



SIEMENS



# Flexible cables

Australian catalogue




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## APPLICATION SELECTION GUIDE

| Construction  | Designation                     |
|---|---------------------------------|
|  <ol style="list-style-type: none"><li>1. PCP elastomer sheath</li><li>2. Protolon R-EP-110 insulation</li><li>3. Tinned copper conductor, highly flexible</li></ol>  | <b>3.3kV 110° Flex<br/>5DF2</b> |
|  <ol style="list-style-type: none"><li>1. CSP elastomer sheath</li><li>2. Elastomer inner sheath</li><li>3. EPR insulation</li><li>4. Copper conductors, flexible</li></ol>                 | <b>OZOFLEX<br/>5DH2</b>         |
|  <ol style="list-style-type: none"><li>1. Special CPE elastomer sheath</li><li>2. Elastomer inner sheath</li><li>3. EPR insulation</li><li>4. Copper conductors, flexible</li></ol> | <b>OZOFLEX (PLUS)<br/>5DH10</b> |




| Rated voltage              | Application and design   | Page |
|----------------------------|--|------|
| 0.6/1kV<br>to<br>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.<br><br>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.<br>For pumps and aerators.<br><br>Suitable for hazardous locations | 52   |

## APPLICATION SELECTION GUIDE

| Construction  | Designation  |
|---|--|
|  <ol style="list-style-type: none"> <li>1. CPE elastomer outer sheath</li> <li>2. Copper braid screen</li> <li>3. Elastomer inner sheath</li> <li>4. EPR insulation</li> <li>5. Copper conductor, flexible</li> </ol>   | <p><b>OZOFLEX (PLUS)<br/>SCREENED (FC+)<br/>5DH5</b></p> |
|  <ol style="list-style-type: none"> <li>1. Special EPR sheath</li> <li>2. Watertight bond between insulation and sheath</li> <li>3. EPR insulation</li> <li>4. Copper conductors, flexible</li> </ol>                   | <p><b>HYDROFIRM (T)<br/>5DH1</b></p>                     |
|  <ol style="list-style-type: none"> <li>1. EPR outer elastomer sheath</li> <li>2. Copper braid screen</li> <li>3. Elastomer inner sheath</li> <li>4. EPR insulation</li> <li>5. Copper conductor, flexible</li> </ol> | <p><b>HYDROFIRM (T)<br/>SCREENED<br/>5DH5</b></p>        |

| Rated voltage | Application and design   | Page |
|---------------|--|------|
| 0.6/1kV       | <p>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.</p> <p>Suitable for hazardous locations</p> | 60   |
| 0.6/1kV       | <p>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.</p>   | 66   |
| 0.6/1kV       | <p>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.</p>   | 76   |




## APPLICATION SELECTION GUIDE

| Construction  | Designation  |
|---|--|
|  <ol style="list-style-type: none"><li>1. PCP elastomer sheath</li><li>2. Elastomer inner sheath</li><li>3. PROTOLON EPR insulation</li><li>4. Copper conductors, flexible</li></ol>  | <p><b>PROTOMONT HD</b><br/>5DL1</p>                        |
|  <ol style="list-style-type: none"><li>1. PCP elastomer sheath</li><li>2. Copper braid screen</li><li>3. Elastomer inner sheath</li><li>4. EPR insulation</li><li>5. Copper conductor, flexible</li></ol> | <p><b>PROTOMONT<br/>SCREENED</b><br/>5DL2</p>              |
|  <ol style="list-style-type: none"><li>1. Silicone rubber insulation</li><li>2. Copper conductors, flexible</li></ol>   | <p><b>SINOTHERM 180°C</b><br/>5DR3<br/>5DR4<br/>5DR5</p> |






| Rated voltage       | Application and design  | Page |
|---------------------|---|------|
| 0.6/1kV             | <p>Extra heavy duty flexible cable for mining, construction, industry and harsh environments.<br/>           Designs suitable for submersion in aggressive liquids.</p> <p>Suitable for hazardous locations</p> | 80   |
| 0.6/1kV             | <p>Heavy duty overall screened EPR/PCP flexible in 4 and 5 core constructions. Submersible pumps, mining where earth screen protection is required.</p> <p>Suitable for hazardous locations</p>                 | 88   |
| 380/660V<br>0.6/1kV | <p>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.</p>            | 95   |

## APPLICATION SELECTION GUIDE

| Construction  | Designation  |
|---|--|
|  <ol style="list-style-type: none"><li>1. Heat resistant, cross-linked elastomeric special compound</li><li>2. Copper conductors, flexible</li></ol>  | <b>SINOTHERM 110°C</b><br>5DR7                                   |
|  <ol style="list-style-type: none"><li>1. EVA Elastomer insulation</li><li>2. Copper conductors, flexible</li></ol>   | <b>EVA 125 FLEX</b><br>5DR7                                      |
|  <ol style="list-style-type: none"><li>1. EVA Elastomer insulation</li><li>2. Multi stranded tinned copper</li><li>4. Cross-linked polyolefine</li></ol> | <b>TECSUN (PV)</b><br>5DH9<br><br><b>TECSUN TWIN (PV)</b><br>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  |
|---|--|
|  <ol style="list-style-type: none"><li>1. PVC sheath</li><li>2. Copper conductors, flexible</li></ol>   | <p><b>PROTOFLEX<br/>5DE7</b></p> <p><b>PROTOFLEX<br/>SCREENED<br/>5DE7</b></p>           |
|  <ol style="list-style-type: none"><li>1. UV-stabilised PVC orange transparent outer sheath.</li><li>2. Tinned copper braid screen.</li><li>3. Cross linked poly ethylene (XLPE) insulation.</li></ol> | <p><b>PROTOFLEX<br/>EMV-FC<br/>UV stabilized<br/>90° rating<br/>5DE6</b></p>   |
|  <ol style="list-style-type: none"><li>1. Clear PVC outer sheath.</li><li>2. Tinned copper braided screen</li></ol>   | <p><b>PROTOFLEX<br/>EMC<br/>5EMC</b></p> <p><b>PROTOFLEX<br/>EMC-FC<br/>5EMV</b></p> |



| 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      | <p>Very flexible screened cable for variable speed drive to motor connections.</p> <p>UV-stabilised</p>   | 136  |

## APPLICATION SELECTION GUIDE

| Construction   | Designation                               |
|--|---|
|  <ol style="list-style-type: none"><li>1. Highest protection IP68 &amp; 15 bar.</li><li>2. One gland body for several cable O.D's.</li><li>3. Highest strain relief.</li></ol>   | <b>EMC cable glands</b>                   |
|  <ol style="list-style-type: none"><li>1. Highest protection IP68 up to 15 bar.</li><li>2. One gland for several cable O.D's.</li><li>3. Highest strain relief.</li></ol>  | <b>blueglobe<sup>®</sup> cable glands</b> |
|  <ol style="list-style-type: none"><li>1. PCP elastomer sheath</li><li>2. Anti torsion textile braid</li><li>3. Elastomer inner sheath</li><li>4. Protolon EPR insulation</li><li>5. Copper conductors, highly flexible</li></ol> | <b>CORDAFLEX (SMK) 5DH3</b>               |

| Rated voltage | Application and design  | Page |
|---------------|---|------|
|               | <p>EMC metric glands are IP68, brass, galv nickel plated. Designed for EMC environments, ensuring positive contact with the cable.</p>  | 138  |
|               | <p>Blueglobe cable glands are available in brass, plastic and stainless steel. Widest sealing range in one gland body. Highest strain relief and IP68 up to 15 bar.</p>   | 142  |
| 0.6/1kV       | <p>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.</p> <p>Suitable for hazardous locations</p> | 147  |


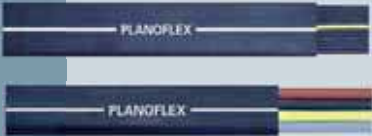
## APPLICATION SELECTION GUIDE

| Construction   | Designation  |
|--|--|
|  <p>1. PCP elastomer sheath<br/>2. Protolon insulation<br/>3. Tinned finely stranded conductors<br/>4. Braid screen available</p>      | <p><b>RONDOFLEX</b><br/>5DG6</p>                   |
|  <p>1. PCP elastomer sheath<br/>2. Protolon insulation<br/>3. Tinned finely stranded conductors<br/>4. Overall braid screen shield</p> | <p><b>RONDOFLEX</b><br/><b>(C)-FC</b><br/>5DG6</p> |






| Rated voltage | Application and design   | Page |
|---------------|--|------|
| 0.6/1kV       | <p>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.</p> <p>Suitable for simple reeling.</p> | 160  |
| 0.6/1kV       | <p>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.</p>  | 166  |

## APPLICATION SELECTION GUIDE

| Construction   | Designation                              |
|--|--|
|  <p><b>RONDOFLEX (CHAIN)</b></p> <ol style="list-style-type: none"><li>1. PCP elastomer sheath</li><li>2. Protolon EPR insulation</li><li>3. Tinned copper conductors, extremely flexible</li><li>4. Individual copper braid screens</li></ol> | <p><b>RONDOFLEX (CHAIN)</b><br/>5DG4</p> |
|  <p><b>PLANOFLEX</b></p> <ol style="list-style-type: none"><li>1. PCP elastomer sheath</li><li>2. PROTOLON EPR insulation</li><li>3. Copper conductors, extremely flexible</li><li>4. Individual copper braid screens</li></ol>                | <p><b>PLANOFLEX</b><br/>5DG5</p>         |




| 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<br>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                   |
|---|-------------------------------|
|  <p>1. Orange PCP outer sheath.<br/>2. Kevlar braided coverage of core assembly.<br/>3. 50/125; 62.5/125 micron graded index and E9 mono mode fibres.</p>                     | <b>OPTOFLEX (M)</b><br>5DG8   |
|  <p>1. Black PCP outer sheath.<br/>2. Kevlar braided coverage of core assembly.<br/>3. 50/125; 62.5/125 micron graded index and E9 mono mode fibres.</p>                      | <b>OPTOFLEX (F.O)</b><br>5DG8 |
|  <p>1. Polyurethane sheath<br/>2. Lead beaded core elements<br/>3. Kevlar rope strength support<br/>4. PROTODUR PVC insulation<br/>5. Copper conductors, highly flexible</p> | <b>SPREADERFLEX</b><br>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 bandwidth 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   |
|---|---|
|  <ol style="list-style-type: none"><li>1. PVC sheath</li><li>2. PROTODUR PVC insulation</li><li>3. Copper conductors, flexible</li><li>4. Central support element</li></ol>   | <p><b>PENDANTFLEX</b><br/>5DE5</p>          |
|  <ol style="list-style-type: none"><li>1. PCP heavy duty sheath</li><li>2. Elastomer inner sheath</li><li>3. Individual copper core screens</li><li>4. PROTOLON EPR insulation</li><li>5. Copper conductors, flexible</li></ol> | <p><b>PROTOMONT</b><br/>XHD<br/>5DL/5DM</p> |
|  <ol style="list-style-type: none"><li>1. CPE Sheath</li><li>2. Exceptional flexibility</li><li>3. Robust construction</li><li>4. EPR insulation</li><li>5. Copper conductors, highly flexible</li></ol>            | <p><b>PROTOMONT</b><br/>241.1</p>         |

| 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                           |
|--|---------------------------------------|
|  <ol style="list-style-type: none"> <li>1. CPE sheath</li> <li>2. Overall copper braid screen</li> <li>3. Elastomer inner sheath</li> <li>4. Polyethylene insulation</li> <li>5. Copper conductors, flexible, screened pairs</li> </ol>                                      | <p><b>MINING MSR</b><br/>5DM4</p>     |
|  <ol style="list-style-type: none"> <li>1. Protofirm PCP sheath</li> <li>2. Elastomer inner sheath</li> <li>3. Protolon EPR insulation</li> <li>4. Semiconductive core screens</li> <li>5. Copper conductors, flexible</li> </ol>  | <p><b>PROTOLON (N)</b><br/>5DK8</p>   |
|  <ol style="list-style-type: none"> <li>1. Protofirm PCP HD</li> <li>2. Anti torsion textile braid</li> <li>3. Elastomer inner sheath</li> <li>4. Protolon EPR insulation</li> <li>5. Semiconductive core screens</li> <li>6. Copper conductors, highly flexible</li> </ol> | <p><b>PROTOLON (SMK)</b><br/>5DK8</p> |



| 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   |
|---|---|
|   | <b>PROTOLON<br/>(SM-R) FO<br/>FIBRE OPTICS<br/>5DK8</b> |
|  <ol style="list-style-type: none"><li>1. Profotirm PCP heavy duty sheath</li><li>2. Anti torsion textile braid</li><li>3. Elastomer inner sheath</li><li>4. Protolon EPR insulation</li><li>5. Semiconductive core screens</li><li>6. Copper conductors, highly flexible</li></ol> | <b>PROTOLON (SB)<br/>5DK8</b>                           |
|  <ol style="list-style-type: none"><li>1. Profotirm PCP sheath</li><li>2. Elastomer inner sheath</li><li>3. Protolon EPR insulation</li><li>4. Semiconductive core screens</li><li>5. Copper conductors, flexible</li></ol>   | <b>PROTOLON<br/>(Single core)<br/>5DK8</b>              |

| 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 Prototflex 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 degradation 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

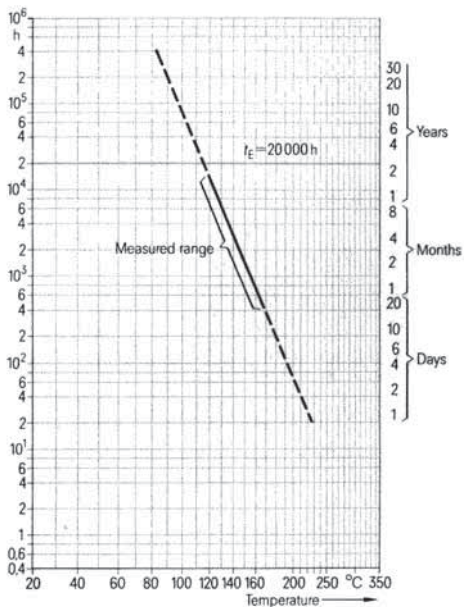


Fig. 1  
Service life of EPR insulation compounds

## VOLTAGE RATINGS

Voltage values are usually expressed in the form  $U_0/U$  and  $U_m$ .  $U_0$  is the rms power frequency voltage between phase and earth.  $U$  is the rms power frequency voltage between phases.  $U_m$  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

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HYDROFIRM (T) 5DH1 PAGE 66

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PROTOMONT HD 5DL1 PAGE 80

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PROTOMONT SCREENED 5DL2 PAGE 88

## SINGLE CORE – SDI 110<sup>0</sup> 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 in indoor and outdoor
- Installed in electrical conduit, on surface and flush-mounted, in closed electrical 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.

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

|                    |       |       |      |      |      |      |      |      |      |      |      |      |      |
|--------------------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|
| [mm <sup>2</sup> ] | 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 110<sup>0</sup> 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<sup>2</sup>.

This ensures no conductor damage will occur in operation.

## SINGLE CORE – SDI 110<sup>0</sup> FLEX

### VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV to 3.3kV AC
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 2.1/3.6kV
  - DC operation  $U_0/U$  = 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 110<sup>0</sup> FLEX

### Selection and ordering data

| No. of cores<br>x conductor<br>size | Part No. | Nominal diameter<br>of bare |
|-------------------------------------|----------|-----------------------------|
| mm <sup>2</sup>                     |          | 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 110<sup>0</sup> FLEX

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

| Normal overall cable conductor | Net cable weight diameter | 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              |

## OZOFLEX – Flexible cables with cross linked elastomeric insulation

### 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<sup>2</sup> 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.

# OZOFLEX – Flexible cables with cross linked elastomeric insulation

## 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:

|                          |             |             |             |             |
|--------------------------|-------------|-------------|-------------|-------------|
| <b>Number of layers:</b> | <b>1</b>    | <b>2</b>    | <b>3</b>    | <b>4</b>    |
| <b>Derating factor:</b>  | <b>0.85</b> | <b>0.65</b> | <b>0.45</b> | <b>0.32</b> |

## OZOFLEX – Flexible cables with cross linked elastomeric insulation

### VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.15kV
  - DC operation  $U_0/U$  = 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, <b>green/yellow</b>   |
| 4 Core                  | brown, black, grey, <b>green/yellow</b>  |
| 5 Core                  | blue, brown, black, grey, <b>green/yellow</b>  |
| Multi core              | black insulation white cores sequentially numbered including a <b>green/yellow</b> earth core. |
| Australian core colours | red, white, blue, black, <b>green/yellow</b>   |

### Selection and ordering data

|  | No. of cores x<br>conductor size | Part No.    | Nominal No. of<br>strands x and<br>strand diameter |
|--|----------------------------------|-------------|--|
|  | mm <sup>2</sup>                  |             | mm   |
| OZOFLEX with<br>black insulation<br>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 |  |

## OZOFLEX – Flexible cables with cross linked elastomeric insulation

### TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm<sup>2</sup>.

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                 |

# OZOFLEX – Flexible cables with cross linked elastomeric insulation

## Selection and ordering data

|  | No. of cores x<br>conductor size | Part No.   | Nominal No. of<br>strands x and<br>strand diameter |
|--|----------------------------------|------------|--|
|  | mm <sup>2</sup>                  |            | mm   |
| without a<br>green/yellow<br>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<br>including a<br>green/yellow<br>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<br>conductor size | Part No.   | Nominal No. of<br>strands x and<br>strand diameter |
|---|----------------------------------|------------|--|
|   | mm <sup>2</sup>                  |            | mm   |
| OZOFLEX<br>including a<br>green/yellow<br>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<br>Colours<br>R,W,B,B,<br>green/yellow<br>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   |

# 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                   |
| 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                 |



## OZOFLEX – Flexible cables with cross linked elastomeric insulation

### Selection and ordering data

|   | No. of cores x<br>conductor size | Part No.   | Nominal No. of<br>strands x and<br>strand diameter |
|---|----------------------------------|------------|--|
|   | mm <sup>2</sup>                  |            | mm   |
| OZOFLEX<br>(Control)<br>including a<br>green/yellow<br>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.

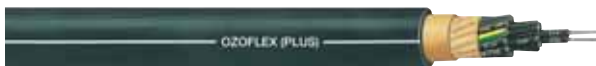
| Nominal Diameter of bare conductor | Nominal cable overall diameter | Approx. net cable weight | Unenclosed Touching |
|------------------------------------|--------------------------------|--------------------------|---------------------|
| mm                                 | mm                             | 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                  |



# OZOFLEX (PLUS)

Flexible cables for submersion in polluted liquids

## 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
- Hygienic 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<sup>2</sup> and all control cables include an additional elastomer inner sheath and all cables up to 6mm<sup>2</sup> 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

# OZOFLEX (PLUS)

Flexible cables for submersion in polluted liquids

## 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:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.15kV
  - DC operation  $U_0/U$  = 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, <b>green/yellow</b>   |
| 4 Core      | brown, black, grey, <b>green/yellow</b>  |
| 5 Core      | blue, brown, black, grey, <b>green/yellow</b>                                      |
| Multi core  | black insulation sequentially numbered including a <b>green/yellow</b> earth core. |

## TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm<sup>2</sup>.

This ensures no conductor damage will occur in operation.

# OZOFLEX (PLUS)

Flexible cables for submersion in polluted liquids


## Selection and ordering data

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

# OZOFLEX (PLUS)

Flexible cables for submersion in polluted liquids

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

|  | No. of cores x<br>conductor size | Part No.   | Nominal No. of<br>strands x and<br>strand diameter |
|--|----------------------------------|------------|--|
| "Brown, black, grey,<br>green/yellow"                  | mm <sup>2</sup>                  |            | mm   |
| OZOFLEX (PLUS)<br>including a<br>green/yellow<br>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)<br>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 |  |

# OZOFLEX (PLUS)

Flexible cables for submersion in polluted liquids

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

## OZOFLEX (PLUS) SCREENED (FC+)

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
- Hygienic cleaning in breweries, food processing plants etc.
- Water depth approx. 10m in waste water, as customarily Encountered 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<sup>2</sup> 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.



# OZOFLEX (PLUS) SCREENED (FC+)

## VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.15kV
  - DC operation  $U_0/U$  = 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, <b>green/yellow</b>   |
| 4 Core      | brown, black, <b>green/yellow</b> , grey   |
| Multi core  | black insulation sequentially numbered including a <b>green/yellow</b> earth core. |

## TENSILE STRENGTH

The maximum allowable tensile stress is 15N/mm<sup>2</sup>.

This ensures no conductor damage will occur in operation.

## OZOFLEX (PLUS) SCREENED (FC+)

### Selection and ordering data

| No. of cores x<br>conductor size | Part No. | Nominal No. of<br>strands x and<br>strand diameter |
|----------------------------------|----------|--|
| mm <sup>2</sup>                  |          | 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 |

# OZOFLEX (PLUS) SCREENED (FC+)

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

# HYDROFIRM (T)

## Round and Flat Cables for Drinking Water Application

### 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<sup>2</sup>. This ensures no conductor damage will occur in operation.

### VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:  
DC operation  $U_0/U$  = 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 <b>green/yellow</b>   |
| 4 core      | – | brown, black, grey and <b>green/yellow</b>  |
| 5 core      | – | brown, black, grey, blue, <b>green/yellow</b>                                       |
| Multi core  | – | black insulation, sequentially numbered, including a <b>green/yellow</b> earth core |

### THERMAL CHARACTERISTICS

Maximum permissible water temperature.

(At higher water temperatures, a shortened cable service life is to be expected)

60 °C

# HYDROFIRM (T)

Round and Flat Cables for Drinking Water Application

## Selection and ordering data


|  | No. of cores x<br>conductor size | Part No.    | Nominal. No.<br>of strands<br>and strand<br>diameter |
|--|----------------------------------|-------------|--|
|  | mm <sup>2</sup>                  |             | mm   |
| HYDROFIRM (T)<br>with black core<br>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 |  |



# HYDROFIRM (T)

## Round and Flat Cables for Drinking Water Application

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   |

# HYDROFIRM (T)

Round and Flat Cables for Drinking Water Application

## Selection and ordering data

|  | No. of cores x<br>conductor size | Part No. | Nominal. No.<br>of strands<br>and strand<br><br>diameter |
|--|----------------------------------|----------|--|
|  | mm <sup>2</sup>                  |          | mm   |
| HYDROFIRM (T)<br>including a<br>green/yellow<br>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  |

# HYDROFIRM (T)

## Round and Flat Cables for Drinking Water Application

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                |

# HYDROFIRM (T)

Round and Flat Cables for Drinking Water Application

## Selection and ordering data

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

|  | No. of cores x<br>conductor size | Part No. | Nominal. No.<br>of strands<br>and strand<br><br>diameter |
|--|----------------------------------|----------|--|
|  | mm <sup>2</sup>                  |          | mm   |
| HYDROFIRM (T)                                  | 4 G 1.5                          | 5DH1 522 | 30 x 0.25  |
| FLAT including<br>a green/yellow<br>earth core | 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   |

# HYDROFIRM (T)

## Round and Flat Cables for Drinking Water Application

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.

# HYDROFIRM (T) SCREENED

## 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<sup>2</sup>.

This ensures no conductor damage will occur in operation.

## VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.2kV
  - DC operation  $U_0/U$  = 0.9/1.8kV
- AC test voltage = 2kV

# HYDROFIRM (T) SCREENED

## CORE COLOUR IDENTIFICATION

|            |   |  |
|------------|---|--|
| 4 core     | – | brown, black, grey and <b>green/yellow</b> 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 <sup>2</sup>                    |          | 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                               |



# HYDROFIRM (T) SCREENED

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



## APPLICATION

- 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<sup>2</sup>.

This ensures no conductor damage will occur in operation.

# PROTOMONT HD

## VOLTAGE RATING

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



## Selection and Ordering Data

|   | No. of cores x<br>conductor size | Part No. | Nominal<br>of strands<br>and strand<br>diameter |
|---|----------------------------------|----------|---|
|   | mm <sup>2</sup>                  |          | mm  |
| PROTOMONT<br>with black core<br>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<br>including green/<br>yellow earth<br>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 <b>green/yellow</b>   |
| 4 core       | - | blue, brown, black and <b>green/yellow</b>  |
| 5 core       | - | blue, brown, black, <b>green/yellow</b> and black                                 |
| Multi core:  | - | black insulation sequentially numbered including a <b>green/yellow</b> 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  | 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  |

# PROTOMONT HD



## Selection and ordering data

|   | No. of cores x<br>conductor size | Part No.    | Nominal<br>of strands<br>and strand<br>diameter |
|---|----------------------------------|-------------|---|
|   | mm <sup>2</sup>                  |             | mm  |
| PROTOMONT<br>including green/<br>yellow earth<br>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

# PROTOMONT HD

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

| Nominal<br>of diameter<br>conductor | Nominal<br>cable<br>diameter | Approx.<br>net cable<br>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   |

# PROTOMONT HD



## Selection and ordering data

|  | No. of cores x<br>conductor size | Part No.  | Nominal<br>of strands<br>and strand<br>diameter |
|--|----------------------------------|-----------|---|
|  | mm <sup>2</sup>                  |           | mm  |
| PROTOMONT<br>including<br>green/yellow<br>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 |   |



# PROTOMONT HD

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

| Nominal<br>of diameter<br>conductor | Nominal<br>cable<br>diameter | Approx.<br>net cable<br>weight | Unenclosed  |   |
|-------------------------------------|------------------------------|--------------------------------|---|---|
|                                     |                              |                                | Spaced  | 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

# PROTOMONT SCREENED

## 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:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.15kV
  - DC operation  $U_0/U$  = 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<sup>2</sup>. This ensures no conductor damage will occur in operation.

### CORE COLOUR IDENTIFICATION

|        |  |
|--------|--|
| 4 core | blue, brown, black, <b>green/yellow</b>      |
| 5 core | red, white, blue, black, <b>green/yellow</b> |

## PROTOMONT SCREENED


### Selection and ordering data

#### 5 CORE OVERALL PROTOMONT SCREENED (F)

|                       | Number of<br>cores x<br>conductor size | Part No. | Nominal<br>strands and<br>strand diameter |
|-----------------------|--|----------|---|
|                       | mm <sup>2</sup>                        |          | mm  |
| PROTOMONT<br>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                                |

# PROTOMONT SCREENED

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

| Nominal<br>of diameter<br>conductor | Nominal<br>cable<br>diameter | Approx<br>net cable<br>weight | Unenclosed<br>Touching   |
|-------------------------------------|------------------------------|-------------------------------|--|
| mm                                  | mm                           | kg/km                         | <br>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   |

## SECTION 2



## HIGH TEMPERATURE CABLES

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# 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

# SINOTHERM 180°C

## 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 continuous 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 continuous 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  $U_0/U$  = 0.6/1kV
- Multi core & glass braided  $U_0/U$  = 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<br>x conductor<br>size | Part No. | Nominal<br>No. of strands<br>and strand<br>diameter |
|-------------------------------------|----------|---|
| mm <sup>2</sup>                     |          | 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<br>diameter<br>conductor | Nominal<br>cable<br>diameter | Approx. net<br>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<br>x conductor<br>size | Part No.   | Nominal<br>No. of<br>strands<br>and strand | Nominal<br>conductor<br>diameter | Nominal<br>cable<br>diameter | Approx.<br>net cable<br>weight |
|-------------------------------------|------------|--|----------------------------------|------------------------------|--------------------------------|
| mm <sup>2</sup>                     |            | 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<br>x conductor<br>size<br><br>mm <sup>2</sup> | Part No.   | Nominal<br>No. of<br>strands<br>and strand<br><br>mm | Nominal<br>conductor<br>diameter<br><br>mm | Nominal<br>cable<br>diameter<br><br>mm | Approx.<br>net cable<br>weight<br><br>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 virtue 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<br>(max. 5 s) |
| ■ Minimum permissible temperatures                           |                     |
| when in motion   | -25°C               |
| when stationary  | -40°C               |

## MECHANICAL CHARACTERISTICS

Permissible pulling force max 15 N/mm<sup>2</sup>

## 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

# SINOTHERM 110°C

## 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 continuous 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 continuous 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  $U_0/U$  = 0.6/1kV
- AC test voltage (test duration)  $U_0/U$  = 2.5kV (15min)

# SINOTHERM 110°C

## Selection and ordering data

| No. of cores<br>x conductor<br>size | Insulation<br>colour | Part No.   | Nominal<br>strands and<br>strand<br>diameter |
|-------------------------------------|----------------------|------------|--|
| mm <sup>2</sup>                     |                      |            | 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                                  |

# SINOTHERM 110°C

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<sup>2</sup>. This ensures no conductor damage will occur in operation.

## VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.15kV
  - DC operation  $U_0/U$  = 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<br>conductor<br>size | Part No.   | Nominal<br>strands and<br>strand<br>diameter |
|-----------------------------------|------------|--|
| mm <sup>2</sup>                   |            | mm   |
| 1 x 4                             | 5DR7 490-5 | 56 x 0.3                                     |
| 1 x 10                            | 5DR7 493-5 | 80 x 0.4                                     |
| 1 x 16                            | 5DR7 492-5 | 126 x 0.4                                    |
| 1 x 50                            | 5DR7 491-5 | 396 x 0.4                                    |

## EVA 125 FLEX

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 intended 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<sup>2</sup>, and 50N/mm<sup>2</sup> 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<br>x conductor<br>size    | Insulation<br>colour | Part No.                         | Nominal<br>conductor<br>diameter | Nominal<br>cable<br>diameter |
|--|----------------------|----------------------------------|----------------------------------|------------------------------|
| mm <sup>2</sup>                        |                      |                                  | 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<br>cross-section<br>and colour | Order<br>No.         | Nominal<br>conductor<br>diameter | Nominal<br>cable<br>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                              |                              |

## TECSUN (PV)

| Approx.<br>net cable<br>weight      | Min<br>bending<br>radius | Max<br>permissible<br>tensile load | Current<br>carrying<br>capacity at<br>60°C   | Permissible<br>short circuit<br>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.<br>net weight<br>Twin Cable | Min<br>bending<br>radius | Max<br>permissible<br>tensile load | Current<br>carrying<br>capacity at<br>60°C ambient<br>temperature<br>(free in air) | Permissible<br>short circuit<br>current<br><br>(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

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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 where 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

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

# PROTOFLEX PVC

## 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<sup>2</sup>.

The maximum allowable tensile stress is 50 N mm<sup>2</sup> 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:  $U_0/U$  = 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.

# PROTOFLEX PVC

## PVC control cables, unscreened

### Selection and ordering data


| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>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                               |



# PROTOFLEX PVC

## PVC control cables, unscreened

### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching   |
|--|----------|---|--|--|
|  |          |   |  | <br>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.

# PROTOFLEX PVC

## PVC control cables, unscreened

### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>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                              |





# PROTOFLEX PVC

## PVC control cables, unscreened

### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>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.

# PROTOFLEX PVC

## PVC control cables, unscreened

### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>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                              |



# PROTOFLEX PVC

## PVC control cables, screened

### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>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.

# PROTOFLEX PVC

## PVC control cables, screened


### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>A<br> |
|--|----------|---|--|--|
| 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   |

# PROTOFLEX PVC

## PVC control cables, screened

### Selection and ordering data

| No. of cores<br>x<br>conductor<br>cross-section<br><br>mm <sup>2</sup> | Part No. | Nominal No.<br>of strands<br>and strand<br>diameter<br><br>mm | Approx.<br>cable<br>diameter<br><br>mm | Unenclosed<br>Touching<br><br>A<br> |
|--|----------|---|--|--|
| 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 PROFLEX -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<sup>2</sup> or greater the earth conductor is divided evenly into 3 separate cores and uniformly 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.

## PROTOFLEX-EMV-FC – UV Stabilised

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)
- Minimum 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:  $U_0/U$  = 0.6kV/1kV
- AC test voltage: = 5kV
- Max. permissible peak AC voltage =2.4kV
- For connection on frequency converter U max. 690 V

# PROTOFLEX-EMV-FC – UV Stabilised

## 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 |
|--|----------|--|-----------------------|------------------------------|
| mm <sup>2</sup>                          |          | 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                         |



# PROTOFLEX-EMV-FC – UV Stabilised

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 <sup>2</sup>               |           | 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                        |
| <b>UV Stabilized</b>          |           |  |                              |
| 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:  $U_0/U$  = 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 <sup>2</sup>     |                | 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       |

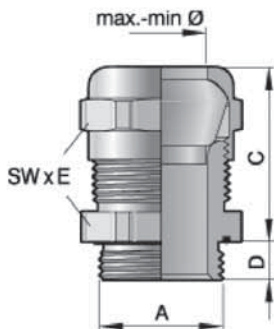
## EMC CABLE GLANDS

| Connection<br>thread / length | Sealing<br>range |       | Screen<br>diameter<br>range |       | Lock nut<br>part No. |
|-------------------------------|------------------|-------|-----------------------------|-------|----------------------|
|                               | mm               | Max   | Min                         | Max   |                      |
| 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            |

## blueglobe® CABLE GLANDS



- 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)





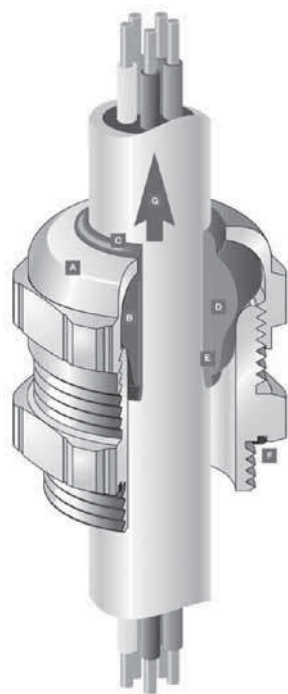
**Gland selection data based on cable O.D**

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

**Part number and gland dimensions**

| Part No  | Connection                |                         | Range<br>max/min. $\varnothing$ | Sealing<br>range<br>without<br>insert<br>max/min. $\varnothing$ |    | C       | Spanner<br>width<br>SW x E<br>mm |
|----------|---------------------------|-------------------------|---------------------------------|---|----|---------|----------------------------------|
|          | Brass<br>Nickel<br>Plated | thread/<br>length<br>mm |                                 | A   | D  |         |                                  |
| bg812 ms | M12x1,5                   | 15                      | 2 - 8                           | 5 - 8   | 21 | 17x18,9 |                                  |
| bg816 ms | M16x1,5                   | 15                      | 4 - 11                          | 7 - 11  | 25 | 20x22,2 |                                  |
| bg820 ms | M20x1,5                   | 15                      | 5 - 14                          | 9 - 14  | 29 | 24x26,5 |                                  |
| bg825 ms | M25x1,5                   | 15                      | 11 - 20                         | 16 - 20   | 29 | 30x33   |                                  |
| bg832 ms | M32x1,5                   | 15                      | 15 - 25                         | 20 - 25   | 32 | 36x39,5 |                                  |
| bg840 ms | M40x1,5                   | 15                      | 20 - 32                         | 26 - 32   | 35 | 45x48   |                                  |
| bg850 ms | M50x1,5                   | 15                      | 31 - 42                         | 35 - 42   | 35 | 57x61   |                                  |
| bg863 ms | M63x1,5                   | 15                      | 41 - 54                         | 46 - 54   | 38 | 68x74   |                                  |

## 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**

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**RONDOFLEX 5DG6 PAGE 160**

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**RONDOFLEX (C) – FC 5DG6 PAGE 166**

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**RONDOFLEX-CHAIN 5DG4 PAGE 172**

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**PLANOFLEX 5DG5 PAGE 184**

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**OPTOFLEX (M) 5DG8 PAGE 196**

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**OPTOFLEX (F.O) 5DG8 PAGE 200**

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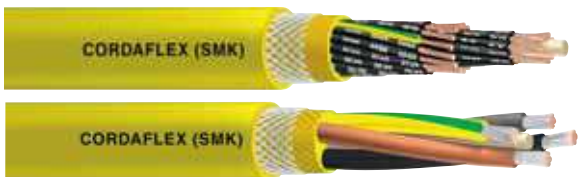
**SPREADERFLEX 5DE5 PAGE 204**

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**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



# 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<br>max = 30 N/mm <sup>2</sup> | 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.



# CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

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

## CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

### 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<sup>2</sup>
- Torsional stresses: ± 50°/m
- Min. distance with S-type directional changes: 20 x D

### MINIMUM BENDING RADII







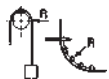
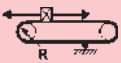
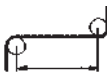
If the bending radii are smaller than those permitted, a reduced service life can be expected depending on the stress conditions. The values given in the following table should be taken as a basis.

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 .

# CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

## Minimum bending radii

| Flexible Cables   |  | CORDAFLEX, PLANOFLEX,<br>RONDOFLEX, SPREADERFLEX,<br>Lift control cable |                  |                   |             |
|---|--|---|------------------|-------------------|-------------|
| Rated voltage $U_0/U$ Up to 0.6/1 kV  |  |   |                  |                   |             |
| Maximum overall diameter<br>of the cable or maximum<br>thickness of the flat cable (mm) |  | Up to<br>8  | Above<br>8 to 12 | Above<br>12 to 20 | Above<br>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<br>a centre feed point                    | 3 x d   | 4 x d            | 5 x d             | 5 x d       |
|        | For forced guidance<br>with reeling operation                    | 5 x d   | 5 x d            | 5 x d             | 6 x d       |
|        | For forced guidance<br>with festoon operation                    | 4 x d   | 4 x d            | 5 x d             | 5 x d       |
|       | For forced guidance<br>with power tracks                         | 4 x d   | 4 x d            | 5 x d             | 5 x d       |
|      | For forced guidance<br>with sheaves                              | 7.5 x d   | 7.5 x d          | 7.5 x d           | 7.5 x d     |
|      | For forced guidance<br>with cable tenders                        | 7.5 x d   | 7.5 x d          | 7.5 x d           | 7.5 x d     |
|      | Minimum distance<br>with double or S-type<br>directional changes | 20 x d  | 20 x d           | 20 x d            | 20 x d      |

# CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

## 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                                      |

## 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:

|                          |             |             |             |             |
|--------------------------|-------------|-------------|-------------|-------------|
| <b>Number of layers:</b> | <b>1</b>    | <b>2</b>    | <b>3</b>    | <b>4</b>    |
| <b>Derating factor:</b>  | <b>0.85</b> | <b>0.65</b> | <b>0.45</b> | <b>0.32</b> |

## TENSILE STRENGTH

CORDAFLEX has a maximum safe reeling tensile strength of 30N/mm<sup>2</sup>. 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.

# CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

## VOLTAGE RATING

- Rated voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.2kV
  - DC operation  $U_0/U$  = 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 2 1/2 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.

# CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

## Selection and ordering data

| Part No.  | Number of cores and nominal cross-section mm <sup>2</sup> | Nominal main conductor diameter mm |
|---|---|------------------------------------|
| <b>Power Cables, Four-core Design</b>   |   |                                    |
| 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                                |
| <b>Power Cables, Five-core Design</b>   |   |                                    |
| 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                                |
| <b>Power Cables, Three-core Design with Protective-earth Conductor split into 3</b>                     |   |                                    |
| 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                           |
| <b>Control Cables for Vertical Reeling Operation, with 20 kN Support Element (SMK-V CONTROL CABLES)</b> |   |                                    |
| 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                                |

## CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

| Nominal diameter of cable<br>mm | Approx. net cable weight<br>kg/km | Maximum permissible tensile force<br>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                                   |

# CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

## Selection and ordering data

| Part No.                       | Number of cores<br>and nominal<br>cross-section<br>mm <sup>2</sup> | Nominal main<br>conductor diameter<br>mm |
|--------------------------------|--|--|
| <b>Control Cables</b>          |  |  |
| 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                                      |
| <b>Bus Cables</b>              |  |  |
| 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                                      |
| <b>Combined Control Cables</b> |  |  |
| 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                                  |

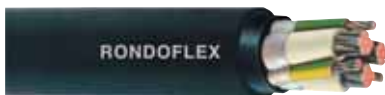


## CORDAFLEX (SMK) – LOW VOLTAGE REELING CABLE

| Nominal diameter of cable<br>mm | Approx. net cable weight<br>kg/km | Maximum permissible tensile force<br>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  $U_0/U$  = 0.6/1kV
- Max permissible operating voltage in AC systems  $U_0/U$  = 0.7/1.2kV
- Max permissible operating voltage in DC systems  $U_0/U$  = 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<sup>2</sup>
- 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

## RONDOFLEX – Round festoon cable

### CORE COLOUR IDENTIFICATION

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

### Selection and ordering data

|                           | Number of<br>cores &<br>nominal<br>area<br><br>mm <sup>2</sup> | Part No. |
|---------------------------|--|----------|
| Power cables              | 1 x 25   | 5DG6 610 |
| SINGLE-CORE DESIGN        | 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              | 4 x 2.5  | 5DG6 664 |
| FOUR AND FIVE-CORE DESIGN | 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 |

# RONDOFLEX – Round festoon cable

## 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               |

# RONDOFLEX – Round festoon cable

## Selection and ordering data

|  | Number of<br>cores &<br>nominal<br>area<br><br>mm <sup>2</sup> | Part No. |
|--|--|----------|
| Power cables   | 3 x 35 + 3 x 16/3  | 5DG6 631 |
| Three-core design with<br>protective-earth conductor<br>split into 3 | 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 |

# RONDOFLEX – Round festoon cable

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 greater 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



# RONDOFLEX (C) – FC OVERALL SCREENED

## ELECTRICAL PARAMETERS

- |  |         |                |
|--|---------|----------------|
| ■ Rated voltage                                    | $U_0/U$ | = 0.6/1kV      |
| ■ Max permissible operating voltage in AC systems  | $U_0/U$ | = 0.7/1.2kV    |
| ■ voltage in DC systems                            | $U_0/U$ | = 0.9/1.8kV    |
| ■ AC test voltage                                  |         | 5kV over 5 min |
| ■ For connection on frequency converters $U_{max}$ |         | 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 <sup>2</sup>   |
| Torsional stresses    | No application   |
| Minimum bending radii | See min bending radii at start of Corda flex SMK chapter<br>Travel 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.

# RONDOFLEX (C) – FC OVERALL SCREENED

## CORE COLOUR IDENTIFICATION

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

## Selection and ordering data

| Number of<br>cores &<br>nominal<br>cross-section | Part No.        | Shield<br>cross-section<br>diameter | Nominal<br>conductor<br>of cable |
|--|-----------------|-------------------------------------|----------------------------------|
| mm <sup>2</sup>                                  | mm <sup>2</sup> | 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                            |

# RONDOFLEX (C) – FC OVERALL SCREENED

## 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               |



## RONDOFLEX (C) – FC OVERALL SCREENED

### Selection and ordering data

| Number of cores & nominal cross-section mm <sup>2</sup> | Part No. | Conductor resistor at 20°C<br><br>Ω/km | Inductance (core/core) at 10 kHz<br>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  |

## RONDOFLEX (C) – FC OVERALL SCREENED

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

| Capacitance<br>(core/shield)<br>at 1 kHz<br>n Farrads/km | Transfer impedance |                   |                   |
|--|--------------------|-------------------|-------------------|
|  | at 1 MHz<br>mΩ/m   | at 10 MHz<br>mΩ/m | at 30 MHz<br>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                                   | $U_0/U$ | = 0.6/1kV         |
| ■ Max permissible operating voltage in AC systems | $U_0/U$ | = 0.7/1.2kV       |
| voltage in DC systems                             | $U_0/U$ | = 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 <sup>2</sup>                               |
| Torsional stresses    | No application   |
| Minimum bending radii | See min bending radii at start of Corda flex SMK chapter |
| Travel 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.    |

# RONDOFLEX-CHAIN

## CORE COLOUR IDENTIFICATION

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



## Selection and ordering data

|                                      | Number of<br>cores &<br>nominal<br>cross-section | Part No. | Nominal<br>conductor<br>diameter |
|--------------------------------------|--|----------|----------------------------------|
|                                      | mm <sup>2</sup>                                  |          | mm                               |
| Power cable<br>single core<br>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     |                                  |



# RONDOFLEX-CHAIN

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   |



# RONDOFLEX-CHAIN

## Selection and ordering data

|  | Number of<br>cores &<br>nominal<br>cross-section | Part No. | Nominal<br>conductor<br>diameter |
|--|--|----------|----------------------------------|
|  | mm <sup>2</sup>                                  |          | mm                               |
| Power cable,<br>single core<br>design,<br>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,<br>3/4 – core<br>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                             |

# RONDOFLEX-CHAIN

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   |



# RONDOFLEX-CHAIN

## Selection and ordering data

|  | Number of<br>cores &<br>nominal<br>cross-section | Part No. | Nomial<br>conductor<br>diameter |
|--|--|----------|---------------------------------|
|  | mm <sup>2</sup>                                  |          | mm                              |
| Power cable,<br>3/4/5 – core<br>design overall<br>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,<br>5/7 – core<br>design                       | 7x4  | 5DG4 171 | 2.9                             |
|  | 5x6  | 5DG4 122 | 3.6                             |
|  | 5x10   | 5DG4 123 | 4.6                             |
|  | 5x16   | 5DG4 124 | 5.9                             |

# RONDOFLEX-CHAIN

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  |



# RONDOFLEX-CHAIN

## Selection and ordering data

|                                    | Number of<br>cores &<br>nominal<br>cross-section | Part No. | Nomial<br>conductor<br>diameter |
|------------------------------------|--|----------|---------------------------------|
|                                    | mm <sup>2</sup>                                  |          | mm                              |
| Control cable,<br>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                             |

## RONDOFLEX-CHAIN

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  |

# RONDOFLEX-CHAIN

## Selection and ordering data

|                   | Number of<br>cores &<br>nominal<br>cross-section | Part No. |
|-------------------|--|----------|
| Fibre optic cable | 6xG62,5/125 $\mu$                                | 5DG4 290 |
|                   | 12xG62,5/125 $\mu$                               | 5DG4 291 |
|                   | 6xE9/125 $\mu$                                   | 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 --- |



## RONDOFLEX-CHAIN

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

| Nominal<br>Conductor<br>diameter | Nominal<br>diameter<br>cable | Approx.<br>net cable<br>weight | Maximum<br>permissible<br>tensile<br>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<sup>2</sup> class 6 conductors greater than 25mm<sup>2</sup>, 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 temperatures. 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**

# PLANOFLEX

## 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<sup>2</sup>.

This ensures no conductor damage will occur in operation.

## VOLTAGE RATING

- Rated voltage:
  - (multicore control)  $U_0/U$  = 380/660V
  - (power)  $U_0/U$  = 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<br>incl. 2.5mm <sup>2</sup> ) | – | black cores sequentially numbered,<br>including a <b>green/yellow earth</b>      |
| 4 Core  | – | blue, brown, black and <b>green/yellow</b>                                       |
| 7 Core  | – | black cores sequentially numbered,<br>including a <b>green/yellow earth core</b> |

## 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.

# PLANOFLEX

## Selection and ordering data

|                            | Number of<br>cores x<br>conductor<br>size | Part No. | Nominal<br>diameter of<br>conductor |
|----------------------------|---|----------|-------------------------------------|
|                            | mm <sup>2</sup>                           |          | mm                                  |
| PLANOFLEX<br>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  
permissible  
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 |

# PLANOFLEX

## Selection and ordering data

|                          | Number of<br>cores x<br>conductor<br>size | Part No. | Nominal<br>diameter of<br>conductor |
|--------------------------|---|----------|-------------------------------------|
|                          | mm <sup>2</sup>                           |          | mm                                  |
| PLANOFLEX<br>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                                 |



# PLANOFLEX

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

Nominal overall  
cable dimension  
Thickness x Width

Approx.  
net cable  
weight

Max  
permissible  
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

# PLANOFLEX

## Selection and ordering data

|  | Number of<br>cores x<br>conductor<br>size | Part No. | Nominal<br>diameter of<br>conductor |
|--|---|----------|-------------------------------------|
|  | mm <sup>2</sup>                           |          | mm                                  |



|                           |        |          |     |
|---------------------------|--------|----------|-----|
| PLANOFLEX<br>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 |



|   |              |          |     |
|---|--------------|----------|-----|
| Controlled<br>Cables with<br>individually<br>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

# PLANOFLEX

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

Nominal overall  
cable dimension  
Thickness x Width

Approx.  
net cable  
weight

Max  
permissible  
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

# PLANOFLEX

## Selection and ordering data

|  | Number of<br>cores x<br>conductor<br>size | Part No.  | Nominal<br>diameter of<br>conductor |
|--|---|-----------|-------------------------------------|
|  | mm <sup>2</sup>                           |           | 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<br>with individual<br>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      |                                     |

# PLANOFLEX

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

| Nominal overall cable dimension<br>Thickness x Width | Approx. net cable weight | Max permissible 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: 7Y11. 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<br>(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 aperture | 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: 7Y11. 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     |

# OPTOFLEX (F.O)

## 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. |
|-------------------------------|----------|
| <b>Multi Mode</b>             |          |
| 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 |
| <b>Mono Mode</b>              |          |
| 6E9/125 micron                | 5DG8 023 |
| 12E9/125 micron               | 5DG8 037 |
| 18E9/125 micron               | 5DG8 010 |

## APPROVALS/ STANDARDS

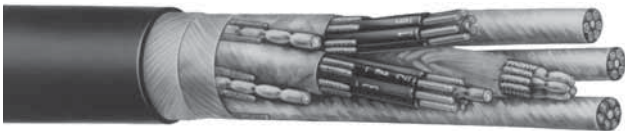
Based on FDDI, ISO/IEC 9314 Part 3, DIN VDE 0888, MSHA-SC 189-1

Additional tests – Bending and reversed bending test.

| Minimum overall diameter | Maximum overall diameter | Approx. net weight | Maximum permissible tensile force |
|--------------------------|--------------------------|--------------------|-----------------------------------|
| mm                       | mm                       | kg/km              | 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**.

# SPREADERFLEX – Spreader Basket Cable

## 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:  $U_0/U$  = 300/500V
- Maximum operating voltages in:  
3 phase AC operation  $U_0/U$  = 318/550V  
DC operation  $U_0/U$  = 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.

## SPREADERFLEX – Spreader Basket Cable

### Selection and ordering data

|   | No. of cores x<br>conductor size | Part No. | Conductor<br>diameter |
|---|----------------------------------|----------|-----------------------|
|   | mm <sup>2</sup>                  |          | mm                    |
| Control cables<br>with intergated<br>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<br>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                   |



## SPREADERFLEX – Spreader Basket Cable

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:  $U_o/U$  = 300/500V
- Maximum operating voltages in:
  - DC operation  $U_o/U$  = 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.

## PENDANTFLEX – Lift control cables

### Selection and ordering data

|                  | No. of cores x<br>conductor size | Part No. | Suspension<br>length | Travelling<br>speed |
|------------------|----------------------------------|----------|----------------------|---------------------|
|                  | mm <sup>2</sup>                  |          | 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 +<br>2 x 0.5FM (c)        | 5DE5 715 | up to 150            | up to 10            |
| Overall Screened | 28 x 1 +<br>2 x 0.5FM (c)        | 5DE5 720 |                      |                     |

FM (c) indicates individually screened control – telephone cores

## PENDANTFLEX – Lift control cables

| 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 |
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| PROTOMONT 241.1 | 5DM6 | PAGE 222 |
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| MINING MSR | 5DM4 | PAGE 228 |
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| PROTOLON | 5DK8 | PAGE 232 |
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| PROTOLON (SB) TYPE 450 | 5DK8 | PAGE 236 |
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| SINGLE CORE HIGH VOLTAGE FLEX | 5DK4<br>5DK5<br>5DK8 | PAGE 242 |
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## 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.



# PROTOMONT XHD – Rubber-Sheathed Flexible Cable

## 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<sup>2</sup>. This ensures no conductor damage will occur in operation.

## VOLTAGE RATING

- Rated Voltage:  $U_0/U$  = 0.6/1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 0.7/1.2kV
  - DC operation  $U_0/U$  = 0.9/1.8kV
- AC test voltage = 3kV (5 min)

## PROTOMONT XHD – Rubber-Sheathed Flexible Cable

### CORE COLOUR IDENTIFICATION

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

### CABLE DESCRIPTION

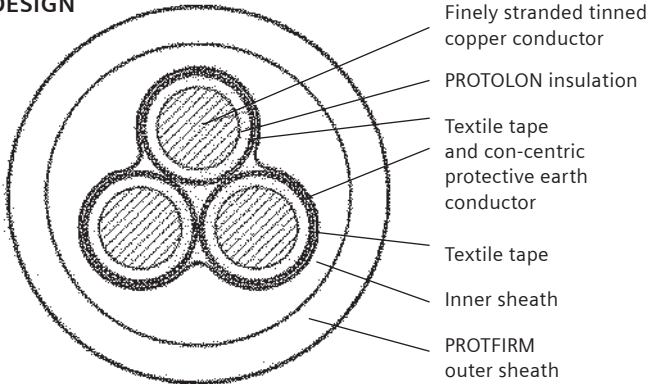
Protomont has a particular description to detail its construction fully. eg., 3 x 25 + 3 x 16/3E indicates 3 power cores each 25 mm<sup>2</sup> and 3 split earth screens (one over each power core) totaling 16 mm<sup>2</sup>.

+ 3 x 2.5 indicates 3 insulated control cores.

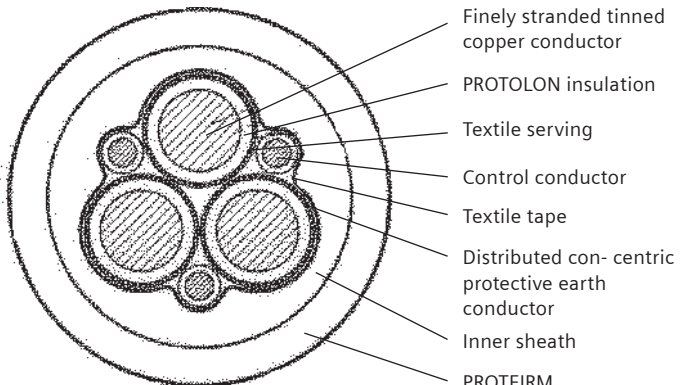
| Conductor size  | Reactance at 50Hz | Impedance at 90°C | Inductance | Capacitance |
|-----------------|-------------------|-------------------|------------|-------------|
| mm <sup>2</sup> | Ω/km              | Ω/km              | mH/km      | µF/km       |
| 4               | 0.1080            | 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        |

# PROTOMONT XHD – Rubber-Sheathed Flexible Cable

## DESIGN



5DM4 – Protomont 3 screened Power Cores



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

# PROTOMONT XHD – Rubber-Sheathed Flexible Cable

## Selection and ordering data

|                  | No. of cores<br>conductor size | Part No. |
|------------------|--------------------------------|----------|
|                  | mm <sup>2</sup>                |          |
| PROTOMONT        | 3 x 1.5 + 3 x 1.5/3E           | 5DM4 604 |
| Untinned         | 3 x 2.5 + 3 x 2.5/3E           | 5DM4 605 |
| 3 Screened       | 3 x 4 + 3 x 4/3E               | 5DM4 606 |
| Power Cores      | 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        | 1 x (2 x 1.5)C                 | 5DL4 052 |
| Control Cores    |                                |          |
| Overall Screened |                                |          |

# 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 |
|-----------|-----|------|-----|----|----|

# PROTOMONT XHD – Rubber-Sheathed Flexible Cable

## Selection and ordering data

|   | No. of cores<br>conductor size    | Part No. |
|---|-----------------------------------|----------|
|   | mm <sup>2</sup>                   |          |
| PROTOMONT<br>Untinned                       | 3 x 2.5 + 3 x 2.5/3E + 3 x 1.5 ST | 5DM4 624 |
| 3 Screened                                  | 3 x 4 + 3 x 4/3E + 3 x 1.5 ST     | 5DM4 626 |
| Power Cores<br>including 3<br>Control Cores | 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<br>Tinned                         | 3 x 2.5 + 3 x 2.5/3E + 3 x 1.5 ST | 5DM4 724 |
| 3 Screened                                  | 3 x 4 + 3 x 4/3E + 3 x 1.5 ST     | 5DM4 726 |
| Power Cores<br>including 3<br>Control Cores | 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

# PROTOMONT 241.1

## 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:  $U_0/U$  = 1.1kV
- Maximum operating voltages in:
  - 3 phase AC operation  $U_0/U$  = 1.1/1.1kV
  - DC operation  $U_0/U$  = 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<sup>2</sup>. 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<br>and nominal<br>conductor size | Part No. |
|--------------------|---|----------|
|                    | mm <sup>2</sup>                               |          |
| PROTOMONT<br>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 x 13/3E + pilot                    | 5DM6 --- |
|                    | 3 x 35 + 3 x 18/3E + pilot                    | 5DM6 201 |

# PROTOMONT 241.1

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

| Nominal No.<br>of strands<br>and strand<br>diameter | Nominal<br>cable<br>diameter | Approx.<br>cable<br>weight | Unenclosed<br>Spaced<br> |
|---|------------------------------|----------------------------|---|
| 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<sup>2</sup>.

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<br>3dB/km at 100kHz |
| Capacitance: | 65 nF/km (max) at 800 Hz             |

# MINING MSR

## 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<br>Conductor size | Part No. | Nominal No.<br>of strands and<br>strand diameter | Nominal<br>conductor<br>diameter |
|----------------------------------|----------|--|----------------------------------|
| mm <sup>2</sup>                  | 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

# PROTOLON

## 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, electric 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 substations, 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 aggressive 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



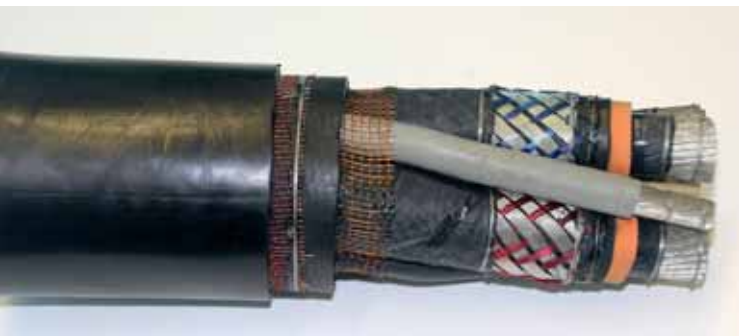


## Protolon (SB) Type 450 Trailing Cable

### 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<br>and nominal<br>cross section | Earth core<br>(total size)<br>split into 2 | Pilot<br>core   |
|---|--|-----------------|
| mm <sup>2</sup>                             | mm <sup>2</sup>                            | mm <sup>2</sup> |

### 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.

# Protolon (SB) Type 450 Trailing Cable

## Selection and ordering data

| No of cores<br>and nominal<br>cross section | Earth core<br>(total size)<br>split into 2 | Pilot<br>core   |
|---|--|-----------------|
| mm <sup>2</sup>                             | mm <sup>2</sup>                            | mm <sup>2</sup> |

### 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 |

# SINGLE CORE HIGH VOLTAGE FLEX

## 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  | $U_0/U = 6.9/12$ kV  |
| AC test voltage |         | 17 kV                |
| Rated voltage   | 12/20kV | $U_0/U = 13.9/24$ 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<br>and conductor<br>cross-section | Part No. | Nominal<br>diameter<br>conductor |
|---|----------|----------------------------------|
|---|----------|----------------------------------|

mm<sup>2</sup>

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 |

## SINGLE CORE HIGH VOLTAGE FLEX

| 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<br>and conductor<br>cross-section | Part No. | Nominal<br>diameter<br>conductor |
|---|----------|----------------------------------|
| mm <sup>2</sup>                                   |          | 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 |



## SINGLE CORE HIGH VOLTAGE FLEX

| 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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## TECHNICAL TABLES AND FORMULAE

### 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                         |

# TECHNICAL TABLES AND FORMULAE

## THREE PHASE FORMULAE

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

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

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

## ELECTRIC MOTORS

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

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

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

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

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

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

## TECHNICAL TABLES AND FORMULAE

### 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

# TECHNICAL TABLES AND FORMULAE

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/mm<sup>2</sup>

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

$$I_{thr} = J_{thr} \times \text{conductor size in mm}^2$$

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

$$\begin{aligned} I_{thr} &= 143 \times 25 \\ &= 3.58 \text{ kA (1 second)} \end{aligned}$$

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

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

## 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.

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

C = Number of Conductors in the cable

CSA = Conductor Cross Section in mm<sup>2</sup>

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

W = Cable Weight in kg/mtr

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

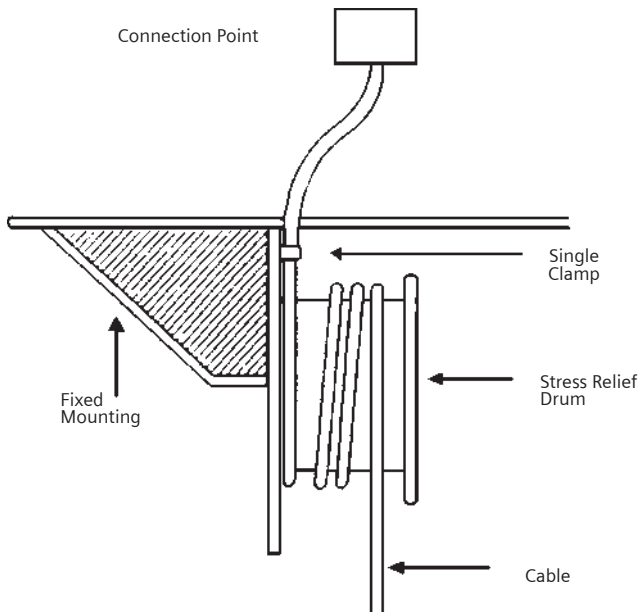
$$\begin{aligned} &= \frac{3 \times 35 \times 30}{2.16 \times 9.81} = \frac{3150}{21.19} = 148.65 \text{ mtrs} \\ &\hspace{15em} \text{maximum} \\ &\hspace{15em} \text{suspension} \\ &\hspace{15em} \text{height} \end{aligned}$$



## 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  $2\frac{1}{2}$  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        | PCP   | CSP/CPE | CPE                         |
|------------------------------|------------|---|---------|-----------------------------|
|                              | 3.3kV Flex | Planoflex<br>Protolon (SM)<br>Cordaflex (SMK)<br>Protomont<br>Rondoflex | Ozoflex | Mining MSR                  |
|                              | Neoprene 1 | Neoprene 2  | Hypalon | Chlorinated<br>Polyethylene |
| Acetic acid                  | P          | P   | F       | F                           |
| Benzene                      | F          | F   | F       | F                           |
| Bitumous tar                 | G          | G   | G       | G                           |
| Bleach (NaClO <sub>2</sub> ) | 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.

# SHEATH MATERIALS

| PU<br>Spreaderflex | EPR<br>Hydrofirm      | EVA<br>EVA125         | SI<br>Sinotherm | PVCP<br>Protolflex    | EPR<br>Pendantflex |
|--------------------|-----------------------|-----------------------|-----------------|-----------------------|--------------------|
| Polyurethane       | Ethylene<br>Propylene | Ethylvinyl<br>Acetate | Silicone        | Polyvinyl<br>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

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

where

$V_d$  = 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

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

where

$V_c$  = millivolts per Ampere metre

$V_d$  = 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<sup>2</sup>

- \* 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<br>mm <sup>2</sup> | Three phase voltage drop at 50Hz, mV/Am<br>Conductor temperature °C |       |       |       |       |       |       |       |
|-----------------------------------|---|-------|-------|-------|-------|-------|-------|-------|
|                                   | 45°C  |       | 60°C  |       | 75°C  |       | 90°C  |       |
|                                   | 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<br>mm <sup>2</sup> | Three phase voltage drop at 50Hz, mV/A.m<br>Conductor temperature °C |       |       |       |       |       |       |       |
|-----------------------------------|--|-------|-------|-------|-------|-------|-------|-------|
|                                   | 45°C   |       | 60°C  |       | 75°C  |       | 90°C  |       |
|                                   | 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<br>Hz | Line attenuation<br>dB/km | Impedance<br>Z |
|--|-----------------|---------------------------|----------------|
| Attenuation data<br>for individually<br>screened<br>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<br>Hz | Line attenuation<br>dB/km | Impedance<br>Z |
|--|-----------------|---------------------------|----------------|
| Attenuation data<br>for twisted<br>screened pair<br>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             |

## PLANOFLEX SCREENED CORES

| Capacitance<br>nF/km | Inductance<br>mH/km | Resistance<br>$\Omega$ /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<br>nF/km | Inductance<br>mH/km | Resistance<br>$\Omega$ /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<br>Conductor temperature °C<br>AC resistance at 50 Hz, Ω/km |        |        |
|----------------|---|--------|--------|
|                | mm <sup>2</sup>   | 60°C   | 75°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.

## CORDS WITH COPPER CONDUCTORS

| Conductor Size | Multicore<br>Conductor temperature °C<br>AC resistance at 50 Hz, Ω/km |        |        |
|----------------|---|--------|--------|
|                | mm <sup>2</sup>   | 60°C   | 75°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     |
| Association of German Electrical Engineers                | VDE     |
| German Lloyds   | GL      |
| European Committee on<br>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 polyethylene              |
| 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       | Polyethylene                           |
| OD       | Outside diameter                       |
| R-CPE-90 | Rubber - chlorinated polyethylene-90°C |
| R-ER-90  | Rubber - ethylene polyethylene-90°C    |
| R-E-110  | Rubber - ethylene polyethylene-110°C   |
| Cu       | Copper conductor                       |
| Tcu      | Tinned copper conductor                |
| SDI      | Single double insulated                |
| LV       | Low voltage                            |
| HV       | High voltage                           |

## NOTES

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