Ergon Energy Corporation Limited

Technical Specification for Composite Fibre Crossarms

ETS07-02-03
Technical Specification for Composite Fibre Crossarms

Contents

1 Purpose and Scope .................................................................................................................. 1
2 References ............................................................................................................................ 1
  2.1 Applicable Standards ..................................................................................................... 1
3 Definitions ............................................................................................................................ 1
  3.1 Definitions .................................................................................................................... 1
4 Drawings .................................................................................................................................. 1
5 Service Conditions ................................................................................................................. 2
6 Design and Construction ......................................................................................................... 2
  6.1 Application .................................................................................................................... 2
  6.2 Design Life .................................................................................................................... 2
  6.3 Materials ....................................................................................................................... 2
  6.4 Construction .................................................................................................................. 3
  6.5 UV Protection ............................................................................................................... 4
  6.6 Strength ......................................................................................................................... 4
  6.7 Electrical Properties .................................................................................................... 4
  6.8 Colour of Surface Material .......................................................................................... 5
  6.9 Identification and Marking ............................................................................................ 5
7 Performance and Testing ......................................................................................................... 5
  7.1 Type Test Certificates .................................................................................................. 5
  7.2 Batch Testing .............................................................................................................. 5
  7.3 Accelerated Ageing Test ............................................................................................. 6
  7.4 Transverse, Longitudinal and Vertical Point Load Testing ...................................... 6
  7.5 Power Arc Test ............................................................................................................ 6
  7.6 Leakage Current Test .................................................................................................. 6
8 Risk Assessment ...................................................................................................................... 6
9 Quality Assurance .................................................................................................................. 6
  9.1 Quality Certification ..................................................................................................... 6
  9.2 Notification of Variation ............................................................................................. 6
10 Production Samples .............................................................................................................. 6
11 Packaging and Marking ....................................................................................................... 7
12 Reliability ............................................................................................................................ 7
  12.1 Service Life ................................................................................................................ 7
13 Training and Technical Support .......................................................................................... 7
14 Safety, Environmental and Ergonomic Considerations ....................................................... 7
Appendix 1: Drawings for Fabricated Crossarms ................................................................. 8
Technical Specification for Composite Fibre Crossarms

Appendix 2: Mechanical Properties ................................................................. 33
  Appendix 2.1– Preferred section sizes (Conforming to specification drawings) ..... 33
  Appendix 2.2– Alternative section sizes ........................................................ 34
Appendix 3: Notes to Tenderers ..................................................................... 35
1 Purpose and Scope

This Specification sets out the requirements for composite fibre crossarms plus composite stay insulators and angle brackets manufactured from fibre reinforced plastic for use on overhead electricity distribution and sub-transmission systems in the outdoor Queensland environment. The generic term Composite Fibre Crossarms shall be used throughout this specification.

2 References

2.1 Applicable Standards

The Composite Fibre Crossarms shall comply with the relevant parts of the following Standards and all amendments issued from time to time except where varied by this Specification.

<table>
<thead>
<tr>
<th>STANDARD</th>
<th>TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurocomp Design</td>
<td>Structural Design of Polymer Composites</td>
</tr>
<tr>
<td>Code and Handbook</td>
<td></td>
</tr>
<tr>
<td>AS 1931.1:1996</td>
<td>High-voltage test techniques – Part 1: General definitions and test requirements</td>
</tr>
<tr>
<td>AS 1931.2:1996</td>
<td>High-voltage test techniques – Part 2: Measuring systems</td>
</tr>
<tr>
<td>AS/NZS 4676:2000</td>
<td>Structural design requirements for utility service poles</td>
</tr>
<tr>
<td>IEC 60721.2.1:2002</td>
<td>Classification of environmental conditions – Part 2-1: Environmental conditions appearing in nature- Temperature and humidity</td>
</tr>
<tr>
<td>JIS K 7015:2013</td>
<td>Pultruded fibre reinforced plastics</td>
</tr>
<tr>
<td>ENA DOC 012:2006</td>
<td>Cross-arm Supply and Performance Specification</td>
</tr>
<tr>
<td>ISO 9001</td>
<td>Quality management systems - Requirements</td>
</tr>
<tr>
<td>AS1720.1:2010</td>
<td>Timber Structures – Design Methods</td>
</tr>
<tr>
<td>AS1720.2:2006</td>
<td>Timber Structures – Timber Properties</td>
</tr>
</tbody>
</table>

3 Definitions

3.1 Definitions

‘Batch’ means as a single production run of a single set of input materials used for the output of the product.

‘Product’ means manufactured items or goods.

‘Specification’ means this technical specification.

4 Drawings

Composite Fibre Crossarms are to be supplied in accordance with this Specification and shall conform to the drawings listed in Appendix 1.

Ergon Energy may also require the Supplier to provide Composite Fibre Crossarms that comply with drawings not listed in Appendix 1, however any such direction will be in writing.
5 Service Conditions

The Composite Fibre Crossarms will be exposed to the following environmental conditions:

<table>
<thead>
<tr>
<th>Solar radiation level</th>
<th>1100 W/m² with high ultra violet content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperatures</td>
<td>50°C max temp (MWDr – mild warm dry climate to IEC 60721) -20°C min temp (WT – warm temperate climate to IEC 60721)</td>
</tr>
<tr>
<td>Precipitation</td>
<td>Tropical summer storms with high winds, and an annual rainfall in excess of 1500 mm.</td>
</tr>
<tr>
<td>Humidity</td>
<td>Extended periods of relative humidity in excess of 90%</td>
</tr>
<tr>
<td>Pollution</td>
<td>Level IV – Very heavy (AS 4436-1996): Areas of coastal salt spray and industrial pollution with equivalent salt deposit densities in the range 2.0 to 3.0 g/m².</td>
</tr>
<tr>
<td>Wind velocity</td>
<td>210 km/hr (58 m/s)</td>
</tr>
</tbody>
</table>

6 Design and Construction

6.1 Application

The Composite Fibre Crossarms are intended as substitutes for hardwood crossarms. The mechanical performance of Composite Fibre Crossarms must equal or exceed that of the hardwood crossarm. Fabrication drawings for Ergon Energy composite fibre crossarms are provided in Appendix 1. Section sizes shown on drawings are preferred so that they integrate with existing designs. Clause 6.4.2 detail preferred section sizes. Alternative section sizes to those shown on the drawings may be supplied as per requirements of clause 6.4.2 of this specification.

The crossarms will be used with pin, shackle, line post, disc and composite long rod insulators and shall be suitable for use at low voltage (415/240V) and 11kV.

The crossarms may be braced (single or double brace) and will be subjected to both cantilever bending and tensile loadings.

6.2 Design Life

The design life should be at least 40 years, in order to meet equivalent timber Durability Class 1 as specified in AS 1720.2:2006 clause 4.16 Table 5 and polymer composite requirements set out in Eurocomp Design Code and Handbook for Structural Design of Polymer Composites - clause 2.4.

6.3 Materials

6.3.1 Resin Binders

Only thermosetting resin binders such as epoxies and vinyl esters shall be used in the manufacture of Composite Fibre Crossarms; no thermoplastic resins will be acceptable. The resin may contain additives for UV protection, flame retardation or tracking resistance.
6.3.2 Fibre Reinforcement
The fibre reinforcement shall be boron free E-CR glass (corrosion resistant) to ASTM D578.

6.3.3 Filler Material
Composite Fibre Crossarms may have the hollow core filled with a high density, closed cell foam or other suitable reinforcement.

Any fillers or devices used to reinforce the strength of the Composite Fibre Crossarms at loading points shall not degrade in strength during the design life of the crossarm.

6.3.4 Surface Treatment
Composite Fibre Crossarms suffer tracking effects due to surface leakage currents. The Supplier shall take appropriate measures to minimise/reduce the effects of tracking on the composite fibre crossarm and provide type tests of these measures. This may take the form of a surface coating or a resin additive. Any coating shall maintain adhesion, remain intact and provide good abrasion resistance over the design life of the crossarm.

6.3.5 End Capping
Composite Fibre Crossarms shall have the ends capped by a material which is impact resistant, secure, permanently fixed and will not degrade during the design life of the crossarm.

6.4 Construction
6.4.1 Process
Composite Fibre Crossarms shall be manufactured by the pultrusion process which ensures the consistent fibre volume and low void content.

6.4.2 Sizes
The preferred crossarm section sizes are 100x100 mm and 125x125mm however other sections sizes may be supplied as well as siamised (laminated) sections in order to achieve the required strength capability if prior written approval has been obtained by Ergon Energy. Other dimensions including overall length and hole locations shall be as specified by Ergon Energy. Alternative section sizes shall be specified in Appendix 2.2 of this specification.

6.4.3 Bolt Holes
The Composite Fibre Crossarms are required to support loads at conductor support, kingbolt and arm brace locations. Bolt holes are required to support bearing loads at these locations commensurate with the bending moment capacity and length of the crossarm section.

Bolt hole locations shall also provide capacity to resist crushing loads resulting from bolt tightening. Bolts are typically tightened using impact wrenches. The largest bolt typically used is M24 with a 75x6mm square washer.

End cuts and holes shall be sealed against moisture ingress into the hollow core of the crossarm. The barrier shall remain effective for the design life of the product under service conditions.
6.4.4 **Steel accessories for composite products.**

The supplier of the stay insulator will be required to provide all fabricated steelwork plates and attach them to the composite fibre section as per the fabrication drawing provided in Appendix 1 prior to transportation to Ergon depot.

6.4.5 **Tolerances**

The following JIS K 7015:2013 tolerances for a pultruded reinforced plastic with a cross-section matching with the Composite Fibre Crossarm's size shall be observed:

<table>
<thead>
<tr>
<th>Type of tolerance observed</th>
<th>Tolerance value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensional of external form</td>
<td>± 2.5 mm (max.)</td>
</tr>
<tr>
<td>Degree of flatness</td>
<td>0.8 mm or less</td>
</tr>
<tr>
<td>Degree of squarness</td>
<td>± 2.0 degrees</td>
</tr>
<tr>
<td>Degree of curve</td>
<td>4.5 mm or less (L=2700mm)</td>
</tr>
<tr>
<td></td>
<td>3.5 mm or less (L=2100mm)</td>
</tr>
</tbody>
</table>

6.4.6 **Appearance**

The surfaces of the Composite Fibre Crossarm shall not have imperfections that may create problems such as hold water, crack, blister, chip or peel throughout its design life.

6.5 **UV Protection**

Composite Fibre Crossarms shall have UV inhibitors in the resin and/or a UV resistant coating material capable of remaining intact for the design life under the service conditions stated in Clause 5.

6.6 **Strength**

The Composite Fibre Crossarms shall have mechanical strength properties with regard to transverse, longitudinal, vertical and bearing at the king bolt at least equal to F17 hardwood crossarm assessed in accordance with AS 1720.1:2010 in section sizes of width by depth of 100x100, 125x100, 100x150 and 125x175mm. The loads are defined as follows:

**Transverse:** The horizontal side load resulting from wind on the wires and/or deviation angles i.e. axial tension or compression load on crossarm.

**Longitudinal:** The wire tension in the direction of the wire i.e. bending load on crossarm.

**Vertical:** The vertical load as a result of the weight of the wire or maintenance loads i.e. bending load on crossarm.

**King Bolt Load:** The resultant load at the king bolt due to the combined forces on each of the wires.

**Short Term Load:** Strength limit state load (typically 3 sec)

**Maintenance Load:** Load experienced during line construction or maintenance (days)

**Sustained Load:** Serviceability limit state load (permanent)

6.7 **Electrical Properties**

The Composite Fibre Crossarms designated as being “electrically insulating” shall meet the following minimum conditions, in accordance with ENA Doc 012 clause 4.3.
6.7.1 **Electrical Resistance**  
Composite Fibre Crossarms shall have a minimum electrical resistance of $10^5$ ohms per metre at 20°C.

6.7.2 **Basic Insulation Level (BIL)**  
Composite Fibre Crossarms shall have a minimum lightning impulse withstand voltage of 300 kV/m under dry conditions.

6.8 **Colour of Surface Material**  
The colour of the surface material shall preferably be green grey.

6.9 **Identification and Marking**  
The Composite Fibre Crossarms shall be legibly branded with a recognised quality identification system. Non-metallic identification shall be used for recording the following details:

   a) Manufacturer’s name or trademark  
   b) Batch number  
   c) Month and year of manufacture (e.g. 06/14)  
   d) Crossarm weight in kg if greater than 20 kg  
   e) Ergon Energy store code

The Supplier shall securely fit the non-metallic identification on the end cap of the crossarm. Composite Fibre Crossarms delivered with missing identification may be rejected.

7 **Performance and Testing**

7.1 **Type Test Certificates**  
Type Test Certificates shall be provided in English, showing the Average Failing Load, Modulus of Elasticity and Short Duration Mechanical Load. The mechanical tests shall be performed in accordance with the ENA Doc 12 clause 5.

Electrical type tests to be performed include:

- Electrical Resistance,  
- Inclined Plane Tracking Test,  
- leakage current test,  
- accelerated ageing test,  
- power arc test,  
- Impulse Flashover Voltage test  
- lightening Impulse.  
- Flammability test

7.2 **Batch Testing**  
The supplier shall have in place a sampling test plan in accordance with AS 1199.1. The test plan shall identify the testing facility, the crossarms, quantity, and types of tests to be carried out including the frequency of the tests for each batch.
Batch testing of the crossarms is to be performed by the manufacturer at regular intervals as stated on their sampling test plan, to ensure the products continued adherence with mechanical properties stated in this specification.

Batch Test Certificates shall be provided with each delivery, (or as otherwise determined by ERGON), stating the batch number and that each cross-arm type delivered meets all of the mechanical properties stated in Appendix 2 of this specification in relation to ultimate longitudinal, vertical, and transverse loads at each conductor attachment.

The method of supplying Batch Test Certificates to Ergon shall be by agreement between the successful tenderer and Ergon at the contract commencement meeting or as otherwise considered necessary by Ergon during the contract period.

7.3 Accelerated Ageing Test
The Composite Fibre Crossarms shall be exposed to intense UV radiation and moisture condensation equivalent to 10 years of exposure under the service conditions. Refer to ASTM G154, AS 4435.4 or equivalent. There shall be no visible defects or degradation in impact resistance, mechanical or electrical strength.

7.4 Transverse, Longitudinal and Vertical Point Load Testing
The Composite Fibre Crossarms will have tensile and intermediate loads applied at positions shown on the drilling pattern drawings and shall comply with the mechanical properties set out in Appendix 2 Mechanical Properties.

7.5 Power Arc Test
This test shall be performed in accordance with ENA Doc 012 Clause 5.4.

7.6 Leakage Current Test
Leakage current shall be observed from a series of applied line to ground voltages under wet and dry conditions.

8 Risk Assessment
There is no requirement for manufacturer provided safety risk assessments for the items covered in this Specification.

9 Quality Assurance
9.1 Quality Certification
Suppliers are expected to have a quality system in place conforming to ISO 9001.

9.2 Notification of Variation
Ergon shall be notified in advance of any variation to the materials, design or manufacturing process. The supplier shall satisfy Ergon that such variation meets this specification by providing conforming test certificates.

10 Production Samples
If requested by Ergon Energy the Supplier shall provide production samples. Each sample shall be delivered freight free, suitably crated and packaged and labelled with the following information:
11 Packaging and Marking

Composite Fibre Crossarms shall be supplied in packages similar to timber crossarms. Refer to Drawing No. 07-02-02 for packaging arrangements used for timber crossarms. Bundles shall be secured with straps that do not damage the surfaces preferably made of plastic. Packaging shall minimise the likelihood of damage during transport and storage.

12 Reliability

12.1 Service Life

The quality of the Composite Fibre Crossarms shall be such that when they are erected at the top of power poles to support power line conductors, the 5 percentile service life shall be a minimum of 40 years (i.e. 95 crossarms out of 100 will still be in service after 40 years).

13 Training and Technical Support

Ergon Energy may at no cost to Ergon Energy require the Supplier to provide training material in the form of drawings, instructions and/or audio visuals.

The Supplier shall provide support to resolve any technical issues that may arise during the period of the contract.

14 Safety, Environmental and Ergonomic Considerations

Suppliers are required to comment on the environmental soundness of the items offered. In particular, comments should address such issues as visual acceptability, chemical composition, packing and handling issues with composite materials, recyclability and disposability at the end of design life.
# Technical Specification for Composite Fibre Crossarms

## Appendix 1: Drawings for Fabricated Crossarms

### Table A

<table>
<thead>
<tr>
<th>DRAWING No.</th>
<th>REV</th>
<th>SCN</th>
<th>TITLE</th>
<th>Can Supply As Drawn Y/N</th>
<th>Proposed Alternative Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-02-02</td>
<td>0B</td>
<td>-</td>
<td>Crossarm Pack Size</td>
<td></td>
<td></td>
</tr>
<tr>
<td>921992-01</td>
<td>0B</td>
<td>2419042</td>
<td>11kV Strain / Termination 2.4m Urban Mounting Bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>921992-02</td>
<td>0B</td>
<td>2419059</td>
<td>22/33kV Strain / Termination 2.7m Urban Mounting Bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>921992-04</td>
<td>0B</td>
<td>2419034</td>
<td>11kV Intermediate 2.4m Urban Mounting Bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>921992-05</td>
<td>0B</td>
<td>2419018</td>
<td>22/33kV Intermediate 2.7m Urban Mounting Bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>921992-07</td>
<td>0B</td>
<td>2418986</td>
<td>11/22/33kV Intermediate 3.3m Rural Mounting Bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>921992-09</td>
<td>0B</td>
<td>2422129</td>
<td>11kV Intermediate 3.0m Rural Mounting Bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>925536-01</td>
<td>0B</td>
<td>2419091</td>
<td>11/22/33kV Fuse/Link 2.4m Pole Mount</td>
<td></td>
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</tr>
<tr>
<td>924043-01</td>
<td>0C</td>
<td>2430353</td>
<td>11kV Strain / Termination 2.4m Pole Mount Double Arm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>924043-02</td>
<td>0C</td>
<td>2430361</td>
<td>22/33kV Strain / Termination 2.7m Pole Mount Double Arm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>924043-03</td>
<td>0B</td>
<td>2419083</td>
<td>22/33kV Intermediate 2.7m Pole Mount</td>
<td></td>
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<td>924043-04</td>
<td>0C-01</td>
<td>2419075</td>
<td>11kV Intermediate 2.4m Pole Mount</td>
<td></td>
<td></td>
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<tr>
<td>924043-05</td>
<td>0A</td>
<td>2437630</td>
<td>LV Intermediate 2.4m composite fibre crossarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>924043-06</td>
<td>0A</td>
<td>2437648</td>
<td>LV Strain/Termination 2.4m composite fibre crossarm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>944182-01</td>
<td>0C-01</td>
<td>2434421</td>
<td>Intermediate 110kV Wishbone Construction 3 piece set with 4200mm Top Crossarm, 3758mm Mid crossarm &amp; 1243mm Brace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>944182-02</td>
<td>0C-01</td>
<td>2434439</td>
<td>Intermediate 110kV Wishbone Construction 3 piece set with 4139mm Top Crossarm, 3758mm Mid crossarm &amp; 1243mm Brace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1039069-01</td>
<td>0A</td>
<td>2444008</td>
<td>66kV Composite Fibre Wishbone Construction, 0-7° angle 2 pice set. 3500mm top crossarm &amp; 2520mm bottom crossarm.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1039069-02</td>
<td>0A</td>
<td>2444016</td>
<td>Composite Fibre Wishbone Construction, 7-25° angle crossarm set. 3500mm top crossarm &amp; 1920mm brace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1030985-01</td>
<td>0A</td>
<td>2439750</td>
<td>Composite Fibre Strain /Termination Crossarm Construction 3300mmx125sq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ES000749-01</td>
<td>0A</td>
<td>2435246</td>
<td>Composite Fibre Suspension/Deviation Crossarm Construction 3300mmx100sq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1012812-01</td>
<td>0A</td>
<td>2434041</td>
<td>Composite Fibre, Predrilled, 3460 x 125 x 125mm, 11kV, Suspension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>924043-07</td>
<td>0A</td>
<td>2444081</td>
<td>Composite Fibre, Predrilled, 2400 x 100 x 100mm, 22/33kV, Intermediate, Double Circuit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1048439-01</td>
<td>0A</td>
<td>TBA</td>
<td>66kV/132kV Stay Insulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1048463-01</td>
<td>0A</td>
<td>TBA</td>
<td>Crossarm brace</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**TOP VIEW**

- 3 holes Ø22
- 100
- 1050

**FRONT VIEW**

- 6 holes Ø22
- Ø18 hole
- Ø18 hole
- 925 ± 0.5
- 950
- 100
- 1050
- 1050
- 1150

**TOLERANCE:** As specified on drawing

**DRILLING:** Drilled holes to be on centre line and perpendicular to crossarm face.

**STORES CODES:** 2419042
 Technical Specification for Composite Fibre Crossarms

TOP VIEW

FRONT VIEW

TOLERANCE: As specified on the drawing.

DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

STORIES CODES: 2419059
TOLERANCE: As specified on drawing.

DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

STORED CODES: 2419034

Ergon Energy Corporation Limited ABN 50 087 646 062
TOLERANCE: As specified on sheet
DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.
STORES CODE: 2479018
TOLERANCE: As specified on drawing.

DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

STORES CODES: 24 1898-M6
Technical Specification for Composite Fibre Crossarms

TCERANCE: As specified on drawing.

DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

STONES CODES: 2422129
Technical Specification for Composite Fibre Crossarms

TOP VIEW
125 x 125

FRONT VIEW
125 x 125

TOLERANCE:
Unless otherwise shown ± 2.0
Hole positioning ± 1.0
Hole size ±0.5, ±0.0

DRILLING:
Drilled holes to be on centre line of face and perpendicular to crossarm face.

STORES CODES:
2430361 2700 x 125 x 125
Technical Specification for Composite Fibre Crossarms

DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

TOLERANCE: As specified on drawing.

STORES CODES: 2419083 2700x100x100
DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

TOLERANCE: As specified on drawing.

STORES CODES: 2419075 2400x100x100
Technical Specification for Composite Fibre Crossarms

**TOP VIEW**

- 4 Holes Ø19

**FRONT VIEW**

- 2 Holes Ø16
- 1 Hole Ø22

**TOLERANCES:**
- Unless shown otherwise ± 2.0
- Hole positioning ± 1.0
- Hole size ±0.5, -0.0

**DRILLING:**
- Drilled holes to be on centre line and perpendicular to crossarm face.

**STORES CODES:**
- 2437630 2400x100x100

Ergon Energy Corporation Limited ABN 50 087 646 062
Technical Specification for Composite Fibre Crossarms

TOLERANCE:
Unless shown otherwise ± 2.0
Hole positioning ± 1.0
Hole size ± 0.5, ± 0.0

DRILLING:
Drilled holes to be on centre line and perpendicular to crossarm face.

STORES CODES:
2437648 2400x125x125
Technical Specification for Composite Fibre Crossarms

Top View (Top Crossarm) Mark P

Front View (Top Crossarm)

Top View (Middle Crossarm) Mark M

Front View (Middle Crossarm)

Top View (Brace) Mark B

Front View (Brace)

MATERIAL: Composite Fibre (125 x 125 x 6.5 SHS)

TOLERANCE: Unless shown otherwise ± 2mm
Hole positioning ± 1.0
Hole size ± 0.5, - 0.0

DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face

STORIES CODE: 2434421
**Technical Specification for Composite Fibre Crossarms**

**Top View (Top Crossarm) Mark Q**

- ø18
- ø26
- ø22
- ø18

**Front View (Top Crossarm)**

- 125
- 1143
- 1422
- 1234
- 240
- 50

**Top View (Middle Crossarm) Mark M**

- ø18
- ø22
- ø26
- ø22

**Front View (Middle Crossarm)**

- 125
- 940
- 1499
- 1069
- 150

**Top View (Brace) Mark B**

- ø22
- ø26

**Front View (Brace)**

- 125
- 1243
- 150
- 993
- 50

**MATERIAL:** Composite Fibre (125 x 125 x 6.5 SHS)

**TOLERANCE:**

- Unless shown otherwise ± 2mm
- Hole positioning ± 1.0
- Hole size + 0.5, - 0.0

**DRILLING:** Drilled holes to be on centre line and perpendicular to crossarm face

**STORES CODE:** 2434439

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**Revision:** 0C-01

**Drawing No.:** 944182-02

**Project:** NETWORK HARDWARE

**Network:** ANGLE 110kV WISBONE CONSTRUCTION WITH 4139mm TOP CROSSARM POLE TYPES Q2-Q5
Technical Specification for Composite Fibre Crossarms

Top View (Top Crossarm) (S4)

Front View (Top Crossarm) (S4)

Top View (Bottom Crossarm) (S2)

Front View (Bottom Crossarm) (S2)

LABEL:
Crossarm identification to be painted on ends and top of crossarms. (S2 or S4)

MATERIAL:
Composite Fibre (125 x 125 x 6.5 SHS)

TOLERANCE:
Unless shown otherwise ± 2mm
Hole positioning ± 1.0
Hole size + 0.5, - 0.0

DRILLING:
Drilled holes to be on centre line and perpendicular to crossarm face

STORES CODE:
2444008
Technical Specification for Composite Fibre Crossarms

Top View (Top Crossarm) (S5)

125

1650

3500

1650

Ø18

Ø18

Top View (Bottom Crossarm) (S1)

125

1920

860

125

Ø18

Ø22

Ø22

125

50

740

150

Front View (Top Crossarm) (S5)

300

1107

100

Label:
Crossarm identification to be painted on ends and top of crossarms. (S1 or S5)

Material:
Composite Fibre (125 x 125 x 6.5 SHS)

Tolerance:
Unless shown otherwise ± 2mm
Hole positioning ± 1.0
Hole size + 0.5, - 0.0

Drilling:
Drilled holes to be on centre line and perpendicular to crossarm face

Stores Code:
2444016

Network Hardware
66kV Composite Fibre Wishbone Construction
7-25° Angle

Drawing Status: F - AS BUILT

Revision: 0A

Ergon Energy Corporation Limited ABN 50 087 646 062
MATERIAL: Composite Fibre (125 x 125 x 6.5 SHS)

TOLERANCE:
- Unless shown otherwise ± 2mm
- Hole positioning ± 1.0
- Hole size + 0.5, - 0.0

DRILLING:
- Drilled holes to be on centre line and perpendicular to crossarm face

STORES CODE: 2439750
MATERIAL: Composite Fibre (100 x 100 x 6.5 SHS)
TOLERANCE: Unless shown otherwise ± 2mm
          Hole positioning ± 1.0
          Hole size ± 0.5, ± 0.0
DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face
STORES CODE: 2435246
Technical Specification for Composite Fibre Crossarms

**TOP VIEW**

- 3 holes Ø26

**FRONT VIEW**

- Ø22 hole
- Ø18 hole

**TOLERANCE:**
As specified on drawing.

**DRILLING:**
Drilled holes to be on centre line and perpendicular to crossarm face.

**STORES CODES:**
2434041

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**NETWORK HARDWARE**
11/22/33kV SUSPENSION
3.46m COMPOSITE FIBRE CROSSARM
POLE MOUNTED

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Ergon Energy Corporation Limited ABN 50 087 646 062
DRILLING: Drilled holes to be on centre line and perpendicular to crossarm face.

TOLERANCE: As specified on drawing.

STORES CODES: 2444081 2400x100x100 (22/33kV)
Technical Specification for Composite Fibre Crossarms

Connection Plates

FRP Stay Insulator

FRP Stay Insulator Assembly

Rating:
- \( T_{300} \geq 100\text{kN} \) short term tension capacity
- \( T_{L0} \geq 40\text{kN} \) long term tension capacity

Tolerance:
- Unless shown otherwise ±2mm
- Hole positioning ±1.0mm
- Hole size ±0.5mm, ±0.0mm

Material:
Structural steel shall be accordance with AS/NZS 3679.2-300
Pultruded Fibre Reinforced Polymer (FRP)

Fabrication:
- Remove all sharp edges, burrs prior to galvanising
- Item to be supplied assembled

Identification:
- Stock code to be stenciled onto insulator or branded onto end cap

Protective Coating:
- Hot dip galvanise steelwork after fabrication in accordance with AS/NZS 4680

Stock Code:
TBA

Ergon Energy Corporation Limited ABN 50 087 646 062

Page 31 of 37
Notes:
1. Insulated brace equivalent to type 1000T & 1000C braces
2. Suits 100 & 125 depth crossarms

Rating:
\[ \sigma_{Nc} \geq 29kN \text{ short term compressive capacity} \]
\[ \sigma_{Nt} \geq 11kN \text{ long term compressive capacity} \]

Tolerance:
Unless shown otherwise ±2mm
Hole positioning ±1.0mm
Hole size +0.5mm, -0.0mm

Material:
Pultruded Fibre Reinforced Polymer (FRP)

Identification:
Stock code to be stencilled onto brace

Stock Code: TBA

Ergon Energy Corporation Limited ABN 50 087 646 062
Appendix 2: Mechanical Properties

Appendix 2.1 – Preferred section sizes (Conforming to specification drawings)

Tenderers are required to list the composite sections tendered as equivalent to the hardwood sections and provide information on the structural properties as listed.

<table>
<thead>
<tr>
<th>Timber section dimensions</th>
<th>100x100</th>
<th>100x125</th>
<th>100x150</th>
<th>125x175</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limit State Design bending moment for timber section (kN.m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>⁴Short term (3 second gust)</td>
<td>5.64</td>
<td>8.94</td>
<td>13.01</td>
<td>18.43</td>
</tr>
<tr>
<td>⁴Maintenance (assumed 5 days)</td>
<td>4.59</td>
<td>7.31</td>
<td>10.64</td>
<td>15.06</td>
</tr>
<tr>
<td>⁴Sustained (50 years +)</td>
<td>2.79</td>
<td>4.43</td>
<td>6.45</td>
<td>9.13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tendered composite section dimensions.</th>
<th>100x100 SHS</th>
<th>100x100 SHS</th>
<th>100x100 SHS</th>
<th>125x125 SHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributed weight (kg/m)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cross sectional area (mm²)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective second moment of area lxx (10⁶ mm⁴)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective second moment of area lyy (10⁶ mm⁴)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modulus of elasticity E (MPa)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultimate material strength (MPa)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Derivation of Properties</td>
<td>³EuroComp Design Code Partial Safety Coefficients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method of Manufacture</td>
<td>- $\gamma_{m,1}$</td>
<td>- $\gamma_{m,2}$</td>
<td>- $\gamma_{m,3}$</td>
<td>- $\gamma_{m,3}$</td>
</tr>
<tr>
<td>Environmental Effects;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short Term</td>
<td>- $\gamma_{m,3}$</td>
<td>- $\gamma_{m,3}$</td>
<td>- $\gamma_{m,3}$</td>
<td>- $\gamma_{m,3}$</td>
</tr>
<tr>
<td>Long Term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| ²EuroComp Design Code Partial Safety Factor |
| Short Term - $\gamma_{m}$ |             |             |             |             |
| Long Term - $\gamma_{m}$ |             |             |             |             |
| Strength reduction factor |             |             |             |             |
| Limit State Design bending moment (kN.m) |             |             |             |             |
| Limit State Design bearing at kingbolt (kN) |             |             |             |             |

2. Eurocomp Design Code Cl 2.3.3.2 Note A & Table 2.3 ($\gamma_{m} = \gamma_{m,1} \cdot \gamma_{m,2} \cdot \gamma_{m,3}$)
3. Eurocomp Design Code Cl 2.3.3.2 Table 2.4, 2.5 & 2.6
Appendix 2.2– Alternative section sizes

If alternative section sizes are proposed by tenderers, tenderers are required to list the composite sections tendered as equivalent to the hardwood sections and provide information on the structural properties as listed.

<table>
<thead>
<tr>
<th>Timber section dimensions</th>
<th>100x100</th>
<th>100x125</th>
<th>100x150</th>
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<td>18.43</td>
</tr>
<tr>
<td>Maintenance (assumed 5 days)</td>
<td>4.59</td>
<td>7.31</td>
<td>10.64</td>
<td>15.06</td>
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<tr>
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</tr>
<tr>
<td>Effective second moment of area lyy (10^6 \text{ mm}^4)</td>
</tr>
<tr>
<td>Modulus of elasticity E (MPa)</td>
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<tr>
<td>Ultimate material strength (MPa)</td>
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<tbody>
<tr>
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<td>Sustained</td>
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</table>

2. Eurocomp Design Code Cl 2.3.3.2 Note A & Table 2.3 \(\gamma_m = \gamma_{m,1}, \gamma_{m,2}, \gamma_{m,3}\)
3. Eurocomp Design Code Cl 2.3.3.2 Table 2.4, 2.5 & 2.6
Appendix 3: Notes to Tenderers

Tenderers are required to provide with their submission, details and supporting documentation as detailed below.

These requirements are itemised in Schedule TD – Technical Document Checklist.

A3.1 – Environmental and Service Conditions which support use: Clause 5.0

Tenderers shall provide details of maximum environmental service conditions that their composite fibre crossarms can be exposed to and remain in service. Tenderers shall provide details of tests conducted, along with data obtained from said testing, to verify these results.

A3.2 – Application: Clause 6.1

Tenderers are required to list the composite sections tendered as equivalent to the hardwood sections and provide information on the structural properties as listed. Tenderers will verify that they are able to supply composite crossarms as per drawings provided in Appendix 1. Column 4 of Appendix 1 shall be completed by the tenderer to confirm the above. If an alternative section will be provided by the tenderer, the tenderer shall specify an alternative size or section in column 5 in Table A of Appendix 1.

A3.3 - Design Life: Clause 6.2

Tenderers shall state the guaranteed design life of the crossarm.

A3.4 - Surface Treatment: Clause 6.3.4

Tenderers shall provide the details of protective measures taken, such as application of additives or coatings, to withstand the tracking effects. This shall include the results from testing.

A3.5 - Sizes: Clause 6.4.2

If a Tenderer proposes to supply siamised (laminated) sections, suitable bonding measures shall be employed and details and testing are required to be supplied with the tender.

A3.6 - Bolt Holes: Clause 6.4.3

Tenderers shall provide details of the bearing and crushing testing at the bolt holes.

A3.7 – Steel accessories for composite products: Clause 6.4.4

Tenderers will provide pricing of steel accessories required for stay insulator constructions. Wishbone construction steel plate is detailed on drawing 944182-04. Stay insulator steelwork and connections are provided on manufacturing drawing 104839-01.

A3.8 – UV Protection: Clause 6.5

Tenderers shall provide details of UV protection methods utilised.

A3.9 – Strength: Clause 6.6

Tenderers shall supply details in Appendix 2 of mechanical properties of the composite crossarm sections offered. Tenderers shall also provide supporting information verifying safety coefficients nominated in Appendix 2. Example, if testing of composite sections has been completed in order to obtain statistical values of strength rating of composite section, then details and results of this testing must be forwarded. If strength was derived by theoretical means, then this information must be supplied.
A3.10 – Electrical Resistance: Clause 6.7.1
Tenderers shall supply details of electrical resistance of their composite fibre crossarms as noted in clause 6.7.1.

A3.11 – Basic Insulation Level: Clause 6.7.2
Tenderers shall supply details of the basic insulation level of their composite fibre crossarms as noted in clause 6.7.2.

A3.12 – Colour of Surface Material: Clause 6.8
Tenderers shall supply details of the colour of the surface material of their composite fibre crossarms as noted in clause 6.8.

A3.13 – Type Test Certificates: Clause 7.1
Tenderers shall supply type test certificates required in clause 7.1.

A3.14 – Batch testing: Clause 7.2
As part of the tender, Tenderers shall submit a sampling test plan in accordance with AS1199.1 and nominate the test facility. The test plan submission shall identify the crossarms, quantity, and types of tests to be carried out including the frequency of the tests for each batch.

A3.15 - Accelerated Ageing Test: Clause 7.3
Tenderers shall specify the Standard used for this testing and supply a test certificate done on the tendered crossarm type.

A3.16 - Transverse, Longitudinal and Vertical Point Load Testing: Clause 7.4
Tenderers shall provide Average and Minimum Failing Loads at localised positions shown on the drilling pattern drawings.

A3.17 Power Arc Test: Clause 7.5
Tenderers shall supply test certificates.

A3.18 - Leakage Current Test: Clause 7.6
Tenderers shall specify method of testing used and test certificates.

A3.19 - Quality Certification: Clause 9.1
Tenderers shall provide documentary evidence concerning the level of Quality System Certification associated with the Supplier and/or manufacturer. This documentation shall include the Capability Statement associated with the Quality System Certification.

Tenderers shall complete Schedule “MSI” detailing their Management Systems (Quality Assurance Systems).
A3.20 - Production Samples: Clause 10
When requested, production samples of each item offered shall be submitted to assist in the evaluation of the offer.

Each sample shall be delivered freight free, suitably crated and packaged and labelled with the following information:

<table>
<thead>
<tr>
<th>Name of Tenderer and this Contract No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Item Numbers</td>
</tr>
<tr>
<td>Any supporting data on features or characteristics</td>
</tr>
</tbody>
</table>

A3.21 - Design life: Clause 6.2
Tenderers are invited to submit any proposals that conform to the performance requirements of this Specification or that increase the design life of existing crossarm designs.

A3.22 – Training: Clause 13
Tenderers shall state the availability of training materials which should include but is not limited to the following topics:

- Handling
- Storage
- Application (particularly in areas of heavy coastal pollution)
- Installation
- Maintenance
- Environmental performance
- Electrical performance
- Mechanical performance
- Disposal
- Installation of mechanical rollers for conductor stringing

A3.23 - Safety, Environmental and Ergonomic Considerations: Clause 14
Tenderers are required to comment on the environmental soundness of the items offered. In particular, comments should address such issues as visual acceptability, chemical composition, packing and handling issues with composite materials, recyclability and disposability at the end of service life.

Additional Requirements

Material Safety Data Sheets (MSDS)
Material Safety Data Sheets for all the materials used in the crossarms and the coating applied shall be provided at the time of submitting the offer.
For the crossarms offered, details with respect to the supplier as well as their manufacture and primary materials used shall be stated in Schedule SD (Supplier Details).

Checklist of Supporting Documentation
Schedule TD (Technical Document Checklist) details a checklist of supporting technical documentation which is required to be submitted with the offer.