

TECHNICAL SPECIFICATION – ELECTRICAL CONDUIT AND FITTINGS

THIS DOCUMENT DESCRIBES THE MINIMUM PERFORMANCE, CONSTRUCTION, TESTING REQUIREMENTS AND SUPPLY REQUIREMENTS FOR NON-METALLIC ELECTRICAL CONDUIT

The purpose of this document is to define the technical specification for non-metallic conduits used to protect cables in Evoenergy electrical installations.

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1. SCOPE

This document describes the minimum performance, construction, testing requirements and supply requirements for non-metallic electrical conduit.

2. PURPOSE

The purpose of this document is to define the technical specification for non-metallic conduits used to protect cables in Evoenergy electrical installations.

3. STANDARDS

All goods must be manufactured and tested to the latest revision of the standards listed below. Evoenergy may consider goods manufactured to other recognised international standards provided the standards are at least equivalent to the Australian/IEC standards. Where this document conflicts with a standard, this document prevails. However, significant inconsistencies should be referred to Evoenergy Asset Standards and Acceptance section for resolution.

All non-compliance with the appropriate regulation & standards (as stated in table 1) must be stated by the supplier.

REGULATIONS	
WHS Act 2011	Work Health and Safety Act 2011
ENA DOC01 – 2008	ENA National Electricity Network Safety Code
STANDARDS	
AS/NZS 2053.1	Conduits and fittings for Electrical Installations
AS 1345	Identification of the contents of pipes, conduits and ducts
AS/NZS 1462.3	Methods of test for plastics pipes and fittings
AS 2439.1	Perforated plastics drainage and effluent pipe and fittings
AS 2700	Colour standards for general purposes
AS/NZS 4130	Polyethylene (PE) pipes for pressure applications
AS 4130	Polyethylene (PE) pipes for pressure applications
ASTM G 154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
SA TS ISO 9002	Quality management systems – guidelines for the application of ISO 9001:2015

TABLE 1. APPLICABLE REGULATIONS & STANDARDS

4. REQUIREMENTS

4.1 General requirements

Conduits and fittings must consist of insulating material only and have no conductive elements or components.

Conduits and fittings must be designed and constructed to provide reliable mechanical protection of the cables, which they enclose as well as adequate electrical protection.

Mechanical properties of conduits must pass the tests mentioned in clause 4.7 of this specification.

The goods supplied must meet the highest standards of engineering, design and manufacturing practices.

All values submitted must be guaranteed values and must be treated as such in the evaluation when assessing whether the delivered goods meets the specification.

Approval of the goods is subject to satisfactory completion of detailed assessment of a provided sample.

Where components are specified in general terms, and specific types are stated to be approved items, equivalents may be offered for approval. However, this must be made clear in the tender documents and sufficient information on the design and engineering performance of the equivalent components must be provided.

4.2 Service conditions

The service conditions in the Australian Capital Territory are generally in accordance with the standard requirements for outdoor use as described in the applicable tables in AS 4436. Electrical conduits and fittings must be designed to operate in service conditions as outlined in the table 2 below.

DESCRIPTION	PARAMETERS
Altitude	<1000m
Maximum ambient temperature	45 deg. C
Minimum ambient temperature	-10 deg. C
Maximum radiant (sun) temperature	75 deg. C
Pollution level (as per AS 4436-1996, Table I)	Level 2 – Medium
Annual average daily 9am relative humidity	60-85%
Vibration	-

TABLE 2. SERVICE CONDITIONS

4.3 Noise levels and radio interference

The equipment may be installed in both a rural and residential areas. Where applicable to the product noise and radio interferences must be kept to levels that comply with AS 1055.

4.4 Specific Items Required

Table 3 below lists the individual conduits required pursuant to this specification. Tenderers are to submit prices against each item.

ITEM NO	ITEM ID	DESCRIPTION
1	1082231	SADDLE, FULL, 16mm, ZINC PLATED STEEL, FOR PVC CONDUIT
2	1080970	CONDUIT, RIGID, 20mm, PVC, MEDIUM DUTY TO AS2053, GREY, 4m LENGTH
3	1081081	ADAPTER, 20mm, PVC, PLAIN TO SCREWED CONDUIT, GREY
4	1193351	LOCK RING, 20mm, PVC, FOR 20mm PLAIN TO SCREWED ADAPTER, GREY

ITEM NO	ITEM ID	DESCRIPTION
5	1082176	LOCK RING, 20mm, ZINC PLATED STEEL, FOR 20mm PLAIN TO SCREWED ADAPTER
6	1081135	BEND, CONDUIT 90°, 20mm, PVC, RIGID CONDUIT, RADIUS ≈ 47mm, MEDIUM DUTY TO AS2053, GREY
7	1170721	CONDUIT, CORRUGATED, 20mm, MEDIUM DUTY TO AS2053, SHEATHED, GREY, 20M COIL
8	1170754	GLAND, STRAIGHT, 20mm, PVC, FOR CORRUGATED CONDUIT, GREY
9	1202471	JUNCTION BOX, 20mm, 1 WAY, PVC, FOR 20mm CONDUIT, GREY
10	1081251	COUPLING, 20mm, PVC, PLAIN, CONDUIT, GREY
11	1082243	SADDLE, FULL, 20mm, ZINC PLATED STEEL, FOR PVC CONDUIT
12	1148357	SADDLE, HALF, 20mm, ZINC PLATED STEEL, FOR PVC CONDUIT
13	1183404	SLEEVE, CONDUIT REPAIR, 20mm, PVC, GREY, 1m LENGTH
14	1080982	CONDUIT, RIGID, 25mm, PVC, MEDIUM DUTY TO AS2053, GREY, 4m LENGTH
15	1081093	ADAPTER, 25mm, PVC, PLAIN TO SCREWED CONDUIT, GREY
16	1193362	LOCK RING, 25mm, PVC, FOR 25mm PLAIN TO SCREWED ADAPTER, GREY
17	1202482	LOCK RING, 25mm, ZINC PLATED STEEL, FOR 25mm PLAIN TO SCREWED ADAPTER
18	1081147	BEND, CONDUIT 90°, 25mm, PVC, RIGID CONDUIT, RADIUS ≈ 64mm, MEDIUM DUTY TO AS2053, GREY
19	1172287	CONDUIT, CORRUGATED, 25mm, MEDIUM DUTY TO AS2053, SHEATHED, GREY, 20M COIL
20	1202493	GLAND, STRAIGHT, 25mm, PVC, FOR CORRUGATED CONDUIT, GREY
21	1082255	SADDLE, FULL, 25mm, ZINC PLATED STEEL, FOR PVC CONDUIT
22	1172298	SADDLE, HALF, WITH NAIL, 25mm, ZINC PLATED STEEL, FOR PVC CONDUIT
23	1183393	SLEEVE, CONDUIT REPAIR, 25mm, PVC, GREY, 1m LENGTH

ITEM NO	ITEM ID	DESCRIPTION
24	1080994	CONDUIT, RIGID, 32mm, PVC, MEDIUM DUTY TO AS2053, GREY, 4m LENGTH
25	1081100	ADAPTER, 32mm, PVC, PLAIN TO SCREWED CONDUIT, GREY
26	1193373	LOCK RING, 32mm, PVC, FOR 32mm PLAIN TO SCREWED ADAPTER, GREY
27	1202504	LOCK RING, 32mm, ZINC PLATED STEEL, FOR 32mm PLAIN TO SCREWED ADAPTER
28	1081159	BEND, CONDUIT 90°, 32mm, PVC, RIGID CONDUIT, RADIUS ≈ 83mm, MEDIUM DUTY TO AS2053, GREY
29	1170732	CONDUIT, CORRUGATED, 32mm, MEDIUM DUTY TO AS2053, SHEATHED, GREY, 25M COIL
30	1170743	GLAND, STRAIGHT, 32mm, PVC, FOR CORRUGATED CONDUIT, GREY
31	1081925	BUSH, 32mm, FEMALE, PVC, GREY
32	1081937	BUSH, 32mm, MALE, PVC, GREY
33	1082267	SADDLE, FULL, 32mm, ZINC PLATED STEEL, FOR PVC CONDUIT
34	1183415	SLEEVE, CONDUIT REPAIR, 32mm, PVC, GREY, 1m LENGTH
35	1082279	SADDLE, FULL, 40mm, ZINC PLATED STEEL, FOR PVC CONDUIT
36	1081019	CONDUIT, RIGID, 50mm, PVC, MEDIUM DUTY TO AS2053, GREY, 4m LENGTH
37	1081410	CONDUIT, RIGID, 50mm, PVC, HEAVY DUTY TO AS2053, ORANGE, 4m LENGTH
38	1081111	ADAPTER, 50mm, PVC, PLAIN TO SCREWED CONDUIT, GREY
39	1193384	LOCK RING, 50mm, PVC, FOR 50mm PLAIN TO SCREWED ADAPTER, GREY
40	1192163	LOCK RING, 50mm, ZINC PLATED STEEL, FOR 50mm PLAIN TO SCREWED ADAPTER
41	1194100	CONDUIT CAP, 50mm, PVC, ORANGE
42	1194133	CONDUIT BELLMOUTH, 50mm, PVC, ORANGE

ITEM NO	ITEM ID	DESCRIPTION
43	1081469	BEND, CONDUIT 90°, 50mm, PVC, RIGID CONDUIT, EXTRA LONG SWEEP RADIUS ≈ 450mm, HEAVY DUTY TO AS2053, ORANGE
44	1081457	BEND, CONDUIT 90°, 50mm, PVC, RIGID CONDUIT, LONG SWEEP RADIUS ≈ 320mm, HEAVY DUTY TO AS2053, ORANGE
45	1082280	SADDLE, FULL, 50mm, ZINC PLATED STEEL, FOR PVC CONDUIT
46	1183426	SLEEVE, CONDUIT REPAIR, 50mm, PVC, ORANGE, 1m LENGTH
47	1194793	CONDUIT, RIGID, 63mm, PVC, HEAVY DUTY TO AS2053, ORANGE, 4m LENGTH
48	1202515	CONDUIT CAP, 63mm, PVC, ORANGE
49	1195156	CONDUIT BELLMOUTH, COUPLING, 63mm, PVC, ORANGE
50	1202790	BEND, CONDUIT 90°, 63mm, PVC, RIGID CONDUIT, EXTRA LONG SWEEP, RADIUS ≈ 450mm, HEAVY DUTY TO AS2053, ORANGE
51	1170876	CONDUIT, RIGID, 125mm, PVC, HEAVY DUTY TO AS2053, ORANGE, 4m LENGTH
52	1081494	BEND, CONDUIT 90°, 125mm, PVC, RIGID CONDUIT, EXTRA LONG SWEEP RADIUS ≈ 450mm, HEAVY DUTY TO AS2053, ORANGE
53	1184308	BEND, CONDUIT 90°, 125mm, PVC, RIGID CONDUIT, LONG SWEEP, RADIUS ≈ 635mm, HEAVY DUTY TO AS2053, ORANGE
54	1184319	BEND, CONDUIT 45°, 125mm, PVC, RIGID CONDUIT, HEAVY DUTY TO AS2053, ORANGE
55	1081470	BEND, CONDUIT 22.5°, 125mm, PVC, RIGID CONDUIT, HEAVY DUTY TO AS2053, ORANGE
56	1193395	CONDUIT, RIGID, 150mm, PVC, HEAVY DUTY TO AS2053, ORANGE, 4m LENGTH
57	1193406	BEND, CONDUIT 90°, 150mm, PVC, RIGID CONDUIT, RADIUS ≈ 635mm, HEAVY DUTY TO AS2053, ORANGE
58	1193418	BEND, CONDUIT 45°, 150mm, PVC, RIGID CONDUIT, RADIUS ≈ 760mm, HEAVY DUTY TO AS2053, ORANGE
59	1202526	BEND, CONDUIT 22.5°, 150mm, PVC, RIGID CONDUIT, HEAVY DUTY TO AS2053, ORANGE

ITEM NO	ITEM ID	DESCRIPTION
60	1081172	BEND, CONDUIT 90°, 50mm, PVC, RIGID CONDUIT, MEDIUM DUTY TO AS2053, GREY
61	1202955	CONDUIT BELLMOUTH, COUPLING, 125mm, PVC, ORANGE
62	1202966	CONDUIT BELLMOUTH, COUPLING, 150mm, PVC, ORANGE
63	1081068	SOLVENT CEMENT, TYPE N, FOR PVC CONDUIT, 250ml
64	TBA	CONDUIT CAP, 125mm, PVC, ORANGE
65	TBA	CONDUIT CAP, 150mm, PVC, ORANGE

TABLE 3. ITEMS REQUESTED

4.4.1 Durability Requirements

The durability parameters applicable to the electrical conduits and fittings are as follows:

1. Resistance to attack by physical agents,
2. Form and dimensional accuracy and stability;
3. Permanence of adhesives, coatings and mechanical fastening systems,
4. Resistance to corrosion,

See subclause 4.5.2 for details

The supplier must give to Evoenergy written evidence of compliance with the durability parameters.

4.4.2 4.4.2 UV protection

Electrical conduits and fittings will be installed in areas subject to high levels of UV radiation. The electrical conduits and fittings must be manufactured with a protection system which is proven to be effective against deterioration due to UV radiation as well as weathering. All surfaces exposed to UV must withstand the effects of UV radiation and wet conditions over a sustained period without causing cracking, blooming or embrittlement of the surface.

It is preferred that this be achieved through the entire thickness of the electrical conduits and fittings components by means such as the use of UV stabilised “aliphatic” resins, however the use of resins enriched with UV inhibitors and UV stabilised pigment is also acceptable. The use of paint finish coating on the outer surface of the electrical conduits and fittings is not acceptable for the purpose of achieving the necessary UV stability.

Documented evidence of compliance must be made available.

4.4.3 Testing of UV Protection (and weathering)

The UV and weathering resistance of the electrical conduits and fittings must be verified through accelerated aging tests in accordance with ASTM G 154.

The supplier must give to Evoenergy written evidence of compliance with the UV protection and weathering parameters.

Evoenergy may request additional accelerated aging tests to be performed to verify the claimed performance.

4.4.4 Service Life

The minimum service life under the environmental conditions stated in clause 4.2 and at sustained mechanical loadings up to their rated maximum must be a minimum of 60 years.

The supplier must give to Evoenergy written evidence of compliance with the service life parameters

4.4.5 Life Extension

An effective and reliable treatment option must be made available to support the achievement of the extension of the 60-year service life of the conduits and fittings.

4.5 Construction requirements

The following are the key requirements for the construction of the conduit:

- 🚫 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 cables.
- 🚫 Rigid conduit dimensions must be in accordance with Table 101 and 102 of AS2053.2.

4.5.1 Non-acceptable Construction

Following types of conduits are NOT acceptable:

- 🚫 Corrugated conduits of any type
- 🚫 Conduits of composite or sandwich/foam core type construction that are non-compliant to AS2053

4.5.2 Additional acceptable conduits

Apart from the conduit & fitting mentioned in table 3, following types of additional conduits (along with related accessories & fittings) are acceptable for installation, in case of Horizontal Directional Drilling as per project requirements in compliance with AS 4130.

- 🚫 225mm OD (min. 188.2mm) HDPE PE100 SDR 13.6 PN12.5 Orange
- 🚫 180mm OD (min. 153mm ID) HDPE PE100 SDR 13.6 PN 12.5 Orange
- 🚫 160mm OD (min. 135mm ID) HDPE PE100 SDR 13.6 PN 12.5 Orange
- 🚫 125mm OD (min. 106mm ID) HDPE PE100 SDR 13.6 PN12.5 Orange
- 🚫 110mm OD (min. 93mm ID) HDPE PE100 SDR 13.6 PN12.5 Orange
- 🚫 63mm OD (min. 54.4mm ID) HDPE PE100 SDR 17 PN 10 Orange

4.5.3 4.5.2 Durability requirements

Electrical conduits and fittings must be sufficiently durable to perform their function for the 60-year design life. The durability parameters to be considered are:

4.5.3.1 Resistance to attack by physical agents

The electrical conduits and fittings must be sufficiently resistant to attack by both natural physical and biological agents to provide the 60-year life span under service conditions outlined in clause 4.2. Physical agents include UV light, rainfall, hail, lightning, high and low humidity, pollution, high temperatures and freezing temperatures.

4.5.3.2 Form and Dimensional Stability

All components of the electrical conduits and fittings must under normal operating conditions retain both their form and dimensions for entire design life.

4.5.3.3 Permanence of adhesives, coatings and mechanical fastening systems

All adhesives, coatings and mechanical fastening systems must be capable of performing adequately for the entire service life of the electrical conduits and fittings. The suppliers must demonstrate long-term adhesive performance by testing to a Standard that is appropriate for the materials of construction.

4.5.3.4 Resistance to corrosion

The product must be made from materials that provide the best corrosion performance in both acidic and alkaline environments and must not degrade in standard atmospheric conditions as stated in clause 4.2.

4.6 Marking

Conduits must be marked with information as stated Clause 6 of AS/NZS 2053.1.

All markings must be durable and easily legible.

Markings must be checked by inspection and meet the requirements set out in accordance with the above-mentioned standard.

4.7 Testing

The following clauses detail the testing requirements for the electrical conduit and fittings. The tests must confirm the ability of the electrical conduit and fittings to meet the technical requirements of this specification.

The manufacturer must provide two copies of certified test reports for type, routine and special tests.

At any time during the supply of the goods, Evoenergy may consider it is necessary to confirm the performance of the product by conducting more tests.

4.7.1 Testing Authority

All testing must be undertaken by any of the following:

- 📄 an authority accredited by NATA for the tests involved; or
- 📄 an authority outside Australia accredited, for the tests involved, by an organisation recognised by NATA through a mutual recognition agreement.
- 📄 a test house whose operations are controlled by a Quality Management System which retains current accreditation by an acceptable third party to a standard not less than that of
- 📄 SA TS ISO 9002. (Acceptance of this form of testing authority must be at the complete discretion of Evoenergy Asset Standards and Specifications Section)

4.7.2 Witnessing of Testing

Evoenergy must be offered the opportunity to be present at all proposed tests (type, batch and routine), and the Contractor must give a minimum of two weeks' advance notification in writing before such tests are carried out.

4.7.3 Testing Resources

All plant, test sources, instruments, connections and labour required for carrying out the tests must be the responsibility of the Contractor. In all tests, the source of energy must be of ample capacity as agreed with the Evoenergy to ensure reliable results.

4.7.4 Type tests

Evoenergy may accept test results of previously conducted type tests, provided the offered electrical conduit and fittings are of the same type as the type tested electrical conduit and fittings, and type tested electrical conduit and fittings are in compliance with this specification.

If an offered electrical conduit and fittings does not successfully pass a type test to Evoenergy's satisfaction, or the test results do not meet the technical requirements of this specification, the manufacturer must ensure that fresh type tests are conducted at the manufacturer's expense. Evoenergy reserves the right to witness type tests, for which a minimum of two weeks' notice must be given.

The manufacturer must submit type test reports and certificates to Evoenergy for its review approval.

4.7.4.1 Tests

The conduit is to be subjected to the full suite of type tests in accordance with AS/NZS 2053.1 Special attention should be given to the following tests:

- a) Mechanical properties- including compression testing, impact testing etc.
- b) Resistance to burning.
- c) Electrical resistance characteristics.

In addition to tests specified in AS 2053.2, items must comply with:

- 📄 Test of Resistance to Impact, Appendix B of AS 2053.1. (Using the test method described in AS/NZS 1462.3 is also acceptable).
- 📄 The test requirements of AS/NZS 1462.1 and AS/NZS 1462.2.

Under no circumstances will conduit be accepted for supply without approval by Evoenergy of the specified evidence of type test conformance. All type test certificates submitted must be signed by a properly authorised person. Such evidence must be submitted as part of tender documentation

Conditional to there being no change to any of the produce characteristics controlled by AS 2053.1, successful type tests may be considered current for a period of up to 10 years from the certified date of test.

4.7.5 Routine tests

All conduits and fittings must be subject to routine testing in accordance with AS 2053.1

4.7.6 Batch tests

Batch testing consisting of the Routine and Special Testing specified in AS 2053.1 must be carried out by or on behalf of the Contractor at the Contractor's nominated testing authority.

4.7.6.1 Test Certificates

The Contractor must supply, in duplicate, certification for the Routine Tests covering the manufacturer's batch from which each delivery of conduits to Evoenergy is to be made.

The test certificate must include all relevant documentation to identify the contract involved and the conduit supplied and must include such information as:

- 📄 Tender Request Number;
- 📄 Blanket Release Number,
- 📄 Order Numbers;
- 📄 Manufacturer's Batch Identification.

The certificate must be signed by a properly authorised person and must certify that the conduit delivered against this release/order came from the manufacturer's batch covered by this certificate. The certificates must be forwarded to the Evoenergy prior to delivery of the conduit.

Should the Contractor fail to supply correct certificates as specified Evoenergy may elect to:

- 📄 Undertake the required tests and deduct the associated costs from the amount due to the Contractor, or
- 📄 Classify the goods as non-conforming.

4.8 Training and support

The Supplier must provide and maintain necessary training and operational material to Evoenergy relevant for the use of electrical conduit and fittings. The training material may be in the form of drawings, instructions and/or audio visuals.

The training materials must include but may not be limited to the following topics: -

- 📁 Transport, Handling and Storage
- 📁 Installation
- 📁 Operation
- 📁 Inspection
- 📁 Maintenance
- 📁 Disposal (recycle, reuse is preferred to disposal)
- 📁 Electrical performance
- 📁 Mechanical properties
- 📁 Fire damage handling
- 📁 Environmental performance

The supplier must also provide a quality control checklist for the receipt of the product into Evoenergy stores. The checklist must also include a further secondary checklist for the review of second hand product that maybe returned to stores following use in the field to determine the products suitability for reuse.

5. REFERENCES

Evoenergy documents	
Document number	Document title
PO0793	Civil Works Manual Volume 2
Australia Standards	
Document number	Document title
AS 2053.1	Conduits and Fittings for Electrical Installations
AS 1345	Identification of the contents of pipes, conduits and ducts
AS/NZS 1462.1	Methods of Test for Plastic Pipes and Fittings
AS 2439.1	Perforated plastics drainage and effluent pipe and fittings
AS 2700	Colour standards for general purposes
AS 3879	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS pipes and fittings
Regulations	
Document owner	Document title
WHS Act 2011	Work Health and Safety Act 2011
ENA DOC 001 – 2019	ENA National Electricity Network Safety Code

VERSION CONTROL

VERSION	DETAILS	APPROVED
1.0	New specification	L.Hancock; B.Suthar; W. Cleland; 13/02/2012
2.0	New format	C.Desai; W. Cleland; 9/02/2015

3.0	Specification Updated	F. Hunnemann; W. Ibrahim; 19/06/2017
4.0	Items table updated	F. Hunnemann; W. Ibrahim; 26/07/2017
5.0	Updated for Evoenergy rebranding	F. Hunnemann; W. Ibrahim; 16/01/2018
6.0	Minor amendments & updated to new template	N. Azizi; W. Cleland; 1/09/2020
6.1	PO07107 reference replaced with PO0793	K. Vedanti; N. Azizi; 7/02/2022
6.2	Clause 4.5.1 amended and clause 4.5.2 added in regards to HDPE conduits; KV	N. Azizi; W. Cleland; 03/06/2022

DOCUMENT CONTROL

DOCUMENT OWNER	PUBLISH DATE	REVIEW DATE
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