

Overhead line fittings

Document No. ETS 0106

Amendment No. 1

15/07/25

Revision History

This amendment replaces the following specifications:

ETS 0106 – Overhead line fittings Am. 0

Important Disclaimer

As the information contained in this publication is subject to change from time to time, Endeavour Energy gives no warranty that the information is correct or complete at the time of its use or is a definitive statement of procedures.

Endeavour Energy reserves the right to vary the content of this publication as and when required. You should make independent inquiries to satisfy yourself as to the correctness and accuracy of the content. Endeavour Energy is not liable to any persons in respect of anything done or not done by any such person in reliance, whether in whole or in part, on this document.

Copyright

This publication is copyright protected. No part of this document may be reproduced by any process without the written permission of Endeavour Energy, except as permitted under the Copyright Act 1968.

Contact Information

The latest version of this document and other standards, are located on Endeavour Energy's standards website located at:

<http://www.endeavourenergy.com.au/asp/webengine/au/com/ee/asp/standards/standards>.

For any enquiries relating to the content of this document please contact the Standards Coordinator on 133 718.

Document Control

Documentation content coordinator: Engineering Delivery Manager

Documentation process coordinator: Branch Process Coordinator

Contents

1	Documentation Scope	5
2	References	5
3	Definitions and Abbreviations	7
4	Actions	7
	4.1 General requirements	7
5	Gain Blocks	11
	5.1 Technical requirements	11
	5.2 Testing requirements	11
6	Helical Fittings	11
	6.1 Technical requirements	11
	6.2 Specialised requirements	11
	6.3 Testing requirements	13
7	Insulator Fittings	15
	7.1 Technical requirements	15
	7.2 Testing requirements	16
8	Non-tension fittings	18
	8.1 Technical requirements for parallel groove clamps	18
	8.2 Technical requirements for split bolts	19
	8.3 Testing requirements	19
9	Protective Fittings	21
	9.1 Technical requirements	21
	9.2 Testing requirements	21
10	Suspension clamps	23
	10.1 Technical requirements	23
	10.2 Testing requirements	24
	10.3 Routine and batch test	25
11	Packaging	25
12	Reliability	25
13	Service History	26
14	Quality Assurance	26
15	Training material	26
16	Environmental considerations	26

17	Variations over time	26
18	Safety Data Sheet (SDS)	26
19	Responsibilities	27

1 Documentation Scope

The scope of work consists of the design, manufacture, testing at manufacturer's works and delivery of overhead line fittings for use on Endeavour Energy's electrical networks.

It is not the intention to specify the manufacturing, testing and material requirements in detail. However, the overhead line fittings must be manufactured to the highest quality standards. The scope includes all items that are necessary for the operation of the equipment, where specified.

All supplied overhead fittings must be manufactured and tested to the standards with the year of publication listed in section 2.0 below. In some circumstances based on local network conditions and experience, this specification is more stringent or is inclusive of requirement not covered in Australian and International Standards; in this circumstance the requirements of this specification must take precedence.

Tenderers must state any non-compliance with the specification in any tender submission and any alternative offers must be submitted in full and separately from any main offer. Any proposed variations from this specification must be referred to Engineering Delivery Manager for approval prior to acceptance.

2 References

External Regulations

NSW Work Health and Safety Act 2011

NSW Work Health and Safety Regulation 2017

External Standards

Standard No.	Year	Title
ENA Doc 01	2019	ENA National Electricity Network Safety Code
AS 1110.1	2005	ISO metric hexagon bolts and screws – Product grades A and B - Bolts
AS 1111.1	2015	ISO metric hexagon bolts and screws – Product grade C – Bolts
AS 1112.3	2015	ISO metric hexagon nuts – Product grade C
AS 1154.1	2009 (R2019)	Insulator and conductor fittings for overhead power lines – Performance, material, general requirements and dimensions
AS 1154.3	2009 (R2019)	Insulator and conductor fittings for overhead power lines – Performance and general requirements for helical springs
AS/NZS 1214	2016	Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series)
AS 1222.1	1992 (R2016)	Steel conductors and stays – Bare overhead – Galvanised (SC/GZ)
AS 1222.2	1992 (R2016)	Steel conductors and stays – Bare overhead – Aluminium clad (SC/AC)
AS/NZS 4680	2006 (R2017)	Hot dip galvanized (zinc) coatings on fabricated ferrous articles

AS 1275	1985 (R2017)	Metallic screw threads for fasteners
AS 1442	2007 (R2017)	Carbon steels and carbon-manganese steels - Hot rolled bars and semi-finished products
AS 1531	1991 (R2017)	Conductors – Bare overhead – Aluminium and aluminium alloy
AS 1554.1	2014	Structural steel welding - Welding of steel structures
AS 1565	2023	Copper and copper alloys - Ingots and castings
AS/NZS 1567	2023	Copper and copper alloys - Wrought rods, bars and sections
AS 1746	1991	Conductors – Bare overhead – Aluminium and aluminium alloy
AS 1874	2000 (R2018)	Aluminium and aluminium alloys - Ingots and castings
AS 2738	2023	Copper and copper alloys - Compositions and designations of refinery products, wrought products, ingots and castings
AS 2848.1	1998 (R2018)	Aluminium and aluminium alloys - Compositions and designations - Wrought products
AS 3607.1	1989 (R2016)	Conductors – Bare overhead, aluminium and aluminium alloy – Steel reinforced
AS 3608	2005	Insulators – Porcelain and glass, pin and shackle type – Voltages not exceeding 1000 V a.c
AS/NZS 4534	2006 (R2017)	Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS 4680	2006 (R2017)	Hot dip galvanized (zinc) coatings on fabricated ferrous articles
AS 4899	2007 (R2018)	Pin insulators – Porcelain and glass for overhead power lines – Voltages greater than 1000V a.c.
AS 60120	2022	Ball and socket couplings of string insulator units - Dimensions
AS 60372	2022	Locking devices for ball and socket couplings of string insulator units - Dimensions and tests
AS/NZS ISO 9001	2016	Quality management systems – Requirements
AS/NZS ISO 14001	2016	Environmental management systems - Requirements with guidance for use
IEC 60471	2020	Clevis and tongue couplings of string insulator units - Dimensions

Company Policies and Procedures

Company Policy (Network) 9.1.6 – Approved material list

Company Policy (Network) 9.2.5 – Network Asset Design

Company Policy (Network) 9.7.1 – Network Asset Construction
Company Policy (Network) 9.8.3 – Network Operations
Company Policy (Network) 9.9.1 – Network Asset Maintenance

Company Standards	
Earthing Design Instruction EDI 100	Distribution earthing design
Mains Construction Instruction MCI 0005	Overhead construction standards manual
Mains Design Instruction MDI 0031	Overhead line design

3 Definitions and Abbreviations

Term	Definition
AAC	All aluminium conductor
AAAC	All aluminium alloy conductor
ACSR	Aluminium conductor, steel reinforced
CBL	Calculated breaking load
LV	low voltage
MCBL	Minimum Conductor Breaking Load
MFL	Minimum Failing Load
NATA	National Association of Testing Authorities
RIV	Radio Interference Voltage
SC/GZ	Steel conductor galvanised

4 Actions

4.1 General requirements

Overhead line fittings are required for use on overhead systems ranging from LV to 132 kV.

4.1.1 Service conditions and durability

The items to be supplied under this specification are to be used in a hostile outdoor environment with the following anticipated environmental extremes:

Table 1: Service conditions

Condition	Environmental Extremes
Ambient temperature	Max: 50°C Summer daytime Min: –15°C Winter night time

Design conductor maximum operating temperatures	120°C for ACSR conductors 100°C for all other conductors
Solar Radiation Level	1100 W/m ² with high ultraviolet content.
Precipitation	Maximum annual rainfall range 1800 – 2400mm. Minimum annual rainfall range 0 – 100mm.
Humidity	Extreme range of relative humidity from 10% to 100%.
Pollution	Areas of coastal salt spray and/or industrial pollution with equivalent salt deposit densities up to 3.0 g/m ² .
Average annual lightning ground flash density	3 strikes per km ²

Items may be subject to snow and ice loading, sand storms, rifle-fire vandalism, extended periods of sunshine and high ambient temperature. Any limitations on the service conditions for which the items offered are not suitable must be provided with the offer. The expected service life of the items must be a minimum of 50 years.

4.1.2 Compatibility with conductors and other fittings

It is a requirement of this specification that the supplier will demonstrate the products offered will be compatible with existing conductors, fittings, overhead constructions or any other products offered.

4.1.2.1 Conductors used in Endeavour Energy

The fittings in this specification are to be made for use on conductors made of aluminium, aluminium alloy, ACSR, copper, and steel. These conductors are manufactured in accordance with Australian Standards AS 1531, AS 1746, AS 3607, AS 1222.1 and AS 1222.2, as well as their historical precedents. The aluminium conductors used may be fully greased, partially greased or ungreased. ACSR and SC/GZ conductors are fully greased. All conductors are right hand lay.

Aluminium and aluminium alloy designations for the conductors used are 1350 and 1120 respectively. Where a fitting is suitable for use on multiple conductor types (such as AAC, AAAC and ACSR), manufacturers should be mindful of the difference in breaking load between these and the implications for type testing.

The following table details the type and overall diameters of the conductors used in Endeavour Energy.

Table 2: Conductors used in Endeavour Energy

Conductor Type	Description	Nominal overall diameter (mm)
AAC	7/2.25 Jupiter	6.75
	7/3.00 Libra	9.0
	7/3.40 Fly	10.2
	7/3.75 Mars	11.3
	7/4.50 Mercury	13.5
	7/4.75 Moon	14.3
	19/3.25 Neptune	16.3
	19/3.75 Pluto	18.8

Conductor Type	Description	Nominal overall diameter (mm)
	19/4.75 Taurus	23.8
	61/3/25 Uranus	29.3
AAAC	7/2.50 Chlorine	7.50
	7/4.50 Hydrogen	13.5
	19/3.25 Krypton	16.3
	61/3.25 Selenium	29.3
ACSR	6/1/3.00 ACSR/GZ Apple	9.0
	6/1/2.50 ACSR/GZ Almond	7.5
	6/1/3.75 ACSR/GZ Banana	11.3
	6/4.75+7/1.60 ACSR/GZ Cherry	14.3
	3/4/1.75 ACSR/GZ Quince	5.3
	3/4/2.50 ACSR/GZ Raisin	7.5
	4/3/3.00 ACSR/GZ Sultana	9.0
	4/3/3.75 ACSR/GZ Walnut	11.3
	30/7/2.50 ACSR/GZ Grape	17.5
	54/7/3.00 ACSR/GZ Mango	27.0
	54/7/3.50 ACSR/GZ Olive	31.5
Steel	7/2.75 SC/GZ conductor	8.3
	7/3.25 SC/GZ conductor	9.8
	7/4.00 SC/GZ conductor	11.8
	19/2.75 SC/GZ conductor	13.8
HDCu	7/1.63 HDCu conductor	4.88
	7/1.75 HDCu conductor	5.25
	7/2.00 HDCu conductor	6.0
	7/2.75 HDCu conductor	8.25
	19/2.00 HDCu conductor	10.0

4.1.3 General marking requirements

The following shall be permanently marked on the body of fittings prior to galvanising:

- Manufacturer's name or trademark
- Manufacturer's part number
- Batch number (to identify month and year of manufacture at a minimum)

Markings should be applied in such a way as to remain legible after galvanising.

4.1.4 General material requirements

All components shall comply with the following (where applicable):

- All ferrous metal parts except those made of stainless steel shall be hot dipped galvanised in accordance with AS/NZS 4680 (or AS/NZS 1214 for threaded fasteners).
- Fittings shall be designed, manufactured and finished so as to avoid sharp radii of curvature, ridges and imperfections that may cause conductor damage during conductor vibration, surface tracking, radio interference, harmful corona discharge or employee injury, when installed in accordance with recommended procedure.
- All materials shall have adequate resistance to the effects of ozone, ultraviolet radiation and air-pollution over the whole range of the service conditions.

- Non-metallic materials employed shall have good resistance to ageing and shall be capable of withstanding service temperatures without detrimental change of properties.
- Materials that are susceptible to UV degradation shall be UV stabilised.
- Materials shall not induce corrosion in materials that are in contact with them.
- Components shall be compatible with other components and the conductor with which they will be in contact.
- All parts of the fittings shall be inherently resistant to atmospheric corrosion both during storage and in service.

4.1.5 General testing requirements

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

Type tests must be less than five (5) 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) written in any language other than English will not be accepted unless the reports are translated into English by a sworn translator.

Type test certificates must specify the overall dimensional details of the fittings, full details of the conductor, armour rods (if required), test assembly, procedure, test requirement and test results. Test certificates only indicating the items have passed without listing the test conditions above will be deemed non-compliant.

The items may be deemed technically non-compliant if the required accredited type test reports are not submitted with the offer.

4.1.6 General batch test requirements

A certificate of compliance in accordance with AS 1874 is to be supplied with each order/delivery.

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 the testing staff.
- Test procedures for all routine/batch tests.
- Testing facility quality control procedures.
- Test instrument calibration certificates/procedures.

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

5 Gain Blocks

5.1 Technical requirements

5.1.1 Materials

Gain blocks must be cast from grade BA701 (preferred) or CA401 (or equivalent) aluminium in accordance with AS 1874.

Castings must be clean and free from harmful inclusions, blow holes and all other defects.

5.1.2 Dimensions

Gain blocks are required for use with 100mm, 125mm, and 150mm crossarms. The gain block drawings, dimensions and tolerances are indicated in Annexure 2 of this specification.

Supplier's drawings, dimensions and tolerances for gain blocks must be submitted with the offer.

5.1.3 Additional marking requirements

In addition to the requirements detailed in clause 4.1.3 of this specification, the following must be stamped on the body of gain blocks:

- Compatible crossarm size (e.g. 125mm)

5.2 Testing requirements

5.2.1 Batch tests

The following batch test must be conducted on a minimum of three samples:

Table 3: Batch tests for gain blocks

Test	Pass Criteria
Verification of dimensions	Dimensions are in accordance with relevant drawings and requirements (including any specified tolerances).

6 Helical Fittings

6.1 Technical requirements

6.1.1 Additional material requirements

In addition to the material requirements in clause 4.1.4, helical fittings may be made from any material or combination of materials, if that enables the fitting to reach its design strength capability. It is expected that aluminium alloy, galvanised steel and copper will be used in the manufacture of helical fittings for the respective conductor types.

6.1.2 Protection against corrosion

For helical fittings, all ferrous metal parts that may be exposed to the atmosphere in service, except those made of stainless steel, must be protected by hot-dip galvanizing in accordance AS/NZS 4534 Class W10.

6.2 Specialised requirements

The following clauses detail the additional technical requirements for each type of helical fitting.

6.2.1 Deadends / terminations

Deadends must be a single piece and preference will be given to deadends which are smaller in length.

Deadends must comply with Clause 2 of AS 1154.3. The Mechanical Strength Type Tests of Clause 2.3.1 of AS 1154.3 for anchor fittings will apply. The electrical type tests described in Clause 2.4 of AS 1154.3 are not required.

6.2.2 Full tension splices

Each splice offered must be designed for the full breaking load of the conductor it is intended to be used with. Single piece splices are preferred for ACSR conductors.

Full-tension splices must comply with Clause 2 of AS 1154.3. The Mechanical Strength Type Tests of Clause 2.3.3 of AS 1154.3 for tension fittings will apply. Electrical type tests in accordance with Clause 2.4 of AS 1154.3 are required.

6.2.3 Guy locks

Guy locks must comply with Clause 2 of AS 1154.3. The Mechanical Strength Type Tests of Clause 2.3.1 of AS 1154.3 for anchor fittings will apply. The electrical type tests described in Clause 2.4 of AS 1154.3 are not required.

6.2.4 Armour rods

Armour rods must comply with Clause 4 of AS 1154.3. The Mechanical Strength Type Tests of Clause 4.2.3 of AS 1154.3 for repair fittings will apply.

6.2.5 Metallic top and side ties

Where armour rods are used in conjunction with tie wires, manufacturers must indicate the compatible armour rod and insulator tie sets. Where armour rods are not used, an elastomeric tube (such as Neoprene or other material with similar performance properties) must be supplied to provide cushioning between the insulator and conductor. Ties will be used on insulators with nominal neck diameters of 76 mm or 113 mm (in accordance to AS 4899), as indicated in Annexure 1.

Top ties must be suitable for line angles of up to 10°, while side ties must be suitable for line angle from 10° to 40°.

Manufacturers must state the nominated holding tension and minimum failing load for all ties offered. It is anticipated that the nominated holding tension will be at least 3.5kN or 15% of the conductor Calculated Breaking Load (CBL), whichever is less, and that the minimum failing load will be at least 20% of the CBL.

6.2.6 Non-metallic top and side ties

Non-metallic top and side ties are used to secure covered conductors in the top or side grooves of insulators. The conductor is not stripped, armour rods are not used, and elastomeric tubes are not required.

Top ties must be suitable for line angles of up to 10°, while side ties must be suitable for line angle from 10° to 40°.

Insulators for covered conductors have a nominal neck diameter of 73 mm or 76 mm.

Manufacturers must state the nominated holding tension and minimum failing load for all ties offered. It is anticipated that the nominated holding tension will be at least 3.5kN or 15% of the conductor Calculated Breaking Load (CBL), whichever is less, and that the minimum failing load will be at least 20% of the CBL.

6.2.7 Spiral vibration dampers

Spiral vibration dampers must be constructed from a suitable polymer designed to minimise the effects of solar radiation degradation, as required by Clause 4.3.2 of AS 1154.3.

They must be suitable for use on conductors operating at up to 120 °C and must not cause damage to the conductor through corrosion, abrasion, or any other means.

6.2.8 Helical suspension and support units

Support units will be used with clamp top horizontal and vertical line post insulators. Suspension units will attach to the tongue end of a 70 kN socket-tongue or clevis-tongue fitting and must be supplied with a suitable threaded clevis bolt with locking split pin.

Each unit must consist of a housing, insert and helical rods. The housing must be made of high strength cast aluminium, except for clamps for conductors less than 10 mm diameter, which may be pressed galvanised steel. The insert between the housing and the helical rods must be made of an elastomer such as Neoprene or other material with similar performance properties.

Any nuts and bolts must be made of galvanised steel, split pins must be grade 316 stainless steel, and the outer strap around the suspension unit housing must be high strength aluminium alloy.

Manufacturers must state the nominated holding tension and minimum failing load for all helical suspension and support units offered. It is anticipated that the nominated holding tension will be at least 3.5kN or 15% of the conductor Calculated Breaking Load (CBL), whichever is less, and that the minimum failing load will be at least 50% of the CBL.

6.3 Testing requirements

Type tests must be carried out on all helical fittings in accordance with this clause, which is based on the requirements of AS 1154.3, prior to acceptance.

6.3.1 Type tests

Type tests must be performed on no fewer than three fittings, as detailed in Clause 1.5.1 of AS 1154.3. Dimensional details of the fitting must be recorded on the type test certificates, along with full details of the conductor used for the type test.

Table 4: Type tests for Helical fittings

Helical fitting type	Type test required	Test reference in AS 1154.3	Pass criteria
Dead end / termination	Type test for glue	Clause 2.2	No separation of wires, no peeling or flaking of glue, no other substantial signs of material degradation.
	Anchor fittings other than fittings for ADSS and OPGW cables	Clause 2.3.1	No conductor slip or failure of fitting when held at 90% of conductor breaking load for 1 minute. Force increased, and load and nature of failure to be recorded.
Full tension splice	Tension fittings	Clause 2.3.3	No conductor slip or failure of fitting when held at 90% of conductor breaking load for 1 minute. Force increased, and load and nature of failure to be recorded.

Helical fitting type	Type test required	Test reference in AS 1154.3	Pass criteria
	Resistance test	Clause 2.4.1	Assembly resistance less than 75% of the measured resistance of the equivalent length of conductor, before and after heating cycle and short-time current tests.
	Heating cycle test	Clause 2.4.2	Maximum temperature on surface of fitting must be less than conductor temperature. No sign of heating, burning or fusing of fitting or conductor.
	Short-time current test	Clause 2.4.3	No conductor slip or mechanical failure of fitting. No sign of heating, burning or fusing of fitting or conductor.
Guy lock	Anchor fittings other than fittings for ADSS and OPGW cables	Clause 2.3.1	No conductor slip or failure of fitting when held at 90% of conductor breaking load for 1 minute. Force increased, and load and nature of failure to be recorded.
Armour rod	Mechanical strength type test	Clause 4.2.3	No failure of fitting when held at 90% of conductor breaking load for 1 minute.
Top and side ties	Holding tension (withstand slip) test	Clause 3.2.1	No conductor slip and no failure of fitting when held at nominated holding tension for 1 minute. Load increased, and recorded at 3 mm of slip or failure of fitting.
	Failing load test	Clause 3.2.2	Failing load > 20% CBL (or manufacturer's specified minimum failing load) Failing load recorded for both directions.
Suspension and support units	Holding tension (withstand slip) test	Clause 3.2.1	No conductor slip and no failure of fitting when held at nominated holding tension for 1 minute. Load increased, and recorded at 3 mm of slip or failure of fitting.
	Failing load test	Clause 3.2.2	Failing load > 20% CBL (or manufacturer's specified minimum failing load) Failing load recorded, and failure must be ductile.
Vibration damper	Solar radiation resistance	-	Tests on the material used and its solar radiation resistance.

6.3.2 Batch tests

The following batch tests must be conducted:

Table 5: Batch tests for Helical fittings

Helical fitting type	Batch test required	Test reference in AS 1154.3	Pass criteria
All fittings	Verification of dimensions	Clause 1.6	Dimensions of fittings must be in accordance with manufacturer's drawing.
Any fittings containing galvanised steel	Galvanising tests	Clause 2.5.3 Clause 3.5.3 Clause 4.4.2	Galvanised fittings must be tested in accordance with AS 1214 or AS/NZS 4534, Class W10.
Top and side ties (additional requirements)	Holding tension (withstand slip) test	Clause 3.2.1	Same as type test.
	Failing load test	Clause 3.2.2	Same as type test.
Suspension and support units (additional requirements)	Holding tension (withstand slip) test	Clause 3.2.1	Same as type test.
	Failing load test	Clause 3.2.2	Same as type test.

7 Insulator Fittings

7.1 Technical requirements

Insulator fittings must be in accordance with AS 1154.1 and the requirements of this document. Where there is a conflict, the requirements of this document must take precedence.

7.1.1 Castings

Castings must be manufactured from materials in accordance with AS 1154.1 Clauses 1.4.6.3, 1.4.6.4 and 1.4.6.5.

Full details of the type of iron to be used must be submitted in the offer.

Castings must be clean, free from harmful inclusions, blow holes, and all other defects.

7.1.2 Forged steel

Forged steel must be in accordance with AS 1154.1 Clause 1.4.6.2 and must be supplied in the heat-treated condition. The steel must be grade X1320, X1340, or equivalent and that the items are suitable for the range of temperatures stipulated in [Clause 4.1.1](#) of this specification.

Full details of the type of steel to be used must be submitted in the offer.

7.1.3 Welding

Welding must be in accordance with AS 1554.1. Welds must be sealed unless shown otherwise to prevent ingress of moisture.

7.1.4 Nuts and bolts

All bolts and nuts must be threaded in accordance with AS 1111 and AS 1112 respectively.

Threads must conform to AS 1275.

Internal threads must be cut and greased after galvanising.

7.1.5 Dimensions

Dimensions of fittings must be in accordance with AS 1154.1 Clause 8, unless otherwise noted. Where the dimensions of a fitting differ or if a fitting is not covered in AS 1154.1, drawings showing the dimensions of the item must be submitted in the offer.

Ball and socket couplings must be in accordance with AS 60120.

Locking devices for socket fitting must be in accordance with AS 60372.

Clevis and tongue couplings must be in accordance with IEC 60471.

7.1.6 Marking requirements

In addition to the general marking requirements specified in clause 4.1.3 of this specification, the following must be permanently marked on the body of fittings prior to galvanising:

- MFL in kilonewtons

Markings should be applied in such a way as to remain legible after galvanising.

7.2 Testing requirements

7.2.1 Type tests

Type tests must be carried out on all products in accordance with this clause, which is based on the requirements of AS 1154.1 Clause 2, prior to acceptance. In accordance with AS 1154.1 Clause 1.5.1, type tests must be performed on no fewer than three fittings identical in all essential details with those to be supplied.

The type tests required to be submitted with the offer are:

Table 6: Type tests for Insulator fittings

Type test	Test reference	Pass Criteria
Mechanical strength test	AS 1154.1 Clause 2.2	No permanent distortion after 50% load for 1 minute (this requirement may be waived if the extended strength test passes). Eventual failure will be of a ductile nature and must occur at a load not less than the MFL. Test must be continued to at least 125% MFL unless failure occurs earlier. Maximum load applied and details of any distortion or failure must be recorded.
Extended strength test	AS 1154.1 Clause 2.2.4	If distortion occurs after one minute at 50% load in test 2.2 above, no increase in distortion must occur after one minute at 60% load.

Type test	Test reference	Pass Criteria
Hardness test	AS 1154.1 Clause 2.3	In accordance with AS 1154.1 Clause 8.1.10.2.

7.2.2 Routine tests

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

Ferrous insulator fittings that are castings or that have welded joints that are exposed to tensile stress in service must be subjected to the following test:

Table 7: Routine test for Insulator fittings

Routine tests	Test reference	Pass Criteria
Tensile strength test	AS 1154.1 Clause 2.4	No breakage, cracking, or permanent distortion.

Fittings that have passed the routine test must be permanently marked.

7.2.3 Batch test

The following batch tests must be conducted:

Table 8: Batch tests for insulator fittings

Batch test	Test reference	Pass Criteria
Verification of dimensions	AS 1154.1 Clause 1.6	Dimensions are in accordance with relevant drawings and requirements (including any specified tolerances).
Mechanical test	AS 1154.1 Clause 2.2	No permanent distortion after 50% load for 1 minute (this requirement may be waived if the extended strength test passes). Eventual failure must be of a ductile nature and will occur at a load not less than the MFL. Test must be continued to at least 125% MFL unless failure occurs earlier. Maximum load applied and details of any distortion or failure must be recorded.
Hardness test	AS 1154.1 Clause 2.3	In accordance with AS 1154.1 Clause 8.1.10.2.
Galvanizing test	AS 1154.1 Clause 2.5.3	In accordance with: AS 4680 for fabricated ferrous articles AS 1214 for threaded fasteners

8 Non-tension fittings

8.1 Technical requirements for parallel groove clamps

The items offered must be in accordance with AS 1154.1 and the requirements of this document. Where there is a conflict, the requirements of this document must take precedence.

8.1.1 Materials

Aluminium components must be one of the following alloys:

- 1050 or 6061 in accordance with AS 2848
- AA603, DA401, CB401 or CC401 in accordance with AS 1874

Copper components must be in accordance with AS 2738 and comprise one of the following alloys:

- C11000, C22000, C51800 in accordance with AS 1567
- C90250, C92610A in accordance with AS 1565

Stainless steel components must be grade 316.

Bolts, nuts, flat washers, and Belleville washers must be grade 316 stainless steel.

8.1.2 Clamp requirements

No current (or only a negligible amount) must be transmitted through the nuts and bolts used with the connector.

Clamps must be designed to accommodate the differential expansion and contraction of components due to thermal cycling.

Each bolt must include a Belleville washer and two stainless steel flat washers except where noted in Annexure 1.

The flat washers must be of an adequate thickness to evenly distribute the bolt stress on the surfaces and of adequate width to enable Belleville washer to sit completely on one of them.

Stability of the contact pressure must be maintained by stainless steel bolts and nuts. These are to be suitably machined and lubricated with anti-seize grease to stop galling when tightening or untightening the bolt. Keeper bars or thrust plates are not acceptable.

Bolts must be of a sufficient length to allow attachment of the fitting to the largest size conductor without total removal of any part of the connector.

Connectors must be suitable for installation and removal using live line techniques. To allow removal of the connector, the nuts of the bolted connection must be held captive in the body, or the body of the connector must be tapped and the connection designed to withstand the maximum tightening torque.

Connectors of a single-bolt type must be designed so as to prevent the clamp components from rotating out of alignment during installation (for example interlocking claws).

Surfaces of clamps that will be in contact with aluminium conductors must be supplied with an oxide and corrosion inhibiting compound already applied. The compound must be impregnated with zinc grit particles and be suitable for operation up to 100°C.

The supplier must advise the minimum / maximum recommended tightening torque as well as the specified tightening technique / procedure. If a special tool is required to hold the clamp in position while tightening, the supplier must advise the make and model number of the tool.

8.1.3 Other requirements

Hexagonal-head bolts:

- must be in accordance with AS 1110.1;
- must have uniform cut threads throughout which are free running and of commercial tolerance 8g in accordance with AS 1275.

Hexagonal-head nuts:

- must have free running cut threads of tolerance 6H in accordance with AS 1275.

Connectors:

- must be designed so that the bolt head does not bind on the surface of the connector during tightening.

Surfaces:

- connector surfaces in contact with the conductors must be grooved in a direction transverse to the conductor axis to penetrate the oxide layer on the surface of the conductor for all conductors.

Aluminium to copper (bimetallic) connectors:

- The interface between aluminium and copper must be achieved by friction welding or other methods that tests indicate will have negligible susceptibility to corrosion.

8.2 Technical requirements for split bolts

8.2.1 Materials

Split bolts must be offered in both natural brass and electro-tinned brass varieties.

8.2.2 Tightening torque

The supplier must advise the minimum / maximum recommended tightening torque.

8.2.3 Marking requirements

In addition to the general marking requirements detailed in clause 4.1.3 of this specification, the following must be stamped on the body of non-tension fittings:

- Range of conductor cross sectional areas or the conductor diameter for each of the connections; and,
- Installation / tightening torque.

Bimetallic clamps must have visible marking to identify the side with the copper insert. This should be visible from ground level after installation.

8.3 Testing requirements

For split-bolts the only mandatory test is the verification of dimensions; however additional tests will be viewed favourably.

8.3.1 Type tests (PG Clamps)

Type tests must be carried out on all products in accordance with this clause, which is based on the requirements of AS 1154.1 Clause 4, prior to acceptance.

In accordance with AS 1154.1 Clause 1.5.1, type tests must be performed on no fewer than three fittings identical in all essential details with those to be supplied.

The type tests required to be submitted with the offer are:

Table 9: Type tests for Non tension fittings

Type test	Reference test	Pass Criteria
Tensile test	AS 1154.1 Clause 4.3.3 (a) or (b)	No movement of the conductor relative to the fitting due to slip. No failure of the fitting.
Tee fittings - main conductor integrity test	AS 1154.1 Clause 4.4.1	No failure of main conductor during the 1 minute test period.
Tee fittings - tensile and slip test	AS 1154.1 Clause 4.4.2.3 (a) or (b)	No slip between fitting and conductor at test load.
Heating cycle test	AS 1154.1 Clause 4.5	Temperature of fitting not to exceed temperature of conductor. Final resistance not to exceed 130% of initial resistance. No local heating, burning, or fusing of any part of the fitting or conductor.
Short time current test	AS 1154.1 Clause 4.6	No local heating, burning, or fusing of any part of the fitting or conductor.

8.3.2 Batch test

The following batch tests must be conducted:

Table 10: Batch test for non tension fittings

Batch test	Reference test	Pass Criteria
Verification of dimensions	AS 1154.1 Clause 4.7.1	Dimensions are in accordance with relevant drawings and requirements (including any specified tolerances).
Tensile test	AS 1154.1 Clause 4.3.3 (a) or (b)	No movement of the conductor relative to the fitting due to slip. No failure of the fitting.
Tee fittings - main conductor integrity test	AS 1154.1 Clause 4.4.1	No failure of main conductor during the 1 minute test period.
Tee fittings - tensile and slip test	AS 1154.1 Clause 4.4.2.3 (a) or (b)	No slip between fitting and conductor at test load.
Hardness test	AS 1154.1 Clause 4.7.3	In accordance with AS 1154.1.
Galvanizing test	AS 1154.1 Clause 4.7.4	In accordance with: AS 4680 for fabricated ferrous articles AS 1214 for threaded fasteners

9 Protective Fittings

9.1 Technical requirements

Protective fitting clamp assemblies must be constructed from aluminium alloy. All hardware such as bolts and washers must be grade 316 stainless steel. The messenger cable must be SC/GZ in accordance with AS 1222.1

Table 11 below details the conductor size the protective fittings must be suitable for:

Table 11: Protective fittings for Aluminium alloy and ACSR conductors

Item No.	Item description	Conductor diameter range (mm)	CBL (kN)	Maximum every day tension and stringing temperature
1	Damper 19/3.75 Neon and 19/3.75 Pluto	18-21	Neon - 47.8 Pluto – 31.9	21.5% of CBL at 5°C
2	Damper 30/7/3.50 Lime	24 -29	Lime - 122	
3	Damper 30/7/2.50 Grape	16-18	63.5	
4	Damper 19/4.75 Taurus and 19/4.75 Oxygen	23-27	Taurus - 51.3 Oxygen -73.6	

9.1.1 Marking

In addition to general marking requirements detailed in clause 4.1.3 of this specification, the following must be permanently marked on the fittings:

- The minimum and maximum conductor diameters.

9.2 Testing requirements

9.2.1 Type test

Type tests must be carried out on all protective fittings in accordance with this clause, which is based on the requirements Clause 7 of AS 1154.1, prior to acceptance.

For the damper efficiency type tests, the laboratory span test (AS 1154.1 clause 7.2.2.2) is the preferred test requirement. Where results for this test cannot be provided, field test (AS 1154.1 clause 7.2.2.3) may be considered as acceptable damper efficiency test at the discretion of Endeavour Energy.

The type tests required to be submitted with the offer are:

Table 12: Type test for Protective fittings

Type test	Reference test	Pass Criteria
Damper efficiency type test – Laboratory span test (strongly preferred).	AS 1154.1 Clause 7.2.2.2	The damper efficiency when calculated by either the power method or the standing wave method in accordance too Appendix B of AS 1154.1 must not be less than the appropriate acceptance curve in Figure B1 of Appendix B in AS 1154.1. The maximum bending amplitude measured 90mm from the rigid support must not exceed 0.25mm peak-to-peak.

Type test	Reference test	Pass Criteria
Damper efficiency type test – Field test (not preferred but may be considered if laboratory span test cannot be done).	AS 1154.1 Clause 7.2.2.3	The test duration must be 4 hours. The bending amplitudes or strains on the conductor, wind velocity, wind direction and turbulence must be measured and provided to Endeavour Energy for evaluation. Test results must provide reference of values to CIGRE SC22 WG22.04, or SC22 WGTF2.11.02, or to equivalent publications for easy evaluation.
Mechanical impedance type test	AS 1154.1 Clause 7.2.3	For each amplitude, separate curves for the resistive and reactive components of mechanical impedance must be plotted against frequency in accordance too Appendix C of AS 1154.1. At higher amplitudes of clamp vibration, the damper response must show a downward frequency shift. The value of resistive and reactive component of the impedance must be calculated and provided with the test results along with the CBL and mass per metre of the conductor used for the test.
Fatigue type test	AS 1154.1 Clause 7.2.4	After the completion of the test, there must be no damage, deformation or loosening of any part of the damper.
Weight pull-off type test	AS 1154.1 Clause 7.2.5	Damper weights must not separate from the messenger wire at loads less than the values indicated in Clause 7.2.5.3 of AS 1154.1.
Mechanical type test - Clamp slip test	AS 1154.1 Clause 7.4	The force at which the clamp slips must be not less than 700 N and must not damage the conductor. Any ancillary device that clamps to the conductor must not damage the conductor by its installation and operation.
Electrical type test – Corona and Radio Interference Voltage (RIV) test	AS 1154.1 Clause 7.5	When conducted through methods described in Appendix D of AS 1154.1: • The corona extinction of the fitting obtained during the test must exceed the specified minimum corona extinction. • The RIV of the fitting recorded at the specified test voltage or conductor voltage gradient must not exceed the specified maximum RIV. • The curve indicating the RIV against the test voltage must not present any sudden change between the specified test voltage or conductor voltage gradient and 110% of the specified test voltage or conductor voltage gradient.

9.2.2 Batch test

The following batch tests must be conducted:

Table 13: Batch test for protective fittings

Batch test	Reference test	Pass Criteria
Verification of dimensions	AS 1154.1 Clause 7.6.2	The dimensions must be in accordance with relevant drawings within the original design limits (including any specified tolerances).
Galvanising test	AS 1154.1 Clause 7.6.3	All ferrous metal parts, must be protected by hot-dip galvanizing in accordance with AS/NZS 4680, except that no individual damaged or uncoated area will exceed 10mm ² , and in accordance with AS 1214 for threaded fasteners.
Fatigue test	AS 1154.1 Clause 7.6.4	In accordance to type test.
Weight pull-off test	AS 1154.1 Clause 7.6.5	In accordance to type test.
Mechanical impedance test	AS 1154.1 Clause 7.6.6	The curves obtained are compared with those obtained in type test. A batch is acceptable if its curves show the same general characteristics as those obtained in the type tests and if major peaks occur at frequencies within +/-10% of those of at least one of the curves obtained in the type tests. If the peaks lie outside this range, the dampers are considered acceptable only if they pass the damper efficiency type tests. These curves must be added to those of the mechanical impedance type test to provide evaluation curves for comparison.

10 Suspension clamps

10.1 Technical requirements

Items SC1 and SC2 in Annexure 1 must be constructed from aluminium alloy body suitable for aluminium alloy and ACSR conductors. Item SC3 in Annexure 1 must be constructed from galvanised cast iron body suitable for SC/GZ and copper conductors.

All items must utilise clevis assemblies with unthreaded M16 clevis pins secured by humpback split pins.

All hardware such as clevis pins, clamp U-bolts, nuts and washers must be galvanised in accordance with AS/NZS 4680. Humpback split pins must be grade 316 stainless steel in accordance with AS 1154.1, Figure 8.23.

Clamps must be suitable for installation and removal using live line techniques. Suspension clamps must be constructed such that the nuts of the bolted section must be held captive in the body.

Table 14 below details the Minimum Failing Load (MFL) of the clamps and the conductor size they must be suitable for.

Table 14: Clamps for Aluminium alloy, ACSR and SC/GZ conductors

Item No.	Item description	MFL (kN)
1	Clamp 21-27 mm Trunnion Al Suspension	64
2	Clamp 27-36 mm Trunnion Al Suspension	44
3	Clamp 6-16 mm Suspension Offset MCI	24

10.1.1 Marking

In addition to the general marking requirements detailed in clause 4.1.3 of this specification, the following must be permanently marked on the fittings:

- The minimum and maximum conductor diameters.

10.2 Testing requirements

10.2.1 Type test

Type tests must be carried out on all suspension clamps in accordance with this clause, which is based on the requirements Clause 5 of AS 1154.1, prior to acceptance.

The type tests required to be submitted with the offer are:

Table 15: Type test for Suspension clamps

Type test	Reference test	Pass Criteria
Holding tension (withstand slip) test	AS 1154.1 Clause 5.3.1	During the 1 min period in which the tensile force is held at the nominated holding tension (15% of the MCBL of the conductor or 3.5kN whichever is lower), there must be no movement of the conductor relative to the fitting due to slip and no failure of the fitting.
Failing load test	AS 1154.1 Clause 5.3.2	The failing load must not be less than the specified MFL in Table 14 and failure must be of a ductile nature.
Clamp bolt tightening test	AS 1154.1 Clause 5.4	For torque value of 1.1 times the installation torque of the bolts and nuts of the clamps, there must be no damage to all clamp components and the conductor inside the clamp. For torque value of 2 times the installation torque or maximum torque (recommended by the bolt supplier), there must be no breakage to either the threaded parts or to the components connected to them.

10.3 Routine and batch test

The following routine and batch tests must be conducted:

Table 16: Routine and batch test for Suspension clamps

Test	Reference test	Pass Criteria
Tensile test – Routine test	AS 1154.1 Clause 5.5	There must be no breakage, cracking or distortion that can be seen by normal or corrected vision without the aid of magnification or measurement.
Verification of dimensions – Batch test	AS 1154.1 Clause 5.6.1	The dimensions must be in accordance with relevant drawings within the original design limits (including any specified tolerances)
Failing load test – Batch test	AS 1154.1 Clause 5.3.2	The failing load must not be less than the specified MFL in Table 14 and failure must be of a ductile nature.
Galvanising tests – Batch test	AS 1154.1 Clause 5.6.3	All ferrous metal parts, must be protected by hot-dip galvanizing in accordance with AS/NZS 4680, except that no individual damaged or uncoated area will exceed 10mm ² , and in accordance with AS 1214 for threaded fasteners.

11 Packaging

The items will be packed at the manufacturer's works and delivered to nominated stores in packages of adequate strength to protect the items during transport and handling. The method adopted must provide corrosion protection of the items in transit and storage. The following information must be legibly and permanently marked on the packing:

- Manufacturer's name, part number, batch number, corresponding Endeavour Energy catalogue number and Purchase Order number;
- The number of items contained in the package;
- Description of contents and gross mass; and,
- Handling or lifting instructions where applicable.

The number of units in each package must be constant for the life of the contract, unless agreed in writing by both parties.

12 Reliability

Suppliers are required to comment on the reliability and performance of the items supplied for a service life of 50 years, under the specified system and environmental conditions.

Such comments must include evidence in support of the reliability and performance claimed, including information on Failure Mode and Effect Analysis. Where items supplied have been found to be defective or fail under normal service conditions within the last 24 months, the supplier may be requested to provide documented evidence that demonstrates changes have been implemented that have rectified the problem(s).

13 Service History

Suppliers must state:

- The period of service of items supplied under this specification within the Australian environmental conditions.
- Australian Electricity Authorities who have a service history of the types of items supplied.
- Contact names and telephone numbers of relevant employees of those supply authorities who can verify the service performance claimed.

14 Quality Assurance

The supplier and/or manufacturer must provide with the offer a certificate of Quality Management System in accordance with AS/NZS ISO 9001 or similar and an Environmental Management System in accordance with AS/NZS ISO 14001 or similar.

15 Training material

Training material in the form of drawings, instructions and/or audio visuals may be required to be provided for the items accepted.

Suppliers must state the availability of training materials which should include but is not limited to the following topics:

- Application (particularly in areas of heavy coastal pollution)
- Installation
- Maintenance
- Mechanical performance

16 Environmental considerations

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

17 Variations over time

Any variation to the design, materials or manufacturing processes associated with the items must be communicated to Endeavour Energy in writing at least three months before any planned change. Endeavour Energy reserves the right to refuse any change without prejudice to any existing right or remedy. Any variation accepted by the purchaser must be conditional upon the Supplier providing suitable test results and documentation that is deemed acceptable.

18 Safety Data Sheet (SDS)

A Safety Data Sheet (SDS) for each material used in the manufacture of items must be provided with the offer.

19 Responsibilities

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

- Approving major changes to this specification in accordance with Table 4 of GAM 0001;
- Making all decisions concerning compliance with this standard delegating any of these authorities and responsibilities to the Head of Asset Management & Digital.

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

- Approving minor changes to this standard in accordance with Table 4 of GAM 0001;
- Making recommendations to the General Manager Future Grid & Asset Management for major changes in respect to this specification.

Engineering Delivery Manager has the authority and responsibility for:

- Periodic review of and any required amendments to this specification;
- Managing dispensation requests for variations to requirements of this specification; and
- Approval of equipment and materials of this specification.

The **manufacturers/suppliers** will be responsible for:

- Creating awareness of their responsibilities under this document.
- determining that the contractor/s under their control have provided suitable training for their staff.
- implementing an effective quality auditing system.
- implementing this document and keeping the **Portfolio Manager** of Endeavour Energy informed of any factors that may prevent them from accepting responsibility for its full implementation.

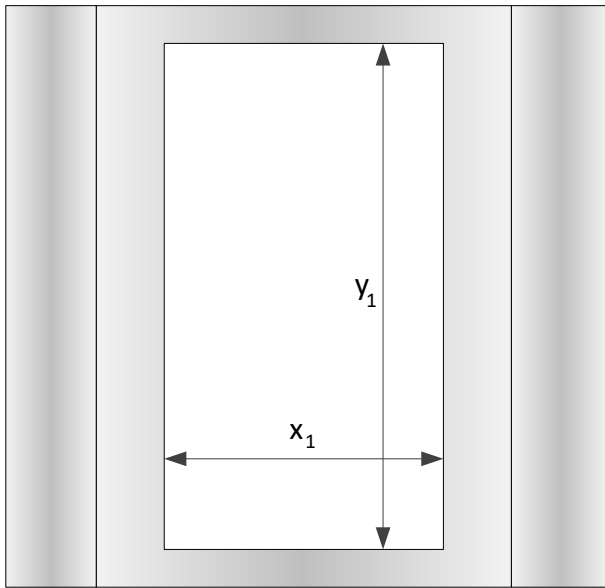
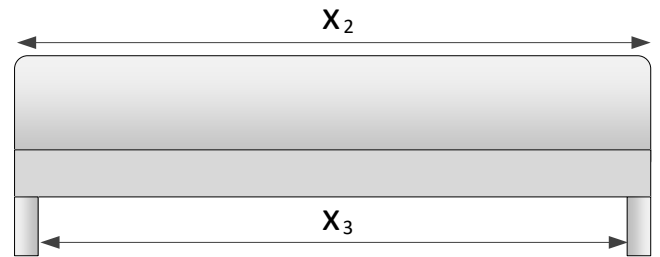
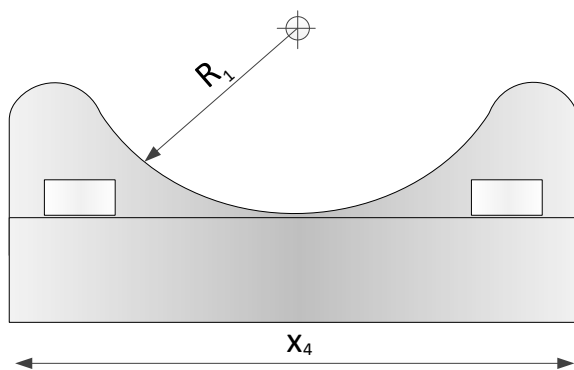
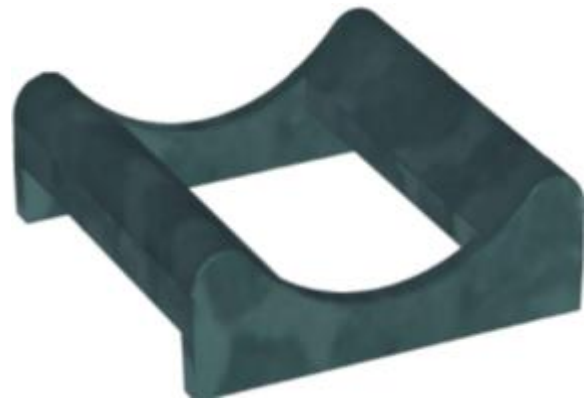
Annexure 1 – Material codes

Item	Description	Material code
GAIN BLOCKS		
GB1	Gain block-Aluminium-100mm	1000000469
GB2	Gain block-Aluminium-125mm	1000001859
GB3	Gain block-Aluminium-150mm	1000001874
GB4	Gain block-Aluminium-100mm (for concrete poles)	1000007431
HELICAL FITTINGS – Dead Ends		
DE1	Deadend for 7/2.25 AAC AAAC	1000007614
DE2	Deadend for 7/3.00 AAC AAAC	1000000836
DE3	Deadend for 7/3.40 AAC AAAC	1000007623
DE4	Deadend for 7/4.50 AAC AAAC	1000007622
DE5	Deadend for 7/4.75 AAC AAAC	1000007616
DE6	Deadend for 19/3.25 AAC AAAC	1000007621
DE7	Deadend for 7/5.00 AAAC compacted 7% to 14mm diameter for 50mm ² HVABC catenary	1000007619
DE8	Deadend for 19/3.75 AAAC compacted 7% to 17.5mm diameter for 150mm ² HVABC catenary	1000007615
DE9	Deadend for 6/1/3.00 ACSR/GZ Apple and 4/3/3.00 Sultana	1000007631
DE10	Deadend for 6/4.75+7/1.60 ACSR/GZ Cherry	1000000839
DE11	Deadend for 3/4/1.75 ACSR/GZ Quince	1000000841
DE12	Deadend for 6/1/2.5 + 3/4/2.50 ACSR/GZ Raisin	1000000843
DE13	Deadend for 4/3/3.75 ACSR/GZ Walnut	1000006483
DE14	Deadend for 7/2.75 SC/GZ Steel conductor	1000000496
DE15	Deadend for 7/3.25 SC/GZ Steel conductor	1000000497
DE16	Deadend for 7/4.00 SC/GZ Steel conductor	1000007620
DE17	Deadend for 19/2.75 SC/GZ Steel conductor	1000000498
DE18	Deadend for 7/1.63 HDCu Copper conductor	1000000303
DE19	Deadend for 7/1.75 HDCu Copper conductor	1000006480
DE20	Deadend for 7/2.00 HDCu Copper conductor	1000000304
DE21	Deadend for 7/2.75 HDCu Copper conductor	1000000305
DE22	Deadend for 19/2.00 HDCu Copper conductor	1000000306
HELICAL FITTINGS – Armour Rods		
AR1	Armour rod for 7/2.50 AAC AAAC & 6/1/2.50 ACSR/GZ Almond	1000000847

Item	Description	Material code
AR2	Armour rod for 7/3.00 AAC AAAC & 6/1/3.00 ACSR/GZ Apple	1000000848
AR3	Armour rod for 7/3.75 AAC AAAC & 6/1/3.75 ACSR/GZ Banana	1000000850
AR4	Armour rod for 7/4.50 AAC AAAC	1000000845
AR5	Armour rod for 19/3.25 AAC AAAC	1000008009
AR6	Armour rod for 19/3.75 AAC AAAC	1000000844
AR7	Armour rod for 6/4.75+7/1.60 ACSR/GZ Cherry	1000000849
HELICAL FITTINGS – Stay lock		
SL1	Stay locks for 19/2.00 w/o lashing rod SC/GZ Steel conductor	1000000500
HELICAL FITTINGS - Full-tension splice		
FS1	Full tension splice for 7/4.00 SC/GZ Steel conductor	100008079
FS2	Full tension splice for 19/3.25 (16mm diameter) SC/GZ Steel conductor	1000008112
HELICAL FITTINGS – Ties		
IT1	Top ties for 76mm insulator neck for 7/3.00 AAC AAAC & 6/1/3.00 + 4/3/3.00 ACSR/GZ Apple + Sultana	1000008245
IT2	Top ties for 76mm insulator neck for 6/4.75+7/1.60 ACSR/GZ Cherry	1000008234
IT3	Top ties for 76mm insulator neck for 18.3 – 23.3mm	1000008932
IT4	Side ties for 73mm neck for 80 CCT	1000001823
IT5	Side ties for 73mm neck for 120 CCT	1000001824
IT6	Side ties for 73mm neck for 180 CCT	1000001825
HELICAL FITTINGS – Vibration Damper		
VD1	Vibration damper for 7/2.50 Spiral AAAC	1000007644
VD2	Vibration damper for 7/4.50 Spiral AAAC	1000000860
VD3	Vibration damper Spiral OPGW 11.44mm	1000005519
VD4	Vibration damper Spiral 8.30mm to 11.72mm	1000000859
VD5	Vibration damper Spiral 14.32mm – 19.30mm	1000007643
HELICAL FITTINGS – Anti-birdcaging device		
ABR1	Anti-birdcaging bundle restraint (pair) for 50mm ² NMSHVABC	1000007637
ABR2	Anti-birdcaging bundle restraint (pair) for 150mm ² NMSHVABC	1000007635
Insulator Fittings		
IF1	Ball clevis, 160kN, Forged Steel	1000007448
IF2	Ball clevis, 70kN, Forged Steel	1000007445
IF3	Ball tongue, 70kN, Forged Steel	1000006019
IF4	Clevis thimble, 70kN, Alum, Hex	1000000865

Item	Description	Material code
IF5	Clevis thimble, 70kN, Alum, Hex 19/4.75	1000002408
IF6	Clevis thimble, 70kN, Forged Steel, Hex	1000000415
IF7	Clevis tongue, 120kN, MCI	1000008237
IF8	Socket clevis, 160kN, Forged Steel, R clip	1000001043
IF9	Socket clevis, 70kN, Forged Steel, W clip	1000002012
IF10	Socket tongue, 70kN, Forged Steel, 16mm hole, W clip	1000001044
Non-Tension Fittings – PG Clamps		
PG1	PG clamp, 11.0-14.5mm Al, 11.0-14.5mm Al, 2xM12 SS	1000000868
PG2	PG clamp, 12.5-20.0mm Al, 10.0-18.0mm Cu	1000000985
PG3	PG clamp, 16.3-33.8mm Al, 16.3-33.8mmAl, 3xM12 SS	1000007553
PG4	PG Clamp, 5.10 -11.3mm Al, 5.10 -11.3mm Al 1xM10	1000007518
PG5	PG clamp, 5.0-10.5mm Al,3.0-9.0mm Cu	1000005528
PG6	PG clamp, 6.0-16.5mm Al, 3.75-12.5mm Cu	1000005529
PG7	PG Clamp, 6 – 70mm Cu. 2xM10 6 – 70mm	1000006802
PG8	PG Clamp 16 -150mm Cu. 2xM10	1000010341
Non-Tension Fittings – Split bolts		
SB1	Split bolt, Natural, 16mm ²	1000000250
SB2	Split bolt, Natural, 35mm ²	1000000251
SB3	Split bolt, Natural, 70mm ²	1000000252
SB4	Split bolt, Natural, 95mm ²	1000000253
SB5	Split bolt, Natural, 185mm ²	1000000254
Protective Fittings		
PF1	Damper 19/3.75 Neon and 19/3.75 Pluto	TBA
PF2	Damper 37/3.75 Phosphorus and 30/7/3.50 Lime	TBA
PF3	Damper 30/7/2.50 Grape	TBA
PF4	Damper 19/4.75 Taurus and 19/4.75 Oxygen	TBA
Suspension Clamps		
SC1	Clamp 21-27 mm Trunnion Al Suspension	1000007482
SC2	Clamp 27-36 mm Trunnion Al Suspension	1000007579
SC3	Clamp 6-16 mm Suspension Offset MCI	1000000416

* TBA – to be advised

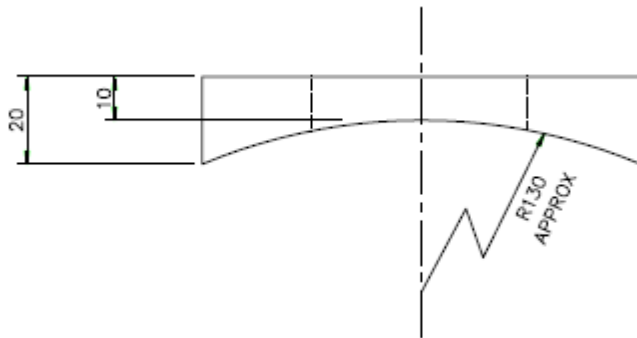
Annexure 2 – Gain Block Dimensions and Drawings**Top View****Side View****Front View****Isometric View**

Dimension	Timber Pole Gain Block Size		
	100mm	125mm	150mm
X_1	75	75	75
Y_1	103	128	156
X_2	122	146	178
X_3	105	128	156
X_4	150	150	150
R_1	80	80	70

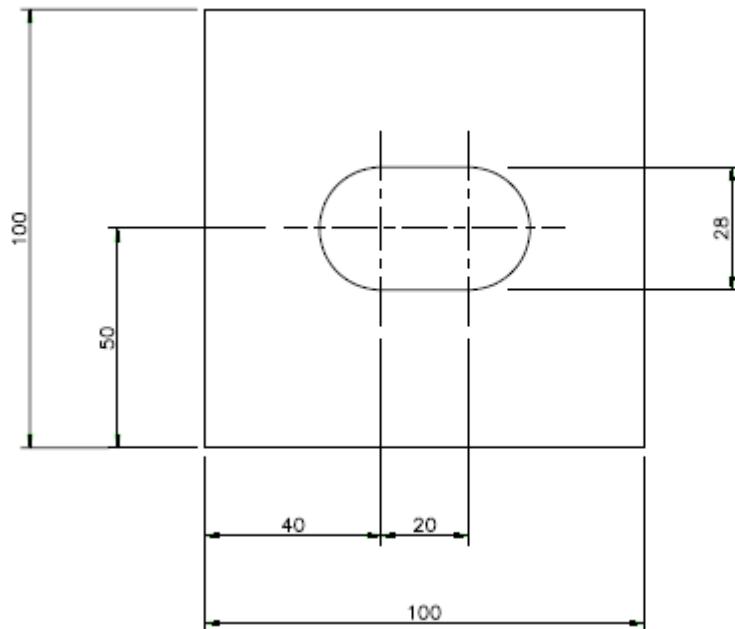
Note:

1. All dimensions in mm.
2. Tolerance for dimensions up to 30mm is ± 1.5 mm.
3. Tolerance for dimensions over 30mm is $\pm 5\%$ with a maximum of 5mm

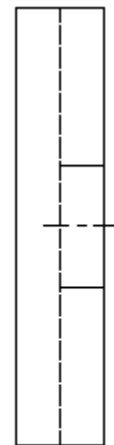
100 MM GAIN BLOCK FOR CONCRETE POLES



FRONT VIEW



TOP VIEW



SIDE VIEW

Note:

1. All dimensions in mm.
2. Tolerance for dimensions up to 30mm is ± 1.5 mm.
3. Tolerance for dimensions over 30mm is $\pm 5\%$ with a maximum of 5mm.

