Ergon Energy Corporation Limited

Technical Specification for PVC Insulated Low Voltage Neutral Screened Copper Cable

ETS03-01-05
Technical Specification for PVC Insulated Low Voltage Neutral Screened Copper Cable

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1. Purpose and Scope

This specification sets out the requirements for PVC insulated low voltage neutral screened copper cable for use on underground distribution systems in Queensland.

The items covered by this technical specification are listed below:

<table>
<thead>
<tr>
<th>ITEM No.</th>
<th>DESCRIPTION</th>
<th>Stock Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CABLE ELECTRICAL UNDER GROUND 0.6/1kV, 2 Conductor, 4mm2 (7/0.85) Cu Neutral screened PVC Insulated, PVC Sheathed Nylon Jacket</td>
<td>2400260</td>
</tr>
<tr>
<td>2</td>
<td>CABLE ELECTRICAL UNDER GROUND, 0.6/1kV, 2 Conductor, 16mm2 (7/1.70) Cu, Neutral Screened, PVC Insulated/PVC Sheathed/Nylon Jacket</td>
<td>2406943</td>
</tr>
</tbody>
</table>

2. References

2.1 Applicable Standards

The cable shall be designed, manufactured and tested in accordance with the following Australian Standards and all amendments issued prior to the date of closing of tenders except where varied by this specification:

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1125</td>
<td>Conductors in Insulated Electric Cables and Flexible Cords</td>
</tr>
<tr>
<td>AS 1574</td>
<td>Copper and Copper Alloys - Wire for Electrical Purposes</td>
</tr>
<tr>
<td>AS 1660</td>
<td>Methods of Test for Electric Cables, Cords and Conductors</td>
</tr>
<tr>
<td>AS 2857 - 1986</td>
<td>Timber Drums for Insulated Electric Cables and Bare Conductors</td>
</tr>
<tr>
<td>AS/NZS 4961:2003</td>
<td>Electric cables—Polymeric insulated— For distribution and service applications</td>
</tr>
<tr>
<td>AS/NZS 5000.1:2005</td>
<td>Electric Cables - Polymeric Insulated for Working Voltages up to and Including 0.6/1kV</td>
</tr>
<tr>
<td>AS/NZS 3808</td>
<td>Insulating and sheathing materials for electric cables</td>
</tr>
<tr>
<td>AS/NZS 9001</td>
<td>Quality Management Systems – Requirements</td>
</tr>
<tr>
<td>ASTM D1603</td>
<td>Standard Test Method for Carbon Black Content in Olefin Plastics</td>
</tr>
</tbody>
</table>

Should inconsistencies be identified between standards and/or this specification, the Tenderer shall immediately refer such inconsistencies to the Purchaser for resolution.
3. Drawings

3.1 Drawings by the Purchaser

There are no drawings attached to this specification.

3.2 Drawings by the Tenderer

The Tenderer shall supply with the tender, detailed drawings or pamphlets of the items tendered.

4. Service Conditions

The conditions under which the cables will be required to operate are:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installation</td>
<td>Installed, directly buried in fine grain bedding material, or, in PVC conduits at a nominal depth of up to 1000 mm, with cable ends rising up concrete or timber poles and exposed to direct sunlight.</td>
</tr>
<tr>
<td>Ambient Air Temperatures</td>
<td>Not exceeding 50°C as determined by a shaded thermometer</td>
</tr>
<tr>
<td>Ambient Ground Temperatures</td>
<td>Not exceeding 35°C</td>
</tr>
<tr>
<td>Altitude</td>
<td>Not exceeding 500 metres above sea level</td>
</tr>
<tr>
<td>Humidity</td>
<td>90% high humidity combined with a high temperature (40°C) followed by a sudden drop in temperature of up to 10°C</td>
</tr>
</tbody>
</table>

Exposed sections of the cable will be subject to the following additional service conditions:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONDITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Radiation Level</td>
<td>1100 watts per square metre with high ultraviolet content</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Tropical summer storms with gust wind speeds above 160km/h and an annual rainfall in excess of 1500mm</td>
</tr>
<tr>
<td>Atmospheric classifications</td>
<td>Areas of coastal salt spray and / or industrial pollution with equivalent salt deposit densities in the range of 2.0 – 3.0 g/m²</td>
</tr>
</tbody>
</table>
5. Design and Construction

5.1 General
The cables shall be designed and manufactured in accordance with AS/NZS 4961:2003

5.2 Core Conductors
The conductors shall be circular plain annealed stranded copper in accordance with Section 2 - “Copper Conductors” of AS 1125.

5.3 Insulation
The insulation material on shall be PVC - V90 complying with AS/NZS 3808. The thickness of the cable insulation shall be in accordance with Table 1 of AS/NZS 5000.1. The cable insulation shall be red in colour.

5.4 Neutral Screen
The neutral screen shall be of a cross sectional area equal to the phase conductor and be stranded annealed copper conductors to AS 1125. The wires shall be applied helically and evenly over the protected core offering a maximum coverage of the core.

5.5 Sheath
Sheath shall be PVC-V90 extruded over, and coaxial with, the neutral screen and shall be capable of removal without screen damage.

The sheath shall be compatible with other materials with which it is in contact. The thickness of the sheath shall be in accordance of Clause 13.4 of AS/NZS 5000.1.

Sheath colour shall be black.

5.6 Insect Protection Jacket
A continuous UV stabilised nylon jacket (nylon 12) not less than 0.4 mm radial thickness producing a smooth glossy surface free from defects or scratches shall be extruded to an even thickness over the entire length of the cable.

The jacket must be capable of removal without damage to the sheath. Jacket colour shall be black.

5.7 Oversheath
The nylon jacket shall be protected by an oversheath of UV stabilised sheathing grade PVC. The oversheath thickness shall be in accordance with Clause 13.4 of AS/NZS 5000.1 to provide adequate protection to the nylon jacket during cable installation in conduit. The colour of the over sheath shall be black.

5.8 Marking of Cables
The cables shall be clearly marked with the following information in accordance with clause 16 of AS/NZS 5000.1.

(a) Registered name/trade mark of the manufacturer.

(b) Year of manufacture.
6. Performance and Testing

6.1 Testing
The cable shall be tested in accordance with Clause 17 of AS / NZS 5000.1.

The following Routine test shall be carried out, on each completed drum of cable, in addition to those required by Clause 17 of AS/NZS 5000.1.

Insulation resistance tests between one core and the other cores joined with readings in MΩ. The test will be carried out at a voltage level of 1.0kV DC and the results recorded after 1 minute or when the reading settles whichever the sooner.

Test configurations shall be from active to neutral / earth – i.e. A – N+E. Acceptance level for new cable is ≥ 100MΩ.

6.2 Type Tests
Certificates for Type Tests conducted in accordance with clause 17 of AS / ANZ 5000.1 shall be submitted with the tender.

6.3 Sample and Routine Tests
Sample and Routine Test Certificates are not required to be despatched with each delivery of cable but shall be made available to the purchaser when requested, within 1 working day. A certificate of compliance shall be provided with each delivery.

6.4 Carbon Black Test
Carbon black content of the outer sheath shall be tested in accordance with ASTM D1603. Test Certificates are not required to be despatched with each delivery of cable but shall be made available to the purchaser when requested, within 1 working day.

7. Risk Assessment
There is no requirement for the Tenderer to provide a safety risk assessment for the items covered by this specification.
8. **Quality Assurance**

8.1 **Purchasers Policy**
It is the Purchaser’s policy to procure goods, equipment and services from sources that demonstrate the ability to support quality products.

8.2 **Documentary Evidence**
Documentary evidence shall be provided concerning the level of Quality System Certification associated with the Tenderer and/or manufacturer. This documentation shall include the Capability Statement associated with the Quality System Certification. It is expected that the Tenderer and manufacturer will have a quality system certified to ISO 9001 in operation.

9. **Samples**

9.1 **Production Samples**
When requested, Tenderers shall submit a production sample of each item offered as part of the tender package.

10. **Packaging and Marking**

10.1 **Cable Length**
The cable shall be supplied in 250 metre lengths unless specified otherwise by the Purchaser. The cable shall be in one length on each drum.

10.2 **Drum Sizes**
Cable shall be supplied on timber drums manufactured in accordance with AS 2857 - 1986.

Operational difficulties are anticipated with the use of timber drums manufactured in accordance with AS 2857-1996. Hence this specification is based on cables supplied on timber drums manufactured in accordance with the requirements of superseded standard AS 2857-1986.

10.3 **Drum Durability**
The cable drums shall be sufficiently robust to ensure that the cable is delivered undamaged, giving due consideration to the method of transportation and the distances involved.

All cable drums shall withstand a minimum of 24 months exposure to all types of weather conditions during outdoor storage, without deterioration.

10.4 **Lagging**
The outer layer of cable shall be protected by a sheet form wrapping (with an overlap) located between the inner faces of the flanges.
10.5 Marking of Drums
The marking of information on the cable drum shall be in accordance with Clause 16.3 of AS / NZS 5000.1. In addition, the following information shall be provided indelibly and legibly marked directly on the flanges:
   a) The name Ergon Energy and the relevant stores stock code.
   b) Contract number.
   c) Order release authority or purchasing order number.
   d) Manufacturer's traceability number – derived from Manufacturer's first letter, hyphen, batch number, hyphen, drum number for this batch.

10.6 Quarantine Requirements
Should cable be supplied from overseas manufacturers, then it is mandatory that all conditions and inspections required by the Australian Quarantine Act are met and that all these costs are included in the tendered price. In particular, timber drums must be fumigated with methyl bromide with a concentration of 48 grams per cubic metre for 24 hours at 210°C. The Tenderer shall ensure that the procedure does not produce any deleterious effects to the cable supplied on the drum.

11. Service Performance
The Tenderers shall state:

| a) | The period of manufacture of PVC insulated cables for use within Australian service conditions. |
| b) | Electricity supply authorities within Australia that have a service history of the items offered; AND |
| c) | Contact names and telephone numbers of relevant employees of those supply authorities who can verify the service performance claimed. |

12. Reliability

12.1 Service Life
Tenderers are required to comment on the reliability of the cable and the performance of the materials offered for a service life of 40 years under the specified service conditions.

12.2 Evidence in Support of Reliability
Such comments shall include evidence in support of the reliability and performance claimed including information on Failure Mode and Effect Analysis.

13. Training
Training material in the form of drawings, instructions, technical papers and/or audio visuals shall be provided for the items accepted under this offer within one (1) month on request. This material shall include, but is not limited to, the following topics:

- Handling (especially during installation).
14. Environmental Considerations

Tenderers are required to comment on the environmental soundness of the design and the materials used in the manufacture of the items offered. In particular, comments should address such issues as recycling and disposal at the end of service life.

15. Information To Be Provided

15.1 Specific Technical Requirements
The Tenderers shall complete Attachment 1 of the specification and guarantee all the details provided.

15.2 Checklist of Supporting Documentation
Attachment 2 details a checklist of supporting technical documentation, which shall be submitted with the tender.
16. Attachment 1 – Technical Details

<table>
<thead>
<tr>
<th>Particulars</th>
<th>0.6/1 kV NEUTRAL SCREENED SERVICE CABLE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4mm² 2 Cond. N/S S/C 2400260</td>
</tr>
<tr>
<td>Nominal area of core conductors (mm²)</td>
<td></td>
</tr>
<tr>
<td>Number of conductor strands</td>
<td></td>
</tr>
<tr>
<td>Cross-sectional area of conductor strand (mm²)</td>
<td></td>
</tr>
<tr>
<td>Average radial thickness of insulation (mm)</td>
<td></td>
</tr>
<tr>
<td>Minimum radial thickness of insulation (mm)</td>
<td></td>
</tr>
<tr>
<td>Insulation material and grade</td>
<td></td>
</tr>
<tr>
<td>Neutral screen Material</td>
<td></td>
</tr>
<tr>
<td>Nominal area of screen conductors (mm²)</td>
<td></td>
</tr>
<tr>
<td>Number of screen strands</td>
<td></td>
</tr>
<tr>
<td>Cross-sectional area of screen strand (mm²)</td>
<td></td>
</tr>
<tr>
<td>Cover (as a percentage of area of insulation)</td>
<td></td>
</tr>
<tr>
<td>Average radial thickness of sheath (mm)</td>
<td></td>
</tr>
<tr>
<td>Material type and grade</td>
<td></td>
</tr>
<tr>
<td>Thickness of the nylon jacket (mm)</td>
<td></td>
</tr>
<tr>
<td>Grade of nylon</td>
<td></td>
</tr>
<tr>
<td>Oversheath material and grade</td>
<td></td>
</tr>
<tr>
<td>Oversheath thickness - Average (mm)</td>
<td></td>
</tr>
<tr>
<td>Outer sheath colour</td>
<td></td>
</tr>
<tr>
<td>Cable overall diameter (mm)</td>
<td></td>
</tr>
<tr>
<td>ID of recommended minimum duct size (mm)</td>
<td></td>
</tr>
<tr>
<td>Cable mass (kg/m)</td>
<td></td>
</tr>
<tr>
<td>Recommended maximum pulling tension (kN)</td>
<td></td>
</tr>
<tr>
<td>Recommended minimum bending radius</td>
<td></td>
</tr>
<tr>
<td>(a) during installation (times cable diameter)</td>
<td></td>
</tr>
<tr>
<td>(b) setting (times cable diameter)</td>
<td></td>
</tr>
<tr>
<td>Particulars</td>
<td>0.6/1 kV NEUTRAL SCREENED SERVICE CABLE</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>4mm² 2 Cond. N/S S/C 2400260</td>
</tr>
<tr>
<td></td>
<td>16mm² 2 Cond. N/S S/C 2406943</td>
</tr>
<tr>
<td>Maximum continuous current rating (Soil Temp. 30°C, Resistivity 1.2K.m/W)</td>
<td>(a) Buried direct (A)</td>
</tr>
<tr>
<td></td>
<td>(b) In ducts (A)</td>
</tr>
<tr>
<td>Design maximum conductor operating temperature</td>
<td>(a) Normal (°C)</td>
</tr>
<tr>
<td></td>
<td>(b) Emergency (2 hour) (°C)</td>
</tr>
<tr>
<td></td>
<td>(c) Short Circuit (°C)</td>
</tr>
<tr>
<td>Maximum D.C. resistance @ 20°C</td>
<td>(Ω/km)</td>
</tr>
<tr>
<td>Maximum AC resistance of conductor of completed cable at 50Hz and 90°C</td>
<td>(Ω/km)</td>
</tr>
<tr>
<td>Positive and negative sequence impedance at 50Hz of completed cable</td>
<td>(a) At 20°C (Ω/km)</td>
</tr>
<tr>
<td></td>
<td>(b) At max. operating temperature (Ω/km)</td>
</tr>
<tr>
<td>Zero sequence impedance at 50 Hz of completed cable at 20°C</td>
<td>(Ω/km)</td>
</tr>
<tr>
<td>Capacitance per phase in microfarads per 1000 metres at 20°C</td>
<td>(mf/km)</td>
</tr>
<tr>
<td>Power frequency withstand voltage five minutes</td>
<td>(kV RMS)</td>
</tr>
<tr>
<td>Insulation Megger readings 100 metre section tested with 2.5 kV Megger</td>
<td>(a) Expected value (GΩ)</td>
</tr>
<tr>
<td></td>
<td>(b) Minimum acceptable value (GΩ)</td>
</tr>
<tr>
<td>Type Test copies attached</td>
<td>(yes/no)</td>
</tr>
<tr>
<td>Type Test Certificate Number</td>
<td></td>
</tr>
<tr>
<td>Length of cable per drum</td>
<td>(m)</td>
</tr>
<tr>
<td>Drum mass complete with cable and lagging</td>
<td>(kg)</td>
</tr>
<tr>
<td>Australian Standard drum size (Fx<em>Bx</em>W)</td>
<td>(mm)</td>
</tr>
<tr>
<td>Spindle Hole Diameter</td>
<td>(mm)</td>
</tr>
<tr>
<td>Manufacturer's Name and Address</td>
<td></td>
</tr>
</tbody>
</table>

SIGNATURE OF TENDERER: __________________________________________
17. **Attachment 2 – Technical Documentation Checklist**

Have full and comprehensive details been submitted **WITH** the tender documents associated with each of the following items:

<table>
<thead>
<tr>
<th>Clause</th>
<th>Particulars</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2</td>
<td>Detailed drawings of cable offered</td>
<td>Yes / No</td>
</tr>
<tr>
<td>6.2</td>
<td>Type Test Certificates</td>
<td>Yes / No</td>
</tr>
<tr>
<td>8.2</td>
<td>Documentary evidence of the Quality System Certification of <strong>BOTH</strong> the TENDERER and the MANUFACTURER (including Capability Statement)</td>
<td>Yes / No</td>
</tr>
<tr>
<td>10.4</td>
<td>Method of lagging protection</td>
<td>Yes / No</td>
</tr>
<tr>
<td>11</td>
<td>Service Performance</td>
<td>Yes / No</td>
</tr>
<tr>
<td>12</td>
<td>Reliability</td>
<td>Yes / No</td>
</tr>
<tr>
<td>13</td>
<td>Training materials</td>
<td>Yes / No</td>
</tr>
<tr>
<td>14</td>
<td>Environmental considerations</td>
<td>Yes / No</td>
</tr>
<tr>
<td>15</td>
<td>Completed <strong>Attachment 1</strong> and <strong>Attachment 2</strong></td>
<td>Yes / No</td>
</tr>
</tbody>
</table>

NAME OF TENDERER: 
ADDRESS OF TENDERER: __________________________________________

SIGNATURE: ______________________ FOR AND ON BEHALF OF TENDERER
DATE: ________________