

Equipment Technical Specification

Cable clamps

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EQUIPMENT TECHNICAL SPECIFICATION

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ETS 0086 Cable clamps

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1.0 PURPOSE

To specify the requirements and tests for cable clamps used on the distribution and transmission networks within the Endeavour Energy franchise area.

2.0 SCOPE

All cable clamps used to provide axial, lateral retention of cable(s) or provide support due to electromechanical forces, in electrical installations including padmount substations, indoor substations, switching stations, zone / transmission substations and cable support stands shall comply with the requirements of this specification.

3.0 REFERENCES

- ENA National Electricity Network Safety Code (Doc 001-2008)
- Endeavour Energy Network Management Plan 2011-2013
- IEC 61914:2009 – Cable cleats for electrical installations
- AS/NZS 60695: Part 11:5. 2005 – Fire hazard testing
- FAE 3026 Product approval and audit form

4.0 DEFINITIONS

Axial retention	Prevent vertical movement of the cable
Lateral retention	Prevent sideways movement of the cable
Electromechanical forces	Movement of the cable caused during fault conditions
NATA	National Association of Testing Authorities, Australia
KEMA	Netherlands Electrotechnical Materials - The global certification authority

5.0 ACTIONS

All cable clamps supplied to Endeavour Energy shall be designed and constructed in accordance with the requirements of this specification, which is based on the technical requirements of IEC 61914.

When assembled and installed, according to the manufacturer's instructions the cable clamps shall be suitable for use in all intended applications and provide reliable, mechanical retention of cables (under normal and fault conditions) without causing damage to the cable.

5.1 General construction and mechanical property requirements

All clamps shall fully encompass the cable and provide equal support on all sides.

Single sided cable saddles are not considered as an acceptable support under this specification.

The force exerted by a power cable under fault conditions can be determined from the cable design voltage; the cable mass per metre; and the expected peak fault current of the respective cable. These values can then be utilized to determine the cable clamp type and hence the minimum required spacing, both horizontally and vertically to ensure the cables are restrained at all times particularly during fault conditions.

For the calculation of mechanical forces between conductors caused by short-circuits, refer to Annex B IEC: 61914.2009.

The surfaces of clamps shall be free from sharp edges or burrs that are likely to damage cables or inflict injury to the installer or user.

All clamps covered by the scope of this document shall have the following properties:

- Clamps shall be manufactured from non-ferrous material such as aluminium or plastic (refer to clause 4.3.3);
- They shall be strong enough to support the cable and capable of withstanding lateral, axial and/or electromechanical loads and forces without breaking or twisting under maximum fault conditions and during everyday use;
- They shall be selected to match the size of cable being supported without crushing the cable or allowing the cable to slip;
- The clamp shall fully encompass the cable and support the cable in all directions;
- Provide uniform retention without crush, abrasive or incision damage to multi-core or single core cables installed individually in flat formation or in a trefoil formation, horizontally or vertically.

5.1.1 Installation methods

Generally Endeavour Energy installations require the clamp to be secured directly to unistrut channel in indoor applications. All clamps are required to meet each of the configurations illustrated in Annexures 2 and 3 of this document.

Alternative mounting methods (i.e. to poles) will also be considered.

5.2 Classification

IEC 61914, clause 6 – classifies the cable cleats (clamps). The table below illustrates Endeavour Energy's requirements in each category.

Area of classification	Classes		
Clause 6.1 – Material	Non-Ferrous Metallic	Non-metallic	Composite
Clause 6.2 – Temperature range	All clamps offered must withstand the permanent application temperature of (0°C – 110°C)		
Clause 6.3 – Resistance to impact	Very Heavy		
Clause 6.4 – Type of retention	With lateral retention	With axial retention	
	Withstanding more than one short circuit		
Clause 6.5.1 – Resistance to UV light (non-metallic or composite)	Resistant to ultraviolet light		
Clause 6.5.2 – Corrosion Resistance (metallic and composite)	High		

Table 1 – Clamps Classification

5.3 Marking and documentation

5.3.1 Marking

Each clamp shall be clearly marked with;

- The manufacturers name, trademark or logo;
- The manufacturers part number;
- Date of manufacture or batch number – *for composite or non-metallic clamps only*;
- The RMS fault level which the clamp can withstand;
- The suitable cable type and/or size range.

Where it is not possible to apply the marking directly onto the product, the product shall be individually packaged. All marking shall be clearly legible on the supplied package.

5.3.2 Documentation

The manufacturer or vendor shall also provide:

- The classifications of the clamp according to 5.2;
- The maximum and minimum cable or bundle diameters;
- The declared lateral load for the clamps;
- The declared axial load for the clamps;
- The maximum allowable spacing between clamps
- The method of assembly and installation including maximum / minimum tightening torques.

All documentation submitted (including reports, tests, testing procedures/policies, calibration certificates and the like) written in any language other than English shall not be accepted by Endeavour Energy unless the reports are translated into English by a sworn translator.

5.3.3 Inductive heating

Cable clamps made from ferromagnetic materials (e.g. cast iron, mild steel) are susceptible to heating from eddy currents, therefore will not be accepted.

5.3.4 Required to suit cable diameters

Typical cable parameters including outer diameter, weight and maximum fault current levels are provided in Annexure 1 of this document for all common Endeavour Energy cables.

5.4 Testing

The type tests shall be carried out in accordance with the required test method procedures, (detailed in Table 2) as set out in IEC 61914:2009 prior to approval being granted for use within Endeavor Energy's network.

Tests shall be carried out on a minimum of three new samples, assembled and installed as for normal use according to the manufacturer's instructions at an ambient temperature of $35\pm 5^{\circ}\text{C}$.

Type tests shall be less than five (5) years old. Type tests beyond this limit may be acceptable at the discretion of Endeavour Energy's Overhead & Underground Mains Manager if sufficient information can be provided to show that the manufacturing process, raw materials, design and quality control processes have not significantly changed since the original test date.

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

- By NATA Australia; or,
- By an accreditation authority recognized by NATA Australia.

Tests from other testing authorities, such as KEMA, may be accepted at the discretion of the Overhead & Underground Mains Manager. Tests other than the short circuit tests may be conducted at the manufacturing facility on the condition that sufficient evidence to demonstrate the capability to perform the tests as specified is provided to Endeavour Energy's Overhead & Underground Mains Manager.

All test reports shall be submitted with a completed form FAE 3026 (for each clamp size) to Endeavour Energy's Overhead & Underground Mains Manager for review/approval.

Test reference	Test name	Test description/criteria									
IEC 61914 Clause 9.2	Impact test	The impact is applied to the test sample which has been fixed using the test arrangement, (as illustrated in <i>figure 1</i> of IEC 61914:2009). <table><tr><td>Mass (kg)</td><td>Height (mm+/-1%)</td></tr><tr><td>5</td><td>400</td></tr></table> The test samples shall show no signs of disintegration or damage.	Mass (kg)	Height (mm+/-1%)	5	400					
Mass (kg)	Height (mm+/-1%)										
5	400										
IEC 61914 Clause 9.3	Lateral load test	The test load as declared by the manufacturer is applied in the most onerous direction of normal use, using the test rig, (as illustrated in <i>figure 2</i> of IEC 61914:2009). Movement of the cable or mandrel used shall be less than 50% of its diameter.									
IEC 61914 Clause 9.4	Axial load test	The test is carried out using a cable or mandrel with an overall diameter equivalent to the minimum declared diameter for which the clamp is designated. Displacement of the cable or mandrel with respect to the clamp shall not be more than 5mm.									
IEC 61914 Clauses 9.5.1 and 9.5.3	Resistance to electromechanical force	The short-circuit test is carried out on the test arrangement as illustrated in <i>figure 4</i> of IEC 61914:2009. A second short-circuit is applied within 5 minutes. The samples shall meet the requirements of the voltage withstand test without damage or failure of the cable insulation. <i>Annexure 1 details the fault levels that the samples must withstand.</i>									
AS/NZS 60695: Part 11:5. 2005	Flame propagation	The flame is applied to the sample for 30secs as detailed in IEC 60695:11:5. 30secs after the test flame is removed; there is no flaming of the sample.									
IEC 61914 Clause 11.1	Resistance to ultraviolet light (for non-metallic and composite clamps)	Samples shall be mounted separately in the ultraviolet light apparatus for the designated time period as detailed in IEC 61914:2009 Clause 11.1. After UV exposure, the samples shall show no signs of disintegration or visible damage.									
IEC 61914 Clauses 11.2.1 and 11.2.2	Resistance to corrosion (for metallic and composite clamps)	Samples shall be subjected to the salt spray test detailed in IEC 61914:2009 Clause 11.2.2 depending on their classification for a duration of: <table><tr><th>Classification</th><th>Typical usage</th><th>Duration</th></tr><tr><td>Low</td><td>Indoor, dry locations</td><td>24hrs.</td></tr><tr><td>High</td><td>Outdoor, wet locations</td><td>192hrs.</td></tr></table> After the test, the samples are dried for 10mins and shall show no visible signs of red rust, disintegration or damage.	Classification	Typical usage	Duration	Low	Indoor, dry locations	24hrs.	High	Outdoor, wet locations	192hrs.
Classification	Typical usage	Duration									
Low	Indoor, dry locations	24hrs.									
High	Outdoor, wet locations	192hrs.									

Table 2 – Type Tests

6.0 AUTHORITIES AND RESPONSIBILITIES

The **Chief Engineer** shall have the authority and the responsibility for:

- Approving technical specifications including any variations.
- Making all decisions concerning compliance in respect to this Specification.
- Nominating Endeavour Energy's representative(s) for either the manufacturing facility inspection and/or witness testing.
- Delegating any of these authorities and responsibilities to the Manager Network Engineering.

The **Manager Primary Systems** shall have the authority and responsibility for:

- Reviewing technical specifications and making recommendations to the Chief Engineer.
- Making recommendations concerning compliance in respect to this Specification.
- Making nominations of Endeavour Energy representatives.

The **Overhead & Underground Mains Manager** shall have the authority and responsibility for the acceptance and approval of all test reports submitted, as specified within this document and making recommendations to the Manager Network Engineering.

The **Manager Supply and Logistics, Program Directors and Project Managers** shall be responsible for ensuring that all cable clamps purchased by Endeavour Energy comply with the requirements of this instruction.

The **Contractor Operations Manager**, Network Connections Branch, shall be responsible for ensuring that all cable clamps installed by Level 1 Accredited Service Providers comply with the requirements of this instruction.

Regional Managers shall be responsible for ensuring that all cable clamps installed by regional Asset Management staff comply with the requirements of this instruction.

7.0 DOCUMENT CONTROL

Documentation content coordinator:	Overhead & Underground Mains Manager
Documentation process coordinator:	Branch Process Coordinator

8.0 Annexure 1: Typical Cable Details

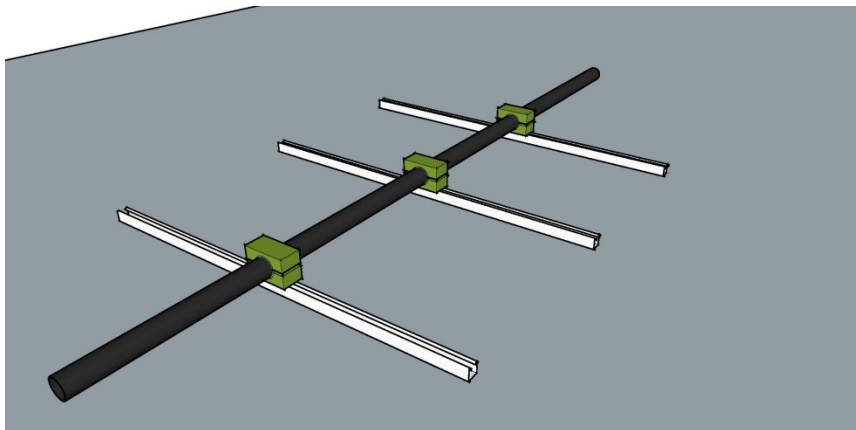
Voltage (kV)	# of cores	Conductor	Conductor size (mm ²)	Cable outer diameter (mm)	Cable mass/metre (kg)	RMS fault level (kA)	Peak fault level (kA)
LV	4	Al (sector)	240	55	9.6	N/A	N/A
11	1	Al	240	34	1.9	13.1	32.8
		Cu	240	37	3.5		
	3	Al	185	65	4.2		
		Al	240	71	5.3		
		Cu	240	74	10.1		
		Cu	300	80	12.2		
22	3	Al	240	81	6.3	13.1	32.8
		Cu	240	81	11.1		

Table 3 – Distribution Cable Sizes

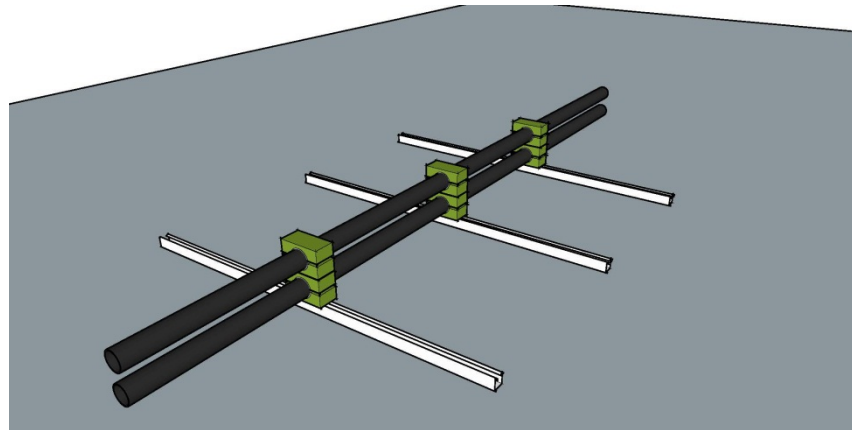
Voltage (kV)	# of cores	Conductor	Conductor size (mm ²)	Cable outer diameter (mm)	Cable mass/metre (kg)	RMS fault level (kA)	peak fault level (kA)
11	1	Cu	800	56	9.9	20	56
			1200	66	13.7		
22	1	Cu	630	55	8.2		
			800	60	10.2		
33	1	Cu	300	52	6.1	31.5	88.2
			630	64	9.4		
			800	68	11.4		
			1200	79	15.5		
66	1	Cu	630	69	10.1	40	112
132	1	Cu	400	79	9.7		
			630	86	12.3		
			800	91	14.5		
			1200	101	18.7		

Table 4 – Transmission Cable Sizes

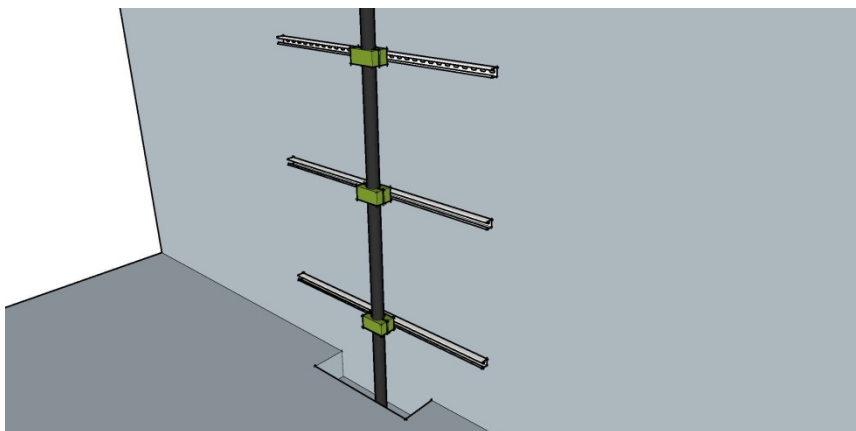
9.0 Annexure 2: Clamp Configurations – Distribution Cables



Horizontal Construction

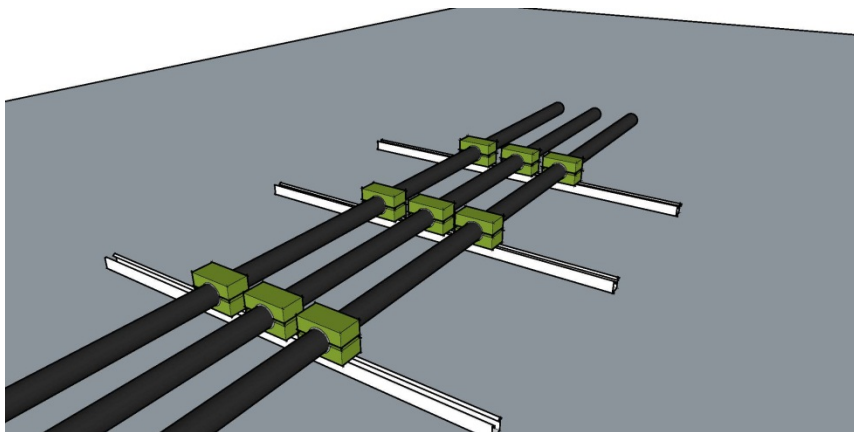


Horizontal Piggyback Construction

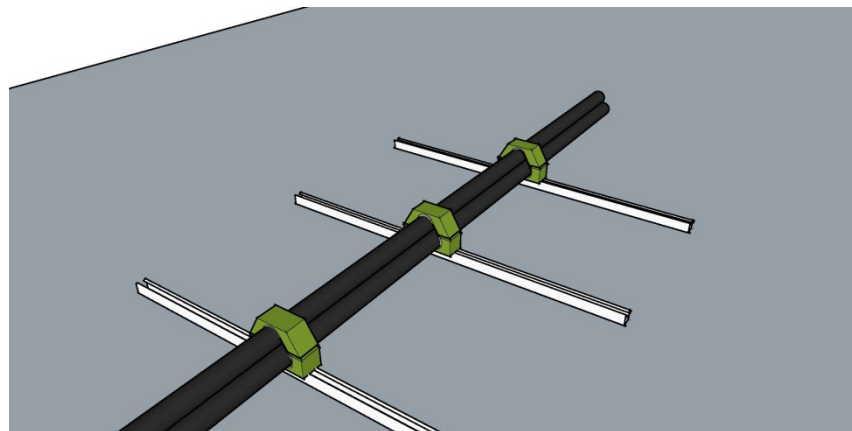


Vertical Construction

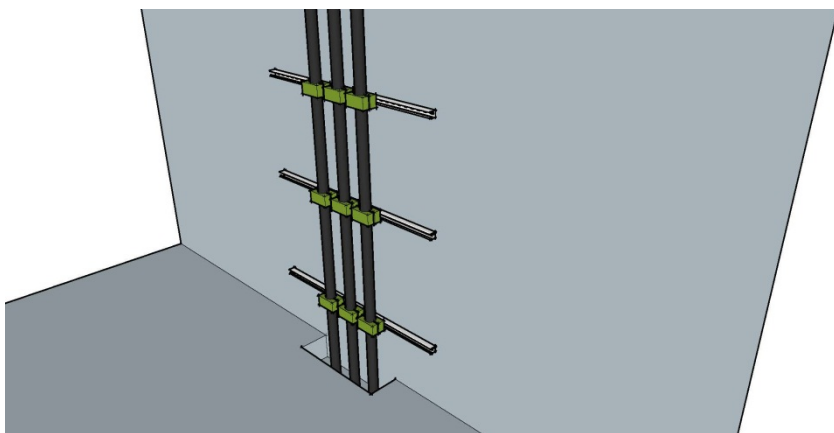
10.0 Annexure 3: Clamp Configurations – Transmission Cables



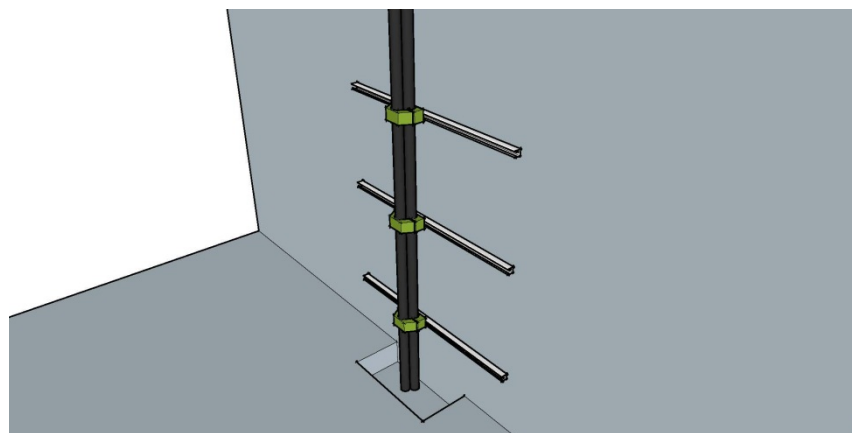
Horizontal Flat Construction



Horizontal Trefoil Construction



Vertical Flat Construction



Vertical Trefoil Construction