

Equipment Technical Specification

In-line service connectors for 100A overhead services

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EQUIPMENT TECHNICAL SPECIFICATION

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ETS 0050 In-line service connectors for 100A overhead services

Contents

1.0	PURPOSE.....	3
2.0	SCOPE.....	3
3.0	REFERENCES.....	3
4.0	DEFINITIONS AND ABBREVIATIONS.....	3
5.0	ACTIONS	3
5.1	In-line service connectors 6-35mm²	3
5.1.1	<i>General.....</i>	3
5.1.2	<i>Service main side</i>	4
5.1.3	<i>Consumer main side.....</i>	4
5.2	Testing requirements.....	4
5.2.1	<i>Type tests</i>	5
6.0	AUTHORITIES AND RESPONSIBILITIES.....	7
7.0	DOCUMENT CONTROL.....	7

1.0 PURPOSE

To specify the requirements for in-line connectors used to connect low voltage aerial bundled cable service mains to consumer mains at the point of attachment.

2.0 SCOPE

The connectors used at the point of attachment shall comply with AS/NZS 4396:1999 and the requirements of this specification.

This specification lists the requirements for in-line phase and neutral connectors for services up to and including 100A on each phase.

3.0 REFERENCES

- Company Policy 9.2.5 - Network Asset Design
- Company Policy 9.6.1 – Network Connections
- Network Management Plan December 2013 Review
- ENA National Electricity Network Safety Code (Doc 01-2008)
- *Work Health and Safety Act 2011*
- AS/NZS 4396:1999 - Connectors - Insulation Piercing - for 0.6/1kV aerial bundled cables – for working voltages up to and including 0.6/1kV

4.0 DEFINITIONS AND ABBREVIATIONS

ABC	Aerial bundled cable
A/F	Across the flats. This term is in reference to bolt diameter.
Consumer main	For the purpose of this document, the conductor on the customer side of the service connector. This term can be used to describe both phase and neutral conductors.
Contact plate	An element of the connector which incorporates piercing teeth and which carries current between the service main and consumer main.
IPC	Insulation piercing connector
Service main	For the purpose of this document, the conductor running between the Endeavour Energy network mains and the service connector. This term can be used to describe both phase and neutral conductors.

5.0 ACTIONS

5.1 In-line service connectors 6-35mm²

5.1.1 General

In-line service connectors shall have the following properties:

- The active phase/s shall clamp/pierce with single (1) shearhead tightening bolts on both service and consumer main. A second head shall be incorporated into the tightening bolt for undoing the connection.
- The neutral phase connector shall clamp/pierce with two (2) shearhead tightening bolts on both service and consumer main. Each bolt shall clamp/pierce independently of the others. A second head shall be incorporated into the tightening bolt for undoing the connection.
- All bolts shall have hexagonal heads with an A/F diameter of 13mm or 17mm.

- All shear head connectors shall have a high visibility coloured indicator of sufficient size and shape to be clearly visible from ground level to indicate whether or not the shear bolts have been fully tightened.
- Bolt heads shall be coloured (service mains side black and consumer mains side white / grey) to distinguish between service and consumer connections.
- Tightening bolt/s acting on the service main side shall act independently of the bolt/s acting on consumer main side.
- The two sides shall be clearly labelled to differentiate between the *service main* and *consumer main* sides.
- There shall be no ready access to live metal components during or after fitting an in-line connector. The connector shall be fully *touch safe* to 1kV in case of inadvertent contact.
- All electrical contacts shall be pre-greased.
- A manufacturer batch identifier or similar shall be included on the connector for the purpose of traceability.
- The connector shall incorporate a means of creating physical separation between the service main and consumer main, to avoid the two being in direct physical contact.
- Neutral two bolt connectors to provide some mechanism to allow for confirmation of correct insertion of cable after the shear bolt has operated.
- The connector shall be UV stabilised and weather and pollution resistant, including a sealing system for all cable sizes (including fully ribbed ABC).
- The contact plate shall be manufactured from, or be plated by, a material such that the interface to both aluminium and copper conductors has an anodic voltage difference of less than 0.35 V (in reference to the galvanic series of materials in seawater).

5.1.2 Service main side

- Shall accept aluminium or annealed copper cable in the range of 6mm² to 35mm².
- Connection shall be an IPC on insulated cable.
- Tightening bolt/s shall be made from a material so that no detrimental electrolytic reaction will occur when in contact with the aluminium / copper service conductor.

5.1.3 Consumer main side

- Shall accept annealed copper cable in the range of 4mm² to 35mm².
- Connection shall be a tunnel type clamp connector on stripped cable.
- The cable strip length shall be shown on the connector.
- Tightening bolt/s shall be made from a material so that no detrimental electrolytic reaction will occur when in contact with the copper consumer main.

5.2 Testing requirements

Type tests shall be carried out on all in-line connectors for 100A overhead services in accordance with this clause, which is based on the requirements of AS/NZS 4396:1999, prior to approval being granted for use within Endeavour Energy's network.

A copy of each of the tests shall be completed and submitted to Endeavour Energy's Network Mains Manager for review/approval.

All type tests (including a set of sample and routine 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, such as KEMA, may be accepted at the discretion of the Network Mains Manager.

All 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).

Tests shall be less than five (5) years old. Tests beyond this limit may be acceptable at the discretion of Endeavour Energy's Network 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 sample and routine tests may be conducted at the manufacturing facility's test laboratory on the condition that sufficient evidence is provided to Endeavour Energy's Network Mains Manager to demonstrate the testing facility's capability to perform the specified tests. As a minimum, the following information shall be provided:

- qualifications/experience of the testing employees;
- test procedures for all sample/routine tests;
- testing facility quality control procedures, and;
- test instrument calibration certificates/procedures.

As part of the product approval process, the Manager Primary Systems will specify in writing if Endeavour Energy accepts tests being conducted at the manufacturing facility's test laboratory.

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.

5.2.1 Type tests

Each of the test references below are from AS/NZS 4396:1999. The test criteria shall be in accordance with AS/NZS 4396: 1999. Additional requirements are set for the: resistance to overtorque test, and; resistance to weathering test. For these, the additional requirements are described below.

Test reference	Test name	Test description / criteria
Appendix B	Shearhead fracture torque test	Test report shall provide shearhead fracture torque in line with the requirements of Appendix B of AS/NZS 4396.
Cl 3.2 and Appendix C	Electrical heat cycle test	Connectors shall meet the requirements of Clause 3.2, and Appendix C of AS/NZS 4396.

Test reference	Test name	Test description / criteria
CI 3.3 and Appendix D	Water penetration test	No electrical breakdown or flashover during the HV test, and connectors must not contain any water.
CI 3.4 and Appendix E	Mechanical damage to conductors test	No severed strands on any of the cables removed from the connector.
CI 3.6 and Appendix G	Low temperature assembly test	Each tested IPC shall establish electrical continuity between the mains and service side of the connector.
CI 3.7 and Appendix H	Resistance to weathering test	Connectors shall not have any surface cracks exposing the interior of the connector. Additional requirement: relevant manufacturer and part numbers shall remain legible.
CI 3.8 and Appendix I	Resistance to overtorque test	No tightening threads shall be stripped; No mechanical failure of any IPC components, and; no splitting of any seals. Additional requirement: following over torque, each test assembly shall have consumer and service mains removed. The test report shall include photos of all contact points following removal of the conductors, and identify if and where there has been any breach of any coating material, exposing the underlying material
CI 3.9 and Appendix J	Attachment of shearheads	Shearheads shall not separate from the fasteners after being subject to a load of at least 100N for at least one minute.

6.0 AUTHORITIES AND RESPONSIBILITIES

The **Chief Engineer** has the authority and the responsibility for:

- approving technical specifications, including any variations;
- making all decisions concerning compliance in respect to this specification;
- approving nominations of Endeavour Energy representatives; and
- delegating any of these authorities and responsibilities to the Manager Primary Systems

The **Manager Primary Systems** has the authority and responsibility for:

- reviewing technical specifications and making recommendations to the Chief Engineer;
- making recommendations concerning compliance in respect of this specification;
- making nominations of Endeavour Energy representatives; and
- reviewing test reports submitted.

The **Manager Logistics** has the authority and responsibility that all in-line connectors purchased by Endeavour Energy comply with the requirements of this instruction.

The **Contractor Operations Manager, Network Connections Branch** has the authority and responsibility that all in-line connectors installed by Level 1 and Level 2 Accredited Service Providers comply with the requirements of this instruction.

Manufacturers/suppliers have the authority and responsibility:

- that they are aware of their responsibilities under this instruction;
- that the ASPs under their control have provided suitable training for their employees;
- that an effective quality auditing system is in place; and for
- implementing this instruction and keeping Endeavour Energy or other responsible equivalent officers informed of any factors that may prevent them from accepting responsibility for its full implementation.

7.0 DOCUMENT CONTROL

Documentation content coordinator: Network Mains Manager

Documentation process coordinator: Standards Process Coordinator