	VG
G	E	P	E	E
F	VG	F	P	E
E	E	E	E	E
P	E	P	P	G
P	E	P	P	VG
E	F	G	P	VG
F-P	P	P	P	P
E	VG	G	E	VG
E	E	VG	VG	G
E	E	E	VG	E
F	E	G	E	G
E	F-G	F	P	VG
E	E	G	E	G
E	G	VG	P	VG

F = Fair P = Poor

PCP Polychloroprene (Neoprene) CSP Chlorosulphonated Polyethylene (Hypalon)
CPE Chlorinated Polyethylene EPR Ethylene Propylene Rubber EVA Ethyl vinyl Acetate
PVC Polyvinyl Chloride

FORMULA

FORMULA 1 ACTUAL VOLTS

$$Vd = \frac{L \times I \times mV/Am}{1000}$$

where
- Vd = volt drop in volts
- L = route length of cable in metres
- I = current to be carried in Amps
- mV/Am = millivolt per ampere metre

* With this method the drop in voltage (in volts) is given and shall not exceed 5% of the supply voltage, i.e., 5% of 415V = 20.75V.

FORMULA 2

$$\text{mV/A.m value } Vc = \frac{1000 \times Vd}{L \times I}$$

where
- Vc = millivolts per Ampere metre
- Vd = volt drop in volts
- L = route length of cable in metres
- I = current to be carried in Amps

* With this method the millivolts per ampere metre is given and the appropriate conductor size shall be selected from Three Phase Voltage Drop (multicore cables and single core) in the following pages (Table 40 and 42). The conductor size selected shall be nearest to, but not exceed the formula result,

e.g., 415V, 3 phase installation,
load demand is 55A,
100m length: OZOFLEX

Result: 3.77mV/A.m 4 x 10mm^2

* To convert single-phase voltage drop (V/A.m) values to three-phase values, multiply the single-phase values by 0.866. To convert three-phase voltage drop (V/A.m) values to single-phase values, multiply the three-phase values by 1.155

VOLT DROP

In accordance with AS 3000 the permissible volt drop from the point of the connection is 5% of the supply voltage. The following tables and formula should be used to satisfy volt drop limitations.

Three Phase Voltage Drop – Single Core Cables in Trefoil

Conductor size	Three phase voltage drop at 50Hz, mV/Am Conductor temperature °C							
	45°C		60°C		75°C		90°C	
mm²	Max.	0.8pf	Max.	0.8pf	Max.	0.8pf	Max.	0.8pf
1.0	40.3		42.5		44.7		46.8	
1.5	25.9		27.3		28.6		30.0	
2.5	14.1		14.9		15.6		16.4	
4	8.77		9.24		9.71		10.2	
6	5.86		6.18		6.49		6.81	
10	3.49		3.67		3.86		4.05	
16	2.20		2.31		2.43		2.55	
25	1.40		1.47		1.54		1.62	
35	1.01		1.07		1.12		1.17	
50	0.757		0.795		0.834		0.872	
70	0.537		0.563		0.589		0.615	
95	0.402		0.420		0.439		0.457	
120	0.332		0.345		0.359		0.373	
150	0.284		0.295		0.305		0.316	
185	0.245	0.245	0.253	0.253	0.261		0.269	
240	0.211	0.208	0.216	0.214	0.221	0.220	0.227	0.226
300	0.191	0.185	0.195	0.190	0.198	0.195	0.202	0.199
400	0.175	0.166	0.178	0.169	0.181	0.173	0.183	0.176
500	0.165	0.150	0.166	0.153	0.168	0.156	0.170	0.158
630	0.155	0.138	0.156	0.140	0.157	0.142	0.159	0.144

Table 40 AS/NZS 3008.1.1:2009

Three phase voltage drop – multicore cables

Conductor size	Three phase voltage drop at 50Hz, mV/Am Conductor temperature °C							
	45°C		60°C		75°C		90°C	
mm²	Max.	0.8pf	Max.	0.8pf	Max.	0.8pf	Max.	0.8pf
1.0	40.3		42.5		44.7		46.8	
1.5	25.9		27.3		28.6		30.0	
2.5	14.1		14.9		15.6		16.4	
4	8.77		9.24		9.71		10.2	
6	5.86		6.18		6.49		6.80	
10	3.49		3.67		3.86		4.05	
16	2.19		2.31		2.43		2.55	
25	1.39		1.47		1.54		1.61	
35	1.01		1.06		1.11		1.17	
50	0.751		0.790		0.829		0.868	
70	0.530		0.556		0.583		0.609	
95	0.394		0.413		0.431		0.450	
120	0.323		0.337		0.351		0.366	
150	0.274		0.285		0.296		0.307	
185	0.234		0.242		0.251		0.259	
240	0.198	0.198	0.204	0.201	0.210	0.210	0.216	0.216
300	0.178	0.175	0.180	0.178	0.186	0.185	0.190	0.189
400	0.162	0.157	0.165	0.158	0.168	0.164	0.171	0.167
500	0.152	0.143	0.154	0.139	0.156	0.148	0.158	0.151

Table 42 AS/NZS 3008.1.1:2009

NOTE: The values in the tables are taken from AS/NZS 3008.1.1:1998 and based on cables operating at maximum conductor temperature. For lightly loaded cables the standard also permits determination of the appropriate Vd in such cases and therefore the tables list reduced conductor temperatures.

NON-INTRINSICALLY SAFE WIRING SYSTEMS IN HAZARDOUS AREAS

(Not applicable to coal mining areas) x Denotes acceptable use

Type of wiring system	Zone 0	Zone 1	Zone 2
Cables in metallic conduit and fittings complying with AS/NZS 2053.1 and AS/NZS 2053.7 and the appropriate protection technique for the area in which they are to be installed	X	X	X
Served MIMS	*	X	X
Thermoplastic, thermosetting or elastomeric sheathed unarmoured			X
Thermoplastic, thermosetting or elastomeric sheathed with armouring or braiding designed for mechanical protection	*	X	X
Cables in rigid and corrugated, non-metallic conduit, minimum light duty, complying with AS/NZS 2053.1, AS/NZS 2053.2 and AS/NZS 2053.5			X
Metal sheathed, served and armoured	*	X	X
Flexible cords and cables in accordance with Clause 3.11.1	*	X	X
Metal sheathed, served and unarmoured			X
Flexible steel conduit with non-metallic serving to AS/NZS 2053.1 and and AS/NZS 2053.8			X
Trunking, ducts, pipes or trenches installed to meet the requirements of Clause 3.8.5		X	X
Flexible conduit assemblies complying with the relevant requirements of AS 2380.2 or AS/NZS 60079.1		X	X

*This wiring system may be installed in a Zone 0 area, if provided with additional protection to counter the harmful environmental effects detailed in clause 3.8.4. This table, extracted from the Hazardous Location Standard AS2381.1, nominates the allowable cable types for each zone classification.

DE-RATING FOR PARALLEL CONNECTION

The following factors should be applied to conductors connected in parallel for the various methods of installation.

Table taken from AS 3008.1.

Arrangement of cables							
			1	2	3	4	5
1.	Bunched in air		1.00	0.87	0.75	0.72	0.70
2.	Bunched on a surface or enclosed in conduit or ducting		1.00	0.80	0.70	0.65	0.60
3.	Single layer on wall or floor	Touching	1.00	0.85	0.79	0.75	0.73
4.		Spaced*	1.00	0.94	0.90	0.90	0.90
5.	Single layer under ceiling	Touching	0.95	0.81	0.72	0.68	0.66
6.		Spaced*	0.95	0.85	0.85	0.85	0.85

AS/NZS 3008.1.1:2009

De-rating factors for bunched circuits

NOTE: De-rating is necessary for the purpose of thermal dissipation. If sufficient clearance from adjacent conductors/cables is allowed for then no de-rating is necessary. To avoid de-rating a minimum clearance of 2 x cable O.D for horizontal, and 4 x cable O.D for vertical installation in air are given in AS/NZS 3008.1.1:2009.

De-rating factors No. of circuits/cables in parallel									
6	7	8	9	10	12	14	16	18	20+
0.67	-	-	-	-	-	-	-	-	-
0.57	0.54	0.52	0.50	0.48	0.45	0.43	0.41	0.39	0.38
0.72	0.72	0.71	0.70	0.70	0.70	0.70	0.70	0.70	0.70
0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
0.64	0.63	0.62	0.61	0.61	0.61	0.61	0.61	0.61	0.61
0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85

* Spaced in the above table indicates a clearance of 1 x cable O.D between adjacent cables.

* Where cables concerned are not the same size, the spacing will be based on the largest cable diameter in the adjacent groups.

ATTENUATION DATA FOR CORDAFLEX AND

	Individually screened conductors		
	Frequency Hz	Line attenuation dB/km	Impedance Z
Attenuation data for individually screened conductors	300	0.85	200
	600	1.2	150
	1200	1.7	110
	2400	2.3	90
	4800	3.2	60
	9600	4.2	50
	19200	5.0	40
	38400	6.0	38
	48000	6.3	35
	57600	6.5	35
	115200	8.0	35
	153600	8.5	35

	Twisted screened pairs		
	Frequency Hz	Line attenuation dB/km	Impedance Z
Attenuation data for twisted screened pair conductors	300	0.42	250
	600	0.60	200
	1200	0.80	150
	2400	1.0	130
	4800	1.3	100
	9600	1.5	90
	19200	2.0	85
	38400	2.8	80
	48000	3.3	78
	57600	3.5	75
	115200	5.5	70
	153600	5.7	70

Capacitance nF/km	Inductance mH/km	Resistance Ω/km
200.2	0.256	50
200.0	0.256	50
200.0	0.256	50
199.9	0.256	50
199.6	0.256	50
199.0	0.256	50
198.6	0.256	50
198.0	0.251	52
197.9	0.249	54
197.8	0.248	55
197.4	0.238	63
197.2	0.235	67

Capacitance nF/km	Inductance mH/km	Resistance Ω/km
102.6	0.69	26
101.4	0.69	26
100.2	0.69	26
99.2	0.67	26
98.6	0.66	26
98.1	0.65	30
97.6	0.61	36
97.2	0.56	48
97.0	0.54	52
96.9	0.52	56
96.4	0.47	78
95.9	0.46	88

AC RESISTANCE OF FLEXIBLE CABLES AND

Conductor size	Single core Conductor temperature °C AC resistance at 50 Hz, Ω/km		
mm²	60°C	75°C	90°C
0.5	45.1	47.4	49.7
0.75	30.1	31.6	33.2
1.0	22.6	23.7	24.9
1.5	15.4	16.2	17.0
2.5	9.23	9.70	10.2
4	5.73	6.02	6.31
6	3.82	4.01	4.21
10	2.21	2.32	2.44
6	1.40	1.47	1.54
25	0.903	0.949	0.995
35	0.641	0.674	0.707
50	0.447	0.470	0.493
70	0.316	0.332	0.348
95	0.240	0.252	0.264
120	0.188	0.197	0.207
150	0.151	0.159	0.166
185	0.125	0.131	0.137
240	0.0958	0.100	0.105
300	0.0780	0.0817	0.0853
400	0.0613	0.0640	0.0666
500	0.0507	0.0527	0.0548

***For the AC resistance of tinned copper conductors, multiply copper value by 1.02.**

The table above lists measured values that conform to AS/NZS 3008.1.1:2009 for rope laid flexible cables. For cables with an alternate core length of lay (e.g., CORDAFLEX) the values will alter slightly.

Conductor Size	Multicore Conductor temperature °C AC resistance at 50 Hz, Ω/km		
mm²	60°C	75°C	90°C
0.5	45.1	47.4	49.7
0.75	30.1	31.6	33.2
1.0	22.6	23.7	24.9
1.5	15.4	16.2	17.0
2.5	9.23	9.70	10.2
4	5.73	6.02	6.31
6	3.82	4.01	4.21
10	2.21	2.32	2.44
16	1.40	1.47	1.54
25	0.903	0.949	0.995
35	0.642	0.674	0.707
50	0.447	0.470	0.493
70	0.316	0.332	0.348
95	0.240	0.252	0.264
120	0.188	0.198	0.207
150	0.152	0.159	0.167
185	0.126	0.132	0.138
240	0.0965	0.101	0.106
300	0.0789	0.0825	0.0860
400	0.0623	0.0649	0.0675
500	0.0518	0.0538	0.0558

AVAILABILITY

Generally the cables listed within this catalogue are available as either stock items in Australia or available on indent from Germany.

Some of the designs listed in our programme, may be subject to manufacture or factory scheduling and availability.

STANDARDS AND APPROVALS

Siemens cable products are manufactured and tested to VDE Specifications established by the Association of German Electrical Engineers. The specifications are restricted to each particular cable design and also consider the application of the cables.

Siemens wire and cable products are used throughout the world. Consequently, many have been tested, approved, or manufactured to the standards of the following organisations:

British Standards	BS
Standards Association of Australia	SAA
Underwriters Laboratories	UL
Canadian Standards Association	CSA
National Electrical Manufacturers Association	NEMA
American Bureau of Shipping	ABS
Lloyds Register of Shipping	LRS
Assocation of German Electrical Engineers	VDE
German Lloyds	GL
European Committee on Electrotechnical Standardisation	CENELEC
International Electrotechnical Commission	IEC
Mine Safety & Health Administration	MSHA

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GLOSSARY

PVC	Thermoplastic polyvinylchloride
EPR	Ethylene propylene rubber
Eva	Ethyl vinyl acetate
XLPE	Cross linked polyethlene
PCP	Polychloroprene
CPE	Chlorinated polyethylene (Hypalon)
SR	Silicone
PU	Polyurethane
EMI	Electromagnetic interference
RFI	Radio frequency interference
GFK	Glass fibre reinforced plastic
EMC	Electromagnetic compatibility
KW	Kilowatt
kV	Kilovolt
AS	Australian standards
V-75	75°C rated PVC
MM	Multi mode (Fibre)
mm	millimetre
PE	Polyethlene
OD	Outside diametre
R-CPE-90	Rubber - chlorinated polythylene-90°C
R-ER-90	Rubber - ethylene polythylene-90°C
R-E-110	Rubber - ethylene polythylene-110°C
Cu	Copper conductor
Tcu	Tinned copper conductor
SDI	Single double insulated
LV	Low voltage
HV	High voltage



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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.