

Equipment Technical Specification

Electrical Conduit, Conduit Fittings, Cable Protection Covers and Marker Tape

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MAINS DESIGN INSTRUCTION

ASSETS STANDARDS AND DESIGN

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ETS 0063 ELECTRICAL CONDUIT, CONDUIT FITTINGS, CABLE PROTECTION COVERS AND MARKER TAPE

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1.0 PURPOSE

To specify the requirements for conduits and accessories for use on the Endeavour Energy electrical network.

2.0 SCOPE

This specification covers the design, engineering, manufacture, testing, supply and delivery of underground electrical conduits, fittings, polymeric cable protection covers and marker tape installed as part of Endeavour Energy's transmission and distribution network.

3.0 REFERENCES

Internal

Mains Construction Instruction MCI 0006 – Underground distribution construction standards manual

Mains Design Instruction MDI 0028 – Underground distribution network design
Annexure 1 – Endeavour Energy Stockcodes

External

ENA National Electricity Network Safety Code (Doc 001-2008)

ENA National Electricity Network Operator and Service Provider Safety Assurance Guidelines (NENS 02-2006)

AS 4702:2000 – Polymeric cable protection covers

AS 60529:2004 – Degrees of protection provided by enclosures (IP Code)

AS/NZS 1462.1:2006 – Methods of test for plastic pipes and fittings

AS/NZS 1477:2017 – PVC pipes and fittings for pressure applications

AS/NZS 2053.1:2001 – Conduits and fittings for electrical installations - General Requirements

AS/NZS 2053.2:2001 – Conduits and fittings for electrical installations - Rigid plain conduits and fittings of insulating material

AS/NZS 2648.1:1995 – Underground marking tape (Non-detectable tape)

AS/NZS 4275.1:1995 – Methods of testing underground marking tape

AS/NZS IEC 60754.2.2017 – Test on gases evolved during combustion

4.0 DEFINITIONS AND ABBREVIATIONS

Halogen free

Conduits and fittings which, on combustion, produce low levels of hydrogenhalide-acid gas emission.

HD

Heavy duty

Hockey stick

Extended arm right angle fitting (in the shape of a hockey stick) to allow entry of consumer mains into the service or mains pillars.

IP

Ingress Protection

LD

Light duty

Non-Hydroscopic

The conduit is unable to absorb and retain an appreciable quantity of moisture from the air.

Sandwich construction

Two layers of rigid PVC separated by a foam core or recycled PVC filler layer.

UPVC

Unplasticised polyvinyl chloride

5.0 ACTIONS

5.1 General Requirements

5.1.1 Colour

The conduit colour, base colour of the cable cover and background colour of marker tape must be Orange.

5.1.2 Environmental requirements

All organisations supplying and/or manufacturing conduits, conduit fittings, cable covers and marker tape in accordance with this specification must either be a signatory to the Vinyl Council of Australia's Product Stewardship Program or demonstrate that their processes address the environmental and health objectives associated with the production, use and disposal of PVC products in line with the programs objectives.

5.2 Testing requirements

Type tests must be carried out on all products in accordance with this clause, prior to approval being granted for installation.

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 the Mains Assets Manager

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 to the Mains Assets Manager for review 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.

5.2.1 Batch Tests / Quality Control

Manufacturers must submit documentation demonstrating the quality control processes (such as batch testing) in place that confirm the products manufactured achieve the minimum standards specified by, this specification, the Australian Standards, and, the products original type test. The documentation must address how the manufacturer's quality control processes prevent the shattering of UPVC products during the physical stresses likely to occur during both installation and normal working conditions.

6.0 CONDUITS, CONDUIT FITTINGS AND BENDS

All UPVC conduits must be designed and constructed in accordance with the requirements of this specification and all other relevant standards referenced within this specification to provide reliable and adequate mechanical protection of the cable which they enclose.

The design and construction of the conduits must be such that allows them to withstand the physical stresses likely to occur during both installation and normal working conditions. Conduits when bent, compressed, shocked or exposed to the limits of their specified temperature range according to their classification must not deform to an extent where the installation of cables becomes difficult or damage to the cables is likely to occur.

6.1 Material

Conduits must be constructed of UPVC insulating material and have no conductive components.

Composite or sandwich construction products using foam filler are acceptable providing all products offered are tested in accordance to Clause 5.2 and pass all tests detailed in Clause 6.4 of this specification.

6.2 Method of Connection

All conduits must be non-threadable and be provided with one end of the conduit formed in the shape of a socket. Fitted sockets will not be accepted as standard alternatives to a formed conduit.

6.3 Mechanical properties

All conduits must comply with the classification detailed in AS/NZS 2053.2 and must be graded accordingly as:

- HD (formerly known as Class 12); and,
- LD (formerly known as Class 6).

6.4 Resistance to flame propagation

All conduits and fittings must have adequate resistance to heat, must be classified as non-flame propagating and pass the type tests specified in AS/NZS 2053.1 and AS/NZS 2053.2.

6.5 Electrical characteristics

All conduits and fittings are to be non-conductive and have electrical insulating characteristics meeting the test requirements as specified in AS/NZS 2053.

All conduits and fittings are to be passive in respect to electromagnetic influences.

6.6 Protection against external influences

6.6.1 Protection against the ingress of water

Conduits are not required to be classified with an IP (Ingress Protection) Code, however must be classified as having high protection (on both the inside and outside of the conduit) against either corrosive or polluting substances (in accordance with AS/NZS 2053.2).

6.6.2 Protection against solar radiation

Conduits are to be classified as without protection against solar radiation. Manufacturers that can provide an UPVC conduit with improved solar radiation performance must provide details of how the improved performance is obtained and identify their products with the letter 'T', indicating protection against solar radiation (*conduits only*).

6.6.3 Protection against moisture

The conduits must be classified as non-hygroscopic. Acid-gas emission properties

Only non-halogen free conduit and fittings will be accepted.

6.7 Identification and Marking

Conduit labelling must be both durable and legible and the process must not cause notching of conduits or fittings. Markings must be inspected and durability confirmed by rubbing by hand.

All identification information will be printed in bold, black font, no less than 9mm in height and must be durable and legible before, during and after product installation.

The following information must be clearly and permanently marked repeatedly onto the conduits at regular intervals of approximately 1m:

- The name of the manufacturer or responsible vendor, or a trademark, or other identifying symbol;
- The nominal size of the conduit or the size(s) of conduit the fitting is intended for.
- The word 'ELECTRICAL' (*conduits only*);
- One of the following as appropriate:
 - 'LIGHT DUTY' or 'LD';
 - 'HEAVY DUTY' or 'HD';
- The minimum and maximum service temperatures as specified by the manufacturer, in degrees Celsius, in the form '0/60'. (*conduits only*).

In addition to the requirements of AS/NZS 2053, the following information must also be clearly and permanently marked onto the conduits:

- The letters 'UPVC';
- The conduits batch number;
- The date of manufacture, using the ISO system in the form 'YYMMDD'; and,
- The number of the Australian Standard(s) that it conforms to.

Conduit Example: TRADE NAME ELECTRICAL 125 UPVC LD 0/60 BATCH 120101
AS/NZS: 2053.

Fittings Example: TRADE NAME 125 UPVC LD BATCH 120101 AS/NZS: 2053.

6.8 Construction and tolerances

6.8.1 Defects

The inside and outside surfaces of conduits and fittings must be reasonably free from burrs, flashes and similar defects. Edges over which cables are likely to be drawn must not damage the cable.

6.8.2 Diameter and wall thickness

All conduits, bends and fittings formed from conduits must conform to the minimum and maximum diameters, wall thicknesses and socket requirements specified in Table 1, Table 3 and Table 4 .

For all conduits and fittings:

- The mean outside diameter and the minimum mean inside diameter of all conduits supplied under this specification must comply with the dimensions set out in Table 1a and Table 1b when measured in accordance with AS/NZS 1462.1.
- The wall thickness at any given point of the entire item must not be less than that specified in Table 1a and Table 1b for the corresponding size and classification of conduit;
- The socket length and diameter must not be less than that specified in Table 3 for the corresponding size and classification of fitting; and,
- The minimum wall thickness must not be compromised during the manufacture or use of all conduit bends.

Table 1a - Conduit diameter and wall thickness.

Nominal size (mm)	<u>Outside</u> Diameter				Wall Thickness (mm)			
	Mean diameter		Including ovality		Light Duty		Heavy Duty	
	min	max	min	max	min	max	min	max
40	39.7	40.0	39.6	40.1	-	-	3.1	3.4
50	49.7	50.0	49.6	50.1	-	-	3.4	3.9
63	62.7	63.0	62.5	63.1	-	-	3.9	4.5

Table 1b - Conduit diameter and wall thickness

Nominal size (mm)	Approximate <u>Internal</u> Diameter				Wall Thickness (mm)			
	Mean diameter		Including ovality		Light Duty		Heavy Duty	
	min	max	min	max	min	max	min	max
100	114.1	114.5	113.7	114.9	-	-	5.9	6.7
125	140.0	140.4	139.5	140.9	3.7	4.3	7.2	8.1
150	160.0	160.5	159.5	161.1	4.2	4.8	8.3	9.3
200	225.0	225.6	224.2	226.4	-	-	10.5	11.7

Nominal sizes of conduits 32mm to 63mm refer to the external diameters, whereas sizes of conduits 65mm to 200mm refer to the approximate internal diameter.

6.8.3 Squareness of ends

Conduit ends must be square within 2 degrees, and free from chips and from rough edges which may injure the installer or cause damage to cables.

6.8.4 Concentricity of sockets / fittings

The inside diameter of all formed sockets must be concentric with the outside diameter of the conduit to within 2.5% of the nominal diameter. Additionally, the socket axis must be parallel to the conduit axis within ± 2 degrees.

6.8.5 Length

The length of each conduit (excluding the formed socket) must be within the following tolerances:

- Conduits supplied in 3, 4 or 4.6 metre lengths must be within +20mm, -0mm of their nominal length;
- Conduits supplied in 6 metre lengths must be within +50mm, -0mm of their nominal length.

6.8.6 Mechanical properties

All rigid conduits must pass bending, compression and impact tests (as detailed in clause 6.4) before acceptance for use in the Endeavour Energy electrical system. All rigid conduits must not have a deflection greater than 10mm within 450mm of either end.

6.9 Conduit bends and fittings

Conduit bends, bellmouths, couplings and sockets are to be factory formed from cut lengths of straight conduit and marked according to the requirements detailed in clause 6.2.

6.9.1 Bends

All bends must be HD construction and have the dimensions that are specified in Table 2.

All bends up to 150mm diameter must have female sockets at both ends.

Bends with a diameter greater than 150mm are permitted to only have a female socket at one end.

Table 2 - Conduit bend dimensions

Nominal size (mm)	Centre Line Radii (mm)			Min Length (mm)		
	22.5°	45°	90°	22.5°	45°	90°
40	-	200 - 300	300 - 600	-		610
40 service hockey stick	-	-	300 - 400	-		800 x 800
50	-	300 - 600	300 - 600	-	356	635
100	-	450 - 600	450 - 600	-	710	1067
100	-	1200 - 2000	1200 - 2000	-	1450	2215
125	500 - 650	500 - 650	500 - 650	1093	860	3210
125	1000 - 1250	1000 - 1250	1200 - 2000	860	1320	
125	-	1800 - 2000		-	1820	
150	-	600 - 2000	600 - 2000	-	-	2385
200	-	2000 - 2400	2000 - 2400	-	2590	3850
200	-	2400 - 3000	2400 - 3000	-	3000	4500

6.9.2 Couplings and sockets

Each length of circular, rigid conduit must have at least one end formed (belled) or fitted with a socket, coupling or another suitable connecting facility to enable use of a spigot and socket joint. Socket and fittings must have concentric internal and external surfaces and be within 2.5% of the nominal diameter. The socket axis must be parallel to the conduit axis within ± 2 degrees.

The sockets of all conduits and fittings must meet the dimensions given in Table 3 and Table 4.

Table 3 - Conduit and fittings socket root diameter requirements

Nominal size (mm)	Minimum effective socket length	Socket <u>root</u> diameter (mm)			
		Mean diameter		Including ovality	
		min	max	min	max
32	25	31.4	31.7	31.2	31.9
40	32	39.4	39.7	39.2	39.9
50	40	49.4	49.7	49.2	49.9
63	50	62.4	62.7	62.2	62.9
100	99	113.5	113.8	113.3	114.0
125	115	139.4	139.7	139.1	139.9
150	124	159.4	159.7	159.1	160.0
200	147	224.3	224.7	-	-

Table 4 - Conduit and fittings socket mouth diameter requirements

Nominal size (mm)	Minimum effective socket length	Socket <u>mouth</u> diameter (mm)			
		Mean diameter		Including ovality	
		min	max	min	max
32	25	32.1	32.4	31.9	32.6
40	32	40.1	40.4	39.9	40.6
50	40	50.1	50.4	49.9	50.6
63	50	63.1	63.4	62.9	63.6
100	99	114.8	115.1	114.6	115.3
125	115	140.8	141.1	140.5	141.3
150	124	160.8	161.1	160.5	161.4
200	147	225.9	226.3	-	-

6.10 Type Tests

6.10.1 Conduits

A complete type test report in accordance with Table 5 must be completed on a 150mm LD conduit. The complete type test report must address all of the requirements and tests specified in the above-mentioned Standards.

For all remaining conduits being offered specific type tests must be completed for each diameter and classification (i.e. LD, HD) of conduit, for example 125mm LD and 125mm HD. The specific type tests are Mechanical Tests (compression test, impact test, pull-out test) and Electrical Characteristics. The vendor must also demonstrate that all conduits that are being offered have been made from the same material composition and have been marked using the same technique as those that appear in the complete type test report mentioned above.

6.10.2 Conduits bends

For each conduit bend being offered, the vendor must:

- Submit a test report as detailed in 6.4.1;
- Submit an additional post bending impact test in accordance with Clause 9.4 of AS/NZS 2053.1.
- Demonstrate that all conduit bends that are being offered have been made from the same material composition and have been marked using the same technique as the conduit that appears in the complete type test report mentioned above.

Table 5 – Conduit Type Tests

Test Reference	Test Name	Outline of test method	Acceptance criteria
AS/NZS 2053.1:2001 Appendix A.	Compression test (medium for LD items and heavy for HD items)	Measure and record the outside diameter of a test sample. Condition the sample. Apply the 1.25kN compression force according to Table A1 of appendix A. Remove the applied force and measure results.	The difference between the initial outside diameter and the after test measured diameter does not exceed 10% and the values specified in table 101, AS/NZS 2053.2:2001.
AS/NZS 2053.1:2001 Appendix B	Impact test (very heavy)	Prepare test piece and chamber. Set the 6.8 kg weight of the hammer and the 300mm fall height in accordance with Table 3 from AS/NZS 2053.1:2001, and then let the hammer fall on the test piece.	There will be no sign of disintegration or cracks in at least nine (9) of the twelve (12) test pieces.
AS/NZS 2053.1:2001 Appendix D	Pull out strength test	Apply and maintain a force of 1.6 +/-2 N vertically downwards upon the joined section of conduit in addition to the mass of the conduit. Maintain the force for 5 min.	The conduits have not separated or pulled out of the fittings and the fittings or the conduits have not fractured.
AS/NZS 2053.1:2001 Appendix E	Ignitability and flame propagation test	<i>Conduit:</i> A sample length of conduit is mounted vertically in a draft free chamber. <i>Fittings:</i> The test piece is suspended vertically in a draft free chamber. A flame is applied to the samples for the specified period, removed and the samples are assessed.	The samples have not ignited by the test flame and/or are not still burning 30 seconds after removal of the flame.
AS/NZS 2053.1:2001 Appendix F	Electrical continuity test	The test is performed on an assembly of conduits and fittings as shown in <i>figure F1</i> . Voltage is applied, voltage drop measured and results recorded.	The test assembly has a resistance of less than 0.05Ω.

Test Reference	Test Name	Outline of test method	Acceptance criteria
AS/NZS 2053.1:2001 Appendix G	Electrical insulating strength test	Immerse the test piece in the electrolyte as shown in <i>figure G1</i> (rigid conduit). Apply a voltage across test electrodes, record and assess the results.	The 100mA over current relay has not tripped during <i>step (e) of Paragraph G3</i> ; and the insulation resistance measured during <i>step (f) of Paragraph G3</i> is greater than 100MΩ.
AS/NZS IEC 60754.2:2017 - Method 5.3	Acid gas emission test	The samples are placed in a combustion boat which is then inserted into the tube furnace, heated, removed and cooled to ambient temperature, rinsed and the resulting solution analysed.	Conduits and fittings classified as halogen-free will not evolve more than the equivalent of 5mg of hydrochloride-acid per gram of sample.

7.0 CABLE COVERS

All cable covers must be designed and constructed in accordance with the requirements of this specification, which is based on the requirements of AS 4702 and all other relevant standards referenced within this specification to provide reliable / adequate mechanical protection of the cable which they are protecting.

7.1 Construction

7.1.1 Material / Finish

Cable covers must be made from a polymeric material that meets the requirements of AS 4702.

Covers must have rounded or chamfered edges, be free of sharp edges, burrs or surface projections that are likely to injure the installer.

7.1.2 Width & length

Cable covers are to be offered in nominal widths of 150mm, 200mm and 300mm which must be within a tolerance of -0%, +5% of their nominal width / length.

The nominal length of the cable cover (for each nominal width) is to be as determined by the maximum weight limit stated in clause 7.3.

The cable cover must be a minimum thickness of 5mm.

7.2 Identification and Marking

7.2.1 Method of Identification

Cable covers must be identified using one of the following methods:

- Being coloured throughout; or
- Painted with a durable paint; or
- Co-extruding on the surface (facing upwards) using a material compatible with the base material; or
- By marking with marker tape(s) which is:
 - bonded to the surface intended to face upwards;
 - centrally positioned along the longitudinal axis of the cover; and
 - cover at least 2/3 of the surface width to which it is applied.

7.2.2 Marking

The polymeric cable covers must be printed in black and maybe offered with printing on a single side only or printing on both sides.

Where the cable protection covers are supplied in rolls and have markings on one surface only, the surface bearing the markings must face out from the roll.

The information below must be clearly and permanently marked onto the cable covers in accordance with the requirements of clause 7 of AS 4702:

- the words '**DANGER ELECTRIC CABLES BELOW**'
- the manufacturers name or trademark

In addition to the requirements of clause 7 of AS 4702, the following information must also be clearly and permanently marked onto the cable covers:

- the date of manufacture, using the ISO system in the form 'YYMMDD'
- a note of compliance with AS 4702

All marking must be repeated at intervals of not more than 1m.

The words '**DANGER ELECTRIC CABLES BELOW**' must be made in block letters of not less than 40 mm in height. Other markings must be not less than 15 mm in height or greater than 50% of the size of '**DANGER ELECTRIC CABLES BELOW**'.

The production batch number must be marked on the packaging.

7.3 Type Tests

Type tests must be carried out on all cable covers in accordance with this clause, which is based on the requirements of AS 4702, prior to approval being granted for use / installation.

Table 6 - Cable Cover Type Tests

Test reference	Test name	Test description/criteria
AS 4702 Clause 8.2	Penetration	The test piece must be conditioned to 20±2°C for a period not less than 2h prior to the test. The strikers must be dropped with a minimum energy of 125J injected into the test piece and the depth of penetration recorded. This test must be repeated five (5) times in the pattern illustrated in clause 8.2.4 of AS 4702. The test piece must be considered as passing the test if no penetration is greater than 50mm and no signs of cracking or breaking are visible.
AS 4702 Clause 8.3	Marking	The test piece must be rubbed by hand for 15s with a cloth soaked with water and again with a piece of cloth soaked with petroleum spirit. At the completion of the test the colouring and marking must still comply with this specification.

Test reference	Test name	Test description/criteria								
AS 4702 Clause 8.4	Resistance to unroll	This test must be performed at least 10 days after manufacture. A complete roll must be conditioned to 10±1°C for at least 2h prior to the test and the test must be conducted within 2 min. Restrain the outer end to a flat surface and uncoil the roll. Hold the inner end of the roll against the flat surface for 1 minute. Place an approx. 100mm dia. mass of 8+0.2,-0 kg on the lagging end. Release the lagging end and after 30 sec, measure the height above the flat level surface. The height above the flat surface must not exceed the following dimensions: <table><tr><th>Nominal Size</th><th>Maximum Height</th></tr><tr><td>150</td><td>20mm</td></tr><tr><td>200</td><td>30mm</td></tr><tr><td>300</td><td>50mm</td></tr></table>	Nominal Size	Maximum Height	150	20mm	200	30mm	300	50mm
Nominal Size	Maximum Height									
150	20mm									
200	30mm									
300	50mm									

7.4 Packaging

The total mass of a package of cable covers (whether in slab form or a roll form) must be no more than 20kg.

Additionally, in order to allow efficient packaging / storage on standard pallets as well as reduce the effect of unrolling, rolls of cable cover must have a max O.D of 600mm and a minimum I.D of 350mm.

Packaged rolls and slabs must be securely strapped with plastic pallet strapping tape for normal transport, storage, and field handling conditions.

8.0 MARKER TAPE

All marker tape must be designed and constructed in accordance with the requirements of this specification, which is based on the requirements of AS/NZS 2648.1 and all other relevant standards referenced within this specification to provide reliable / adequate visual warning of the cable which they installed above.

8.1 Construction

All marker tapes must meet the following requirements as stated in clauses 4 to 7 of AS 2648.1.

The marker tape must be manufactured from any material which complies with this specification.

8.1.1 Width & length

Marker tape must be offered in a nominal width of 150mm and in nominal lengths of 100m and 500m. The tolerance of the width must be within $\pm 5\%$ of the nominal and must be no less than the stated nominal length.

8.1.2 Roll former

The tape must be wound on a former of adequate strength to allow handling and unrolling. The former must have an internal diameter of between 50mm and 105mm. Each roll of tape must be in

one continuous length from periphery to core, not precluding the use of splices. Splices must be a minimum of 500 mm apart and must meet the longitudinal elongation at break requirements

8.1.3 Identification and Marking

All marking must be repeated at intervals of not more than 1m.

The marker tape must be printed in black, on one side only, with vertical block type lettering using full strokes.

The information below must be clearly and permanently printed onto the identification tape with a minimum letter size of 25mm:

“DANGER ELECTRIC CABLES BELOW”

8.2 Type Tests

Type tests must be carried out on all marker tapes in accordance with this clause, which is based on the requirements of AS/NZS 4275 Parts 1 - 6, prior to approval being granted for use / installation.

Unless otherwise stated below, all tests specimens must be conditioned for a minimum of 8 hours at $23\pm 2^{\circ}\text{C}$ and only moved to the testing location immediately prior to testing.

Table 7 - Marker Tape Type Tests

Test reference	Test name		Test description/criteria
AS 2648.1 Clause 9.1	Elongation at break		Ten test specimens must be tested from each sample of marking tape; five in the longitudinal direction and five in the transverse direction. The speed of testing must be set at 500mm/minute. The samples must have a minimum longitudinal elongation and transverse elongation of 300% and 350% respectively.
AS 2648.1 Clause 9.2	Tear Resistance		A test specimen 75mm long by 25mm wide must have a clean longitudinal slit $50\pm 1\text{mm}$ long cut into it. Using a grip separation speed of 300mm/min record the load necessary to propagate the tear through the entire specimen. Tests must be conducted on not less than five specimens in each direction. The tear resistance of the specimens longitudinally and transversely must not be less than 3.0N and 3.5N respectively.
AS 2648.1 Clause 9.3	Impact Resistance		A sample must be clamped in position and a dart with a total mass of $160+5,-0\text{g}$ positioned $660+5,-0\text{mm}$ above the tape dropped into the centre of the sample. The sample must withstand any penetration by the dart
AS 2648.1 Clause 9.4	Chemical Resistance	Chemical Resistance Conditioning	The test specimen must be conditioned to $50\pm 5^{\circ}\text{C}$ for $168+2,-0\text{h}$ immediately prior to testing. The test specimens are to be immersed in the chemical baths (hydrogen sulphide and/or ammonium hydroxide) for the stated periods. The hydrogen sulphide specimens are to be stored in a lightproof enclosure for one week at $20\pm 5^{\circ}\text{C}$. The test specimens are then to be washed in with distilled water and then dried.

Test reference	Test name	Test description/criteria
	Background Discolouration	After the conditioning stated above the change in colour between the conditioned and unconditioned samples must be not greater than Scale 3 of the Grey Scale.
	Adhesion to print	After the conditioning stated above an adhesive tape must be applied to each line of printing on the specimen. Allow the adhesive to bond for 1 minute and remove the tape at approximately 10s per length. No more than 10% of the area of printing must be removed.
	Deterioration of elongation properties	The conditioned samples must be tested in accordance with AS 2648.1 clause 9.1 and must have a minimum longitudinal elongation and transverse elongation of 240% and 280% respectively.

9.0 AUTHORITIES AND RESPONSIBILITIES

General Manager Asset Management has 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 Asset Standards and Design

Manager Asset Standards and Design is responsible for the content of this standard and must have the authority and responsibility for:

- reviewing technical specifications and making recommendations to the General Manager Asset Management.
- making recommendations concerning compliance in respect to this Specification.

Mains Assets Manager has 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 Asset Standards and Design.

Manager Supply and Logistics is responsible that all conduits and fittings purchased by Endeavour Energy comply with the requirements of this instruction.

Contractor Operations Manager, Network Connections Branch, is responsible for confirming that all conduits and fittings installed by Level 1 Accredited Service Providers comply with the requirements of this instruction.

Regional Managers is responsible that all conduits and fittings installed by regional Asset Management staff comply with the requirements of this instruction.

10.0 DOCUMENT CONTROL

Documentation content coordinator: Mains Assets Manager

Documentation process coordinator: Branch Process Coordinator

Annexure 1 – Endeavour Energy Stockcodes

Description	Stockcode
Conduits	
40mm x 4m HD	1005893
50mm x 4m HD	1005900
80mm x 4m LD WHITE	SC16951
100mm x 4m HD	1550904
125mm x 4m HD	1567940
125mm x 6m LD	1005911
150mm x 4m HD	1550912
150mm x 6m LD	1546662
200mm x 4m HD	1567957
Bends	
40mm 90° HD "Hockey stick" bend for service pillar	SC15742
40mm 90° HD	1005960
40mm 45° HD	SB10444
50mm 90° HD	1005984
100mm 45° HD	1568377
100mm 45° HD	1568385
100mm 90° HD	1568393
100mm 90° HD	1568401
125mm F/F 22.5° HD	1568443
125mm F/F 22.5° HD	1568435
125mm F/F 45° HD	1568427
125mm F/F 45° HD	1568419
125mm M/F 45° HD	1551647
125mm M/F 90° HD	1006010
200mm M/F 45° HD	1568450
200mm M/F 45° HD	1568567
200mm M/F 90° HD	1568468
200mm M/F 90° HD	1568476
BellMouths	
50mm HD	1556547
100mm HD	1568484
125mm HD	1556539
150mm HD	1568492
200mm HD	1568500
Couplings	
50mm HD to 61mm LD Slip coupling	1553544
50mm HD to 50mm HD Slip coupling	1568526
125mm LD 300mm long Slip coupling	1006046
150mm LD 300mm long Slip coupling	1568534
200mm LD Slip coupling	1568542
Cable protection cover	
300mm x 5mm thick x 1200mm long SLAB	1568559
200mm x 5mm thick x 21m roll	SC17842
300mm x 5mm thick x 10m roll	1114339
Polyethylene marker tape 150mm x 350m roll	1023184