

Composite Crossarms

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Revision History

This amendment replaces the following specifications:

ETS 0107 – Composite Crossarms Amendment 0

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Document Control

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1 Purpose

To specify the requirements for **distribution and transmission** composite crossarms for use on Endeavour Energy's electrical network.

2 Scope

This specification covers the design, engineering, manufacture, testing, supply and delivery of **distribution and transmission** composite crossarms installed as part of Endeavour Energy's electrical networks.

3 References

External Regulations	
Electricity Supply Act 1995 (NSW)	
Electricity Supply (Safety and Network Management) Regulation 2014	
National Electricity (NSW) Law 1997	
National Electricity Rules	

External Standards		
Standard No.	Year	Title
AS 60071.1	2024	Insulation co-ordination – Definitions, Principles and rules
AS/NZS 2947.1	1999	Insulators – Porcelain and glass for overhead power lines – Voltages greater than 1000 Vac, Part 1: Test methods – insulator units
AS 61109	2020	Insulators for overhead lines - Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1 000 V - Definitions, test methods and acceptance criteria (IEC 61109:2008, MOD)
AS 5577	2013	Electricity network safety management systems
AS/NZS 7000	2016	Overhead Line Design Standard
AS/NZS ISO 9001	2016	Quality Management Systems – Requirements
AS/NZS ISO 14001	2026	Environmental Management Systems – Requirements with guidance for use
ASTM D 2303	2020	Standard test methods for liquid containment, inclined plane tracking and erosion of insulating materials
ASTM D 635	2022	Standard test method for rate of burning and/or extent and time of burning of plastics in a horizontal position
ASTM E 84	2026	Standard test method for surface burning characteristics of building materials
ASTM D 570	2022	Standard Test Method for water absorption of plastics

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ASTM G 154	2023	Standard practice for operating fluorescent ultraviolet (UV) lamp apparatus for exposure of non-metallic materials
ASTM D 8019	2023	Standard test methods for determining the full section flexural modulus and banding strength of fibre reinforced polymer crossarms assembled with centre mount
ENA Doc 001	2019	ENA National Electricity Network Safety Code
ENA Doc 012	2006	Crossarm supply and performance specification
Eurocomp Design code and handbook	2005	Structural design of Polymer Composites
IEC 62631-3-1	2023	Dielectric and resistive properties of solid insulating materials - Part 3-1: Determination of resistive properties (DC methods) - Volume resistance and volume resistivity - General method
IEC 62631-3-2	2023	Dielectric and resistive properties of solid insulating materials - Part 3-2: Determination of resistive properties (DC methods) - Surface resistance and surface resistivity
IEC 60587	2022	Electrical insulating materials used under severe ambient conditions – Test methods for evaluating resistance to tracking and erosion.

Company Policies and Procedures

Company Policy (Network) 9.2.5 – Network Asset Design
 Company Policy (Network) 9.7.1 – Network Asset Construction
 Company Procedure (Network) ENG 0002 Network Standards Framework
 Appendix 1 – Specified items
 Appendix 2 – Additional/Supplementary Drawings
 Appendix 3 – Bolted connection test

4 Definitions and Abbreviations

Term	Definition
AS	Australian Standard
FMEA	Failure Mode Effects Analysis
GP	General Purpose
LEL	Lower exclusion limit. This is calculated as the mean of the sample size minus 1.65 times the standard deviation.
NATA	National Association of Testing Authorities
NZS	New Zealand Standard
SP	Structural Purpose

5 Actions

The following sections detail the requirements that composite crossarms are required to meet when installed in the Endeavour Energy Network.

5.1 General requirements

5.1.1 Service condition and durability

All crossarms supplied must be able to operate under the conditions outlined in Table 1 below.

Table 1 – Environmental Conditions

Condition	Environmental Limits
Ambient Temperatures	Maximum: 50°C Minimum: -15°C
Solar Radiation Levels	1100 W/m ² with high ultraviolet content.
Wind Loading	As specified in AS/NZS 7000
Precipitation	Maximum annual rainfall range 1800 – 2400mm. Minimum annual rainfall range 0 – 100mm.
Humidity	Extreme range of relative humidity from 10% to 100%.
Pollution levels	Pollution level – IV very heavy Areas of coastal salt spray and/or industrial pollution with equivalent salt deposit densities up to 3.0 g/m ² .
Isokeraunic level	Maximum of 60 thunderstorm days per year

5.2 Technical Requirements

5.2.1 Electrical Requirements

Table 2 - Electrical Requirements

Condition	Reference Standard	Limits
Basic insulation level (BIL)	AS 60071.1	Minimum 300 kV/m
Electrical Resistance	IEC 62631-3-1:2023 IEC 62631-3-2:2023	10 kΩ/m

5.2.2 Mechanical Requirements

5.2.2.1 Strength Requirements

The crossarm must be capable of resisting dead, tensile, live and wind loads.

The minimum bending capacities specified in Appendix 1 are the required design capacities at the strength limit state for a serviceable design life of 50 years. These capacities are based on existing timber and steel crossarm arrangements and are inclusive of the applicable strength reduction factors in Table 3. These capacities must be verified with appropriate test reports.

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Table 3 – Timber and steel crossarm strength reduction factors

Crossarm type	Serviceability	Strength
Timber	0.17	0.4
Steel	0.9	0.9

Note: AS/NZS 7000 provides guidance on the strength reduction factor of composite crossarms under serviceability conditions which is 0.3. However, no guidance is given for an appropriate strength reduction factor for the ultimate strength condition. The manufacturers shall recommend a more appropriate strength reduction factor for the ultimate condition which Endeavour will consider but this will need to be justified with appropriate supporting data.

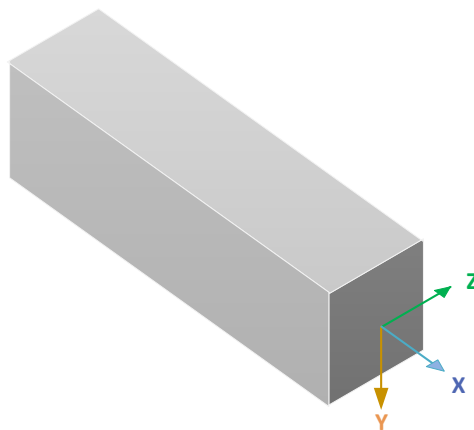


Figure 1 – Crossarm orientation

5.2.2.2 Compression Requirements

All crossarms shall have a minimum axial compression capacity of 80 kN in the longitudinal (X) direction, as shown in Figure 1.

5.2.2.3 Technical Design Data

For each composite crossarm, the manufacturer shall supply, as a minimum, the following technical design data:

- modulus of elasticity (MPa);
- Design normal stress (MPa) for axial tension and axial compression;
- geometric information including:
 - cross sectional dimensions;
 - cross sectional areas;
 - Second moment of area about the principal axes (Y-axis and Z-axis inertia, cm⁴);
 - Section modulus about the principal axes (Y-axis and Z-axis);
- coefficient of linear expansion.

5.2.2.4 Crossarm modifications

Endeavour Energy requires crossarms as per the standard sizes / drilling patterns shown in Appendix 1 – Specified Items.

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In addition to these, crossarms are required to be modified on an ad-hoc basis to suit the needs of brownfield and non-standard constructions. The supplier is required to specify whether the crossarms can be drilled for this purpose, or whether an attachment is required.

A preference is given to crossarms which can be drilled; however, the supplier must prove that:

- There are no harmful by-products from drilling. The supplier must provide details of any PPE or procedures which are required when drilling;
- The strength is not compromised;
- The drilling does not cause moisture ingress. The supplier must provide a procedure to mitigate moisture ingress due to drilling.

Suppliers must provide detailed drilling procedures and/or details and testing of additional fittings (where drilling is not an option) to indicate their ultimate mechanical strength, use and limitations.

5.2.2.5 Deflection

The deflection of the crossarms under maximum dead loads must be limited to a maximum of 5% of the bendable length.

5.2.3 Maintenance Requirements

All crossarms supplied must be designed to achieve a maintenance free design life of at least 50 years.

5.2.3.1 Failure Mode and Effects Analysis (FMEA)

The supplier must supply Endeavour Energy a failure mode and effects analysis (FMEA) of the crossarms. The FMEA must indicate experienced failures of the crossarms, and also the mean time between failures (MTBF), and the recommended maintenance regime and maintenance tasks and intervals.

5.2.3.2 Repairs

Endeavour Energy reserves the right to reject any crossarms having a substantial defect, such as dents or distortions, damage to the outer coating of the crossarms, incorrect positioning of holes, or defects of any other kind. If repairs are deemed appropriate, they may be carried out only with prior approval from Endeavour Energy. The service life and strength of repaired crossarms must be no less than undamaged crossarms.

The supplier must also provide a methodology and any products required when minor damages (such as scratches and dents) occur in the field.

5.2.3.3 Disposal / End of Life requirements

The supplier must provide disposal details for their product. Products which can be reused/recycled is preferred.

5.2.4 Crossarm Material

The crossarms must be a reinforced polymer fibre construction. The resin must be thermosetting resin such as epoxy or vinyl ester resin and manufactured using the pultrusion process. The resin must contain additives that act as a flame retardant and provide low shrinkage.

Boron-free ECR fibreglass (Electronic corrosion resistant glass) is preferred due to its acid resistance and high temperature resistance properties.

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All sharp edges must be removed.

5.2.4.1 Crossarm coating and colouring

The crossarms must have a protective coating material which must be durable and have excellent electrical insulation and tracking resistance properties and low toxicity for everyday conditions, during the design life of the crossarms. It must be resistant to UV, stress cracking, adverse weather conditions, detergents, salt spray and typical airborne pollutants.

The coating must add flame retardancy to the product.

The coating must be maintenance free and last for the design life of the crossarms.

The supplier must provide the following details on the coating used for the crossarms: material; thickness; method of coating; electrical resistance; dielectric strength; water absorption; and, toxicity index.

The preference for crossarms colour is 'green-grey' colour to be in line with CCA timber poles. Crossarms of alternative colours may also be considered.

The surface finish shall have a smooth finish and have a water absorption of <0.03% as per ASTM D570.

If the supplier can provide the provision of a non-slip coating on the top layer of the crossarms, this should be offered.

5.2.5 Dimensions and Tolerances

The composite crossarms must meet the dimensions specified in Appendix 1 – Specified Items of this instruction and the tolerances specified in the following table. Designs which can reduce the total number of required crossarms will be preferred. The current spacing between the drill holes is the minimum accepted distance. If the current spacing cannot be met, with the proposed length crossarms, the supplier must submit an alternative sized crossarms.

Table 4 – Tolerances

Condition	Tolerance
Width	± 3 mm
Depth	± 3 mm
Length	-0 mm, +25 mm
Corner radius	±10 mm

5.2.6 End Caps

The crossarms must be end capped with a suitable non-conductive cap that is impact resistant, permanently fixed and must not degrade during the service life of the crossarms. It must remain secured to the crossarms under the service conditions outlined in Table 1 – Environmental Conditions and under forces applied during transport, movement, installation or the influence of birds or animals.

The end cap must prevent the ingress of moisture.

Details of the end cap and how it is fixed / sealed to the crossarms must be provided for review.

5.2.7 Durability requirements

The following section details the five durability parameters.

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5.2.7.1 Resistance to attack by physical agents

The crossarms must be resistant to attack by both physical and biological agents to provide the specified design life. Physical agents include UV light, rainfall, high humidity, high temperatures and freezing temperatures.

5.2.7.2 Form and dimensional stability

The crossarms should not have the tendency to shrink, twist or sag whilst in service.

5.2.7.3 Resistance to corrosion

The crossarms must be made of materials that provide the best corrosion performance in the wide range of environments, especially the conditions set out in Table 1 – Environmental Conditions.

The supplier must demonstrate the crossarms are suitable for all environmental conditions.

5.2.7.4 Fire performance

The crossarms must have a good fire resistance to both bushfires and pole top fires. Tests must be conducted on composite crossarms to compare fire performance with untreated durability class 2 hardwood crossarms. Refer to Table 7 - Other type test requirements.

5.2.7.5 Resistance to lightning and power arcs

Crossarms shall withstand the specified lightning impulse and power arc tests without visible damage that would impair the electrical or mechanical performance of the crossarm.

5.2.8 Compatibility and interchangeability

The composite crossarms must be compatible and interchangeable with current crossarms and hardware. The dimensions and sizing of current crossarms are given in Appendix 1 – Specified Items.

5.2.9 Weight

The weight of the crossarms must be provided with the offer. Preference will be given to crossarms that are lighter.

5.2.10 Workability and Material Safety Data Sheets (MSDS)

The supplier must submit MSDS for the composite crossarms and all other materials used within it (for example, coatings, fillers) and outline any precautions to be taken when cutting or drilling composite crossarms where field modifications may be undertaken on site.

5.2.11 Marking / Identification

The crossarms must have permanent marking which will indicate:

- The name of the manufacturer; and
- The month and year of manufacture.

The marking must be of height, so the identification can be read from a distance of 12 metres and be located on the bottom of the crossarms. Alternate positions will be considered.

5.2.12 Handling

All crossarms covered by this specification must be constructed to allow handling, erection and transport without causing damage to the crossarms. In particular, the manufacturer must supply details of preferred lifting techniques, including any special equipment required, and recommended storage methods.

Where a lifting sling is required, a non-permanent mark must be provided to indicate the point of attachment.

5.2.13 Delivery Requirements

All items supplied must be suitably packaged to deliver the items undamaged, giving due consideration to the methods and distance of transportation and handling.

Each delivery document must be provided with the following information:

- Manufacturer's name;
- Purchaser's name (that is, Endeavour Energy);
- Order number;
- Item description;
- Quantity; and
- Total mass (kg).

5.2.14 Environmental Considerations

Suppliers shall provide comment on environmental sustainability of the design and materials used in the manufacture of items offered. At a minimum, this shall include:

- waste reduction and management practices.
- end-of-life recyclability of the crossarms and recommended disposal method.
- where complete recyclability is not feasible, identify and propose suitable repurposing or reuse opportunities for the crossarms material.
- the use of reusable packing and/or recyclable packaging materials.

5.3 Testing Requirements

5.3.1 General Test Requirements

Where a crossarm has been tested to a standard different to those listed in the following sections, or where the supplier believes an alternate test demonstrates a similar characteristic of the crossarm, the supplier must submit documentation on how the proposed standard/test differs from the indicated standard.

5.3.2 Type Tests

The type tests required to be submitted with the offer are listed in Table 5 - Mechanical type test requirements, Table 6 - Electrical type test requirements and Table 7 - Other type test requirements.

Table 5 - Mechanical type test requirements

Standard	Test Name	Test Description	Pass Criteria
EN 50308 Clause 5.2	Sudden load release test	The crossarm will be subject to 5 sudden load releases when subjected to a dead/tensile load of 30% of the average failing load.	No breakages must occur.
ASTM D8019-23	3-Point Bend Test Termination and Suspension Point load testing	5 samples will be tested for Termination and Suspension construction types until failure. Record flexural modulus, calculated moment at failure, calculated stress at failure, and crossarm deflection must be recorded.	The 5% lower exclusion limit (LEL) of the samples must have a strength greater than the strength requirements shown in Appendix 1. Deflection of crossarms under load must not exceed 5%.
-	Bolted connection capacity test	Test the capacity of the bolt connections in both the vertical and horizontal directions, as detailed in Appendix 3.	Report only.
-	Crush resistance test	M20 bolt installed in the crossarm with a 60mm round washer, tightened to a torque value of 220Nm (grade 5.8 equivalent).	There shall be no signs of bowing and/or cracking under test.
-	Axial compression test	The crossarm shall be tested under axial tension and axial compression loading.	The crossarm shall demonstrate a minimum axial compression capacity of 80 kN. Axial tension test results shall be reported.

Table 6 - Electrical type test requirements

Standard	Test Name	Test Description	Pass Criteria
AS/NZS 2947.1 and EN 50308	Dry lightning impulse withstand test and 50%	A lightning impulse of not less than 300 kV shall be applied to a 1 m length of crossarm and the impulse withstand	No damage must occur.

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012 Clause 5.3	flashover voltage tests	voltage and 50% flashover voltage recorded.	
AS 61109 (IEC 61467) and ENA Doc 012 Clause 5.4	Power arc test	Increase voltage until an arc is initiated on the crossarm.	Following the test, the crossarm shall exhibit no cracking, delamination, fibre exposure, permanent bowing or other visible structural damage.
IEC 62631-3-1 and IEC 62631-3-2	Electrical Resistance	The resistance of 1 m crossarm must be measured at 20°C.	The resistance must be a minimum of 10kΩ/m
IEC 60587 (Method 2), ASTM D2303	Inclined plate tracking test	Test specimens must be tested to 2.5kV for 1 hour and increased to 2.75kV for 1 hour as per Method 2.	Current in the high voltage circuit does not exceed 60mA or the specimen does not display any holes from erosion.

Table 7 - Other type test requirements

Standard	Test Name	Test Description	Pass Criteria
ASTM E84 and ASTM D635	Fire resistance test	Crossarms to be subjected to the tests indicated in ASTM E84 and D635. Whether the material sustains a flame when the heat source is removed must be recorded. Tests must also indicate whether there are any hazards present in the final residue when the composite is burnt.	Time to extinguish fire must be less or equal to a timber crossarm. (It is preferable to be tested against Australian timber crossarm)
ASTM G154	Accelerated UV test	Specimen (with coating) must be tested for a minimum of 10000 hours. Changes to colour, roughness and appearance must be noted.	No fibre blooming of the specimens will be accepted.

5.3.3 Equivalent Type Test Requirements

5.3.3.1 Mechanical tests

Type tests must be provided for each type (length and construction type) of crossarms offered. A crossarm of one length or one construction type (that is, suspension or termination) does not qualify a crossarm of a different length or construction type.

Tests must be conducted both with and without the appropriately sized gain block (refer to Endeavour Energy drawing 240872 or 240379). Where the crossarm member fails before the gain block, then only one set of tests is required to be submitted.

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5.3.3.2 Electrical tests

Only one set of electrical tests detailed in Table 6 - Electrical type test requirements, are required for a set of crossarms.

5.3.3.3 UV testing requirements

In addition to the accelerated UV test detailed in Table 7 - Other type test requirements, the supplier must also submit documentation to demonstrate that the mechanical strength of the crossarm(s) offered is not compromised when exposed to the Australian environment over the life of the asset.

5.3.4 Type Accreditation and reporting requirements

All type tests **shall** be carried out by a testing authority/laboratory holding accreditation:

- by NATA Australia; or,
- by an accreditation authority recognised by NATA Australia.

Tests from other testing authorities may be accepted at the discretion of Endeavour Energy.

All type test reports shall be accompanied by copies of the accreditation certificate(s) issued to the testing laboratory. The accreditation certificate(s) **shall** be valid for the relevant test(s) and for the duration of the test(s).

Type tests shall be less than ten (10) years old. Type tests beyond this limit may be submitted provided sufficient information to demonstrate that the manufacturing process, raw materials, design, and quality control processes have not significantly changed since the original test date is also submitted with the offer.

All documentation submitted (including reports, tests, testing procedures/policies, calibration certificates and the like) **shall** be in English.

Type test certificates **shall** specify the overall dimensional details of the crossarms, test assembly, procedure, test requirement and test results. Test certificates only indicating that the items have passed without listing the test conditions above will be deemed non-compliant.

5.3.5 Batch testing

Batch tests must be carried out on every batch of crossarms produced to demonstrate quality assurance of items supplied.

Batch test certificates must be supplied with each order/delivery and **specify** that the crossarms meet the requirement of this specification. All routine and batch tests may be conducted at the manufacturing facility's test laboratory on the condition that sufficient evidence is provided with the offer to demonstrate the testing facility's capability to perform the specified tests. As a minimum, the following information must be provided:

- Qualifications/experience of testing staff;
- Test procedures for all routine/batch tests;
- Testing facility quality control procedures; and
- Test instrument calibration certificates/procedures.

As part of the assessment **process**, Endeavour Energy will specify in writing if they accept the routine/batch tests being conducted at the manufacturing facility's test laboratory.

The supplier must propose the frequency and type of tests to be performed as part of the batch testing.

6 Authorities and Responsibilities

Listed below are the positions or groups of positions that have specific authorities and responsibilities associated with this specification.

General Manager Future Grid and Asset Management has the authority and responsibility for:

- approving major changes to this specification in accordance with ENG 0002, including any variations;
- making all decisions concerning compliance with this instruction;
- delegating any of these authorities and responsibilities to the **Head of Asset Management and Digital**.

Head of Asset Management and Digital has the authority and responsibility for:

- approving minor changes to this specification in accordance with ENG 0002;
- making recommendations to the **General Manager Future Grid & Asset Management** for major changes in respect to this specification.
- Making recommendations concerning compliance in respect to this specification.

Asset Engineering Manager has authority and responsibility for:

- periodic review of this technical specification for industry best practice and Endeavour Energy's requirements;
- reviewing all test reports submitted;
- making recommendations to the **Head of Asset Management and Digital** based on industry best practice;

The **Head of Procurement** has overall responsibility for ensuring that all crossarms purchased by Endeavour Energy comply with the requirements of this instruction.

The **Head of Customer Network Solutions** is responsible for ensuring that all crossarms installed by Level 1 Accredited Service Providers comply with the requirements of this specification.

Manufacturers/suppliers shall be responsible for:

- maintaining awareness of their responsibilities and conformance requirements under this specification.
- checking all products supplied to Endeavour Energy comply with this specification.
- checking that an effective safety, environmental and quality auditing system is in place.
- implementing this Specification and keeping Endeavour Energy or other responsible equivalent officers informed of any factors that may prevent them from accepting responsibility for its full implementation.

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7 Appendix 1 – Specified Items

The following table lists the **distribution and transmission** crossarms to be supplied to Endeavour Energy.

Table 8 – Details of specified crossarms

Item No.	Crossarm code	Crossarm description	Crossarm dimensions in mm (L x D x H)	Endeavour Energy Drawing	“Z” Axis min. bending capacity M_{sz} (kNm) ¹ “Strength limit state”	“Y” Axis min. bending capacity M_{sy} (kNm) ¹ “Strength limit state”
1	XA010	LV	2030 x 100 x 100	537367 Sh 1	6	6
2	XA020	HV	2030 x 100 x 100	537367 Sh 1		
3	XA030	HV	2030 x 125 x 125	537367 Sh 1	9	13
4	XA040	HV	2706 x 100 x 100	537367 Sh 1	6	6
5	XA040A	HV for SMR projects	2630 x 125 x 125	537367 Sh 2	6	6
6	XA040R	HV Recloser	2830 x 100 x 100	537367 Sh 2	6	6
7	XA050	LV Sub Box	1530 x 100 x 100	537367 Sh 2	9	13
8	XA055	HV Sub Platform	1830 x 125 x 125	537367 Sh 2	23	11
9	XA060	HV Sub standoff	1830 x 100 x 100	537367 Sh 3	6	6
10	XA065	LV Sub Urban	2830 x 100 x 100	537367 Sh 3	6	6
11	XA070	LV Sub Coastal	3030 x 100 x 100	537367 Sh 3	7	9
12	XA075	Crossarm regulator	4040 x 100 x 100	537367 Sh 3	9	13
13	Type 2	Transmission Type 2	2100 x 125 x 100	079042	7	9
14	Type 3	Transmission Type 3	3300 x 150 x 125	537427 Sh 2	9	13
15	Type 4	Transmission Type 4	2700 x 125 x 100	537427 Sh 1	7	9
16	Type 5	Transmission Type 5	1800 x 100 x 125	079045	9	7
17	Type 6	Transmission Type 6	6300 x 200 x 125	537427 Sh 1	18	28
18	Type 7	Transmission Type 7	3300 x 100 x 125	537427 Sh 1	9	7
19	Type 8	Transmission Type 8	3300 x 100 x 125	079048	9	7
20	Type 9	Transmission Type 9	2400 x 100 x 125	537427 Sh 1	9	7
21	Type 10	Transmission Type 10	2400 x 100 x 125	079050	9	7
22	C1	“Steel Long Span” C1	3300 x 65 x 125	052797	4	21
23	C2	“Steel Long Span” C2	2300 x 65 x 125	052785	4	21
24	C3	Steel Termination C3	3000 x 152 x 152	052796	Refer to Drawing	

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25	H2	H-Pole Crossarm H2	9000 x 200 x 75	074148	Refer to Drawing
26	H3	H-Pole Crossarm H3	9500 x 200 x 200	076615	Refer to Drawing

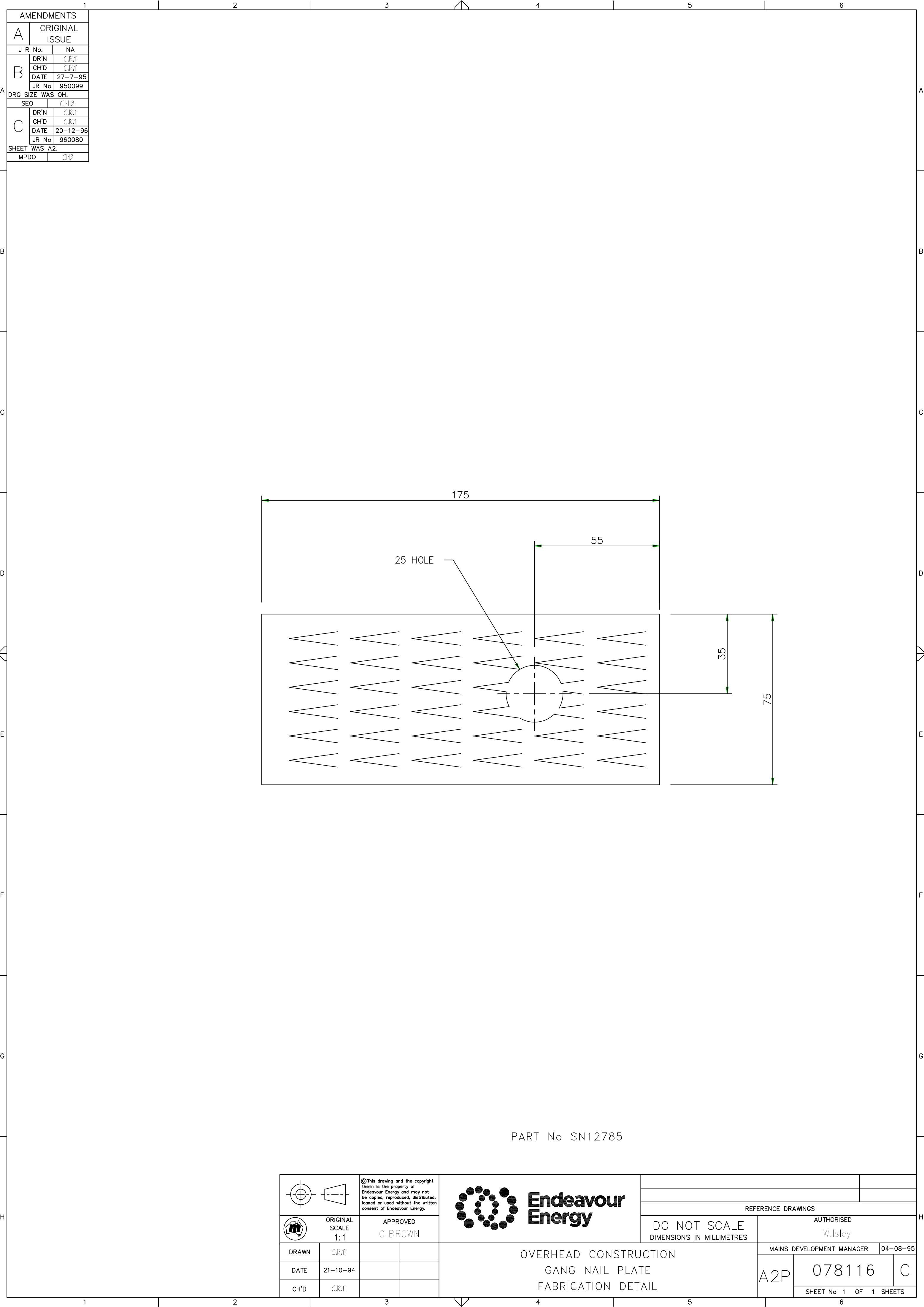
Notes:

1. Final crossarm dimensions are subject to supplier capability. Any variation from the nominated dimensions shall not affect the specified hole layout, hole sizes, hole locations or fitting interfaces.

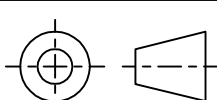
8 Appendix 2 – Drawings

Table 9 – Drawings associated with this specification

Drawing Number	Amendment	Drawing Title
063900	F	Overhead construction pole mounted bolts
078116	C	Gang Nail plate fabrication detail
240379	B	Concrete Pole crossarm mounting bracket detail (Gain block)
240872	B	Wood Pole crossarm mounting bracket detail (Gain block)



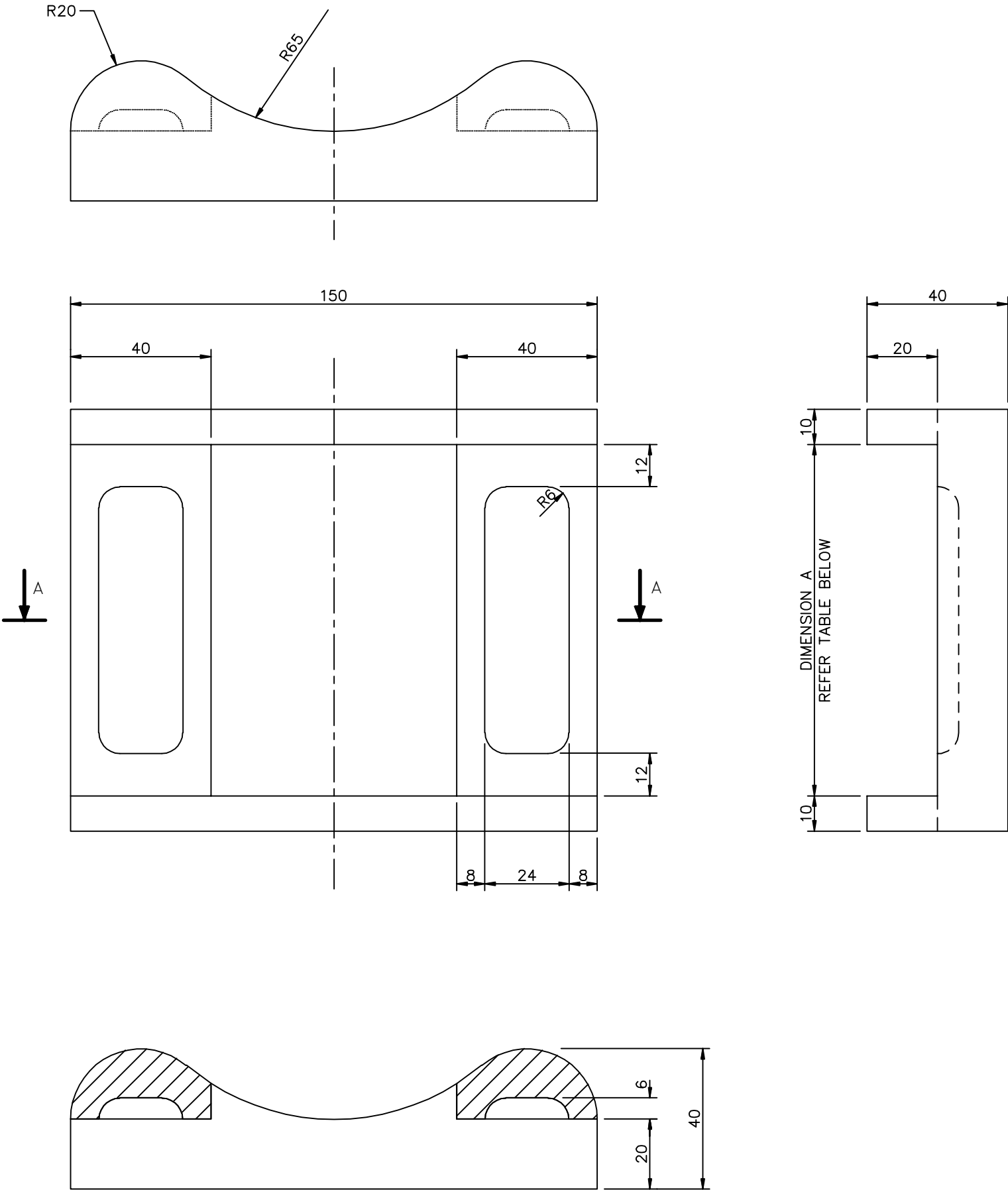
PART No SN12785

		© This drawing and the copyright therein is the property of Endeavour Energy and may not be copied, reproduced, distributed, loaned or used without the written consent of Endeavour Energy.		 Endeavour Energy						
ORIGINAL SCALE 1:1		APPROVED C.BROWN				REFERENCE DRAWINGS				
				OVERHEAD CONSTRUCTION GANG NAIL PLATE FABRICATION DETAIL		DO NOT SCALE DIMENSIONS IN MILLIMETRES		AUTHORISED W.Isley		
DRAWN		C.R.T.				MAINS DEVELOPMENT MANAGER 04-08-95				
DATE		21-10-94				A2P		078116		C
CH'D		C.R.T.						SHEET No 1 OF 1 SHEETS		

AMENDMENTS	
A	ORIGINAL ISSUE
J R No.	960080
DR'N	S.F
CH'D	R.D
DATE	24-10-24
UR No	N/A
REPLACED STOCK CODE BY MATERIAL NO.	
EDM	K.S

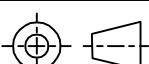
NOTES

1. MATERIAL: CAST ALUMINIUM ALLOY, DESIGNATION BP401 TO AS1874.
2. TOLERANCE TO BE $\pm 2\text{mm}$.
3. FINISH: CASTING TO BE CLEAN AND FREE FROM HARMFUL DEFECTS.



SECTION A-A

MATERIAL NO	NOMINAL SIZE	DIMENSION A
1000000469	100	105
1000001859	125	130
1000001874	150	155

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 ORIGINAL SCALE 1:1		APPROVED C.Brown		REFERENCE DRAWINGS										
				DO NOT SCALE DIMENSIONS IN MILLIMETRES				AUTHORISED W.Isley						
DRAWN	C.R.T.			WOOD POLE CROSSARM MOUNTING BRACKET DETAIL						MGR NETWORK MAINS ASSETS		12-03-97		
DATE	23-10-96									A2P		240872		B
CH'D	C.R.T.											SHEET No 1 OF 1 SHEETS		

9 Appendix 3 – Bolted connection test

The following test is a mechanical test designed to determine the breaking limit of a pin type construction and for kingbolt assemblies.

Test set up

The test must comprise of a 200 mm sample of the composite crossarm, with an appropriately sized hole for a M20 bolt, shown in Figure 2(a).

This will be placed into a custom-made test jig, Figure 2(b), which must be designed such that when the crossarm sample is placed in the jig, the crossarm is not resting on the jig. This is so the mechanical stress is transferred through the crossarm, to the high tensile rod and through the jig supports.

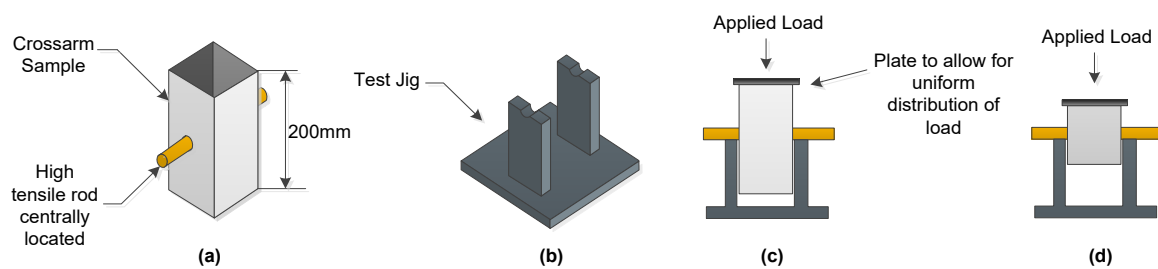


Figure 2 - Test set up. (a) Sample (b) Test Jig (c) test in vertical direction (d) test in horizontal direction

Procedure

A uniformly applied load must be gradually placed on the crossarm via a metal plate, until failure occurs.

The force at which failure occurs and the way in which the failure occurs must be recorded.

The test must be repeated on ten (10) different samples for each direction, shown in Figure 2(c) and Figure 2(d).

Results

The following must be calculated from the 10 results:

- The mean (μ) value (kN);
- The standard deviation (σ) (kN);
- Minimum failure value (kN);
- Coefficient of variation ($(\sigma)/(\mu)$);
- 5th Percentile ($\mu - 1.65\sigma$);
- The characteristic value – which will be the lesser of:
 - 5th Percentile / 1.10;
 - Minimum value / 1.10.

