

Quarry Products and Raw Materials

Key summary points

- This document specifies the minimum technical, manufacturing, testing, supply and delivery requirements for quarry products and raw materials to be used in the Evoenergy low and medium voltage electricity distribution network.

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1 Scope

The purpose of this technical specification is to provide the minimum technical and testing requirements for quarry products and raw materials to be used in the Evoenergy Electricity Distribution Network

It is not the intention of this specification to specify all the details of each of the materials. However, the material supplied must meet all the requirements specified in the relevant Standards and in this document.

2 Purpose

The purpose of this specification is to set out in detail the minimum technical requirements for quarry products and raw material to support engineering design and procurement to ensure network safety, reliability and compliance with regulatory obligations and requirements.

3 Standards and References

All material shall be supplied and tested to the latest revision of the standards listed below. Evoenergy will consider material produced and tested to other recognised international standards provided the standards are at least equivalent to the Australian/IEC standards and relevant testing reports and certificates are supplied to Evoenergy. Where this document conflicts with a standard, this document will prevail. However, significant inconsistencies should be referred to the Evoenergy's Standards Engineer for resolution.

All non-compliance with the appropriate Standards shall be stated by the supplier.

Table 1. Standards and References

Regulations	
WHS Act 2011	Work Health and Safety Act 2011
ENA DOC01:2008	ENA National Electricity Network Safety Code
Standards	
ASTM D5334-14	Standard Test Method for Determining the Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure.
AS 1141 (series)	Methods of sampling aggregate (various)
AS 1141.31 – 2015	Methods of sampling aggregates – Method 31: Light Particles
AS 1141.14 – 2007	Methods of sampling aggregates – Method 14: Particle shape, by proportional calliper
AS 1141.22 – 2019	Methods of sampling aggregates – Method 22: Wet/dry strength variation
AS 1141.36 – 2017	Methods of sampling aggregates – Method 36: Sulphur in metallurgical slag, crushed rock or other pavement materials
AS 1289 (series)	Methods of Testing Soils for Engineering Purposes
IEEE 442 – 2017	Guide for Soil Thermal Resistivity Measurements for general information on test equipment for use on TR testing.
AS 2758.1 – 2014	Aggregates and rock for engineering purposes – Concrete Aggregates
AS 4676 – 2000	Structural Design Requirements for Utility Services Poles
AS ISO 9001-2016	Quality Management Systems
RMS T114 – 2012	Test Method – Maximum Dry Compressive Strength of Road Construction Materials
Local Standards	
MIT 09A	TCCS Municipal Infrastructure Technical Specification – Topsoil.
IC-QA-3051	Granular Pavement Base and Subbase Materials

4 Service Conditions

The materials specified in this document shall be suitable for use within the Evoenergy distribution network and associated civil infrastructure installations in the Australian Capital Territory and surrounding regions.

Materials shall maintain their physical, mechanical and thermal properties under the environmental conditions likely to be encountered during transportation, storage, installation and service life as outlined in Table 2.

Table 2. Service Conditions

Service Condition	Range
Altitude	<1000m
Maximum ambient temperature	45° C
Minimum ambient temperature	-10° C
Average ambient temperature maximum	40 deg. C
Environment	Climatic Zone – Temperate Industrial proximity – exposure zone B1
Pollution level	Level 2 – Medium

5 Requirements

5.1 General Requirements

The material supplied must meet the intent of the nominated standards and codes. All product and product part dimensions must be ISO Metric.

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

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

Where material is 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.

5.2 Bedding Material for Electrical Infrastructure

Bedding material shall consist of naturally occurring sand or processed sand free from clay lumps, organic matter, vegetation, waste materials, contaminants and other deleterious substances that may adversely affect the performance, durability or installation of underground electrical assets.

Bedding material shall comply with the thermal requirements of either Type A or Type B (see clause 5.2.1), as nominated in the project documentation.

5.2.1 Thermal Requirements

Bedding material used for electrical infrastructure shall possess thermal characteristics suitable for the dissipation of heat generated by underground cables and shall comply with the following maximum thermal resistivity (TR) classifications, as specified in the project requirements:

- **Type A:** Maximum thermal resistivity of **0.9 °C·m/W**
- **Type B:** Maximum thermal resistivity of **1.2 °C·m/W**

Note: Any tolerance from above values is not acceptable as it will reduce the cable rating/feeder capacity

5.2.2 Washed / Unwashed Sand

Evoenergy's preferred bedding material for electrical infrastructure is unwashed sand sourced from a natural deposit and containing a controlled percentage of naturally occurring fines.

Unwashed sand is preferred as the retained fines typically improve compaction characteristics, reduce air voids, and provide greater stability for cable bedding and sand-cement backfill applications. The material shall be non-plastic and free from clay lumps, organic matter, vegetation, contaminants, and other deleterious substances.

The bedding sand shall comply with the grading requirements in Table 3.

Table 3. Bedding Sand Grading Requirements

AS Sieve Size	% Passing by Mass
4.75 mm	100
2.36 mm	90 – 95
1.18 mm	60 – 70
600 µm	40 – 50
300 µm	5 – 30
75 µm	0 – 10

The material shall have a Plasticity Index (PI) not exceeding 3 and shall not contain particles larger than 4.75 mm and achieve the applicable Type A or Type B thermal resistivity classification specified for the project. At the time of supply, the material moisture content shall not exceed 8% and the material shall be capable of being compacted to the specified density without the addition of water or other conditioning measures.

Washed sand may be accepted where it can be demonstrated that the material satisfies all specified grading, thermal performance, compaction, and strength requirements and has been approved by Evoenergy.

Note: Preference for unwashed sand does not remove the requirement for the material to comply with all specified physical, thermal, and durability requirements.

5.2.3 Sand – Cement Bedding

Sand-cement bedding shall consist of a homogeneous mixture of approved bedding sand and General Purpose (GP) cement at a ratio of 20 parts sand to 1 part cement by volume, unless otherwise specified in the project documentation.

The bedding material shall provide adequate trench stability, support for underground electrical infrastructure, and resistance to settlement during installation and service.

The sand shall comply with the requirements of this Specification and be free from clay lumps, organic matter, vegetation, waste materials, and other deleterious substances. Cement shall comply with the relevant Australian Standard.

Sand-cement bedding shall be batch mixed under controlled conditions at the supplier's premises at a fixed batching plant or approved quarry batching facility to ensure a uniform and consistent product. Mixing of sand and cement within the trench or at the work site is not permitted.

Where thermal performance requirements apply, the completed sand-cement mixture shall be thermal resistivity (TR) tested prior to supply and demonstrated to comply with the relevant project requirements. The Supplier shall provide certified test reports for approval before delivery of the material to site.

The material shall be delivered to site in a thoroughly mixed condition and shall not contain segregated material, cement-rich pockets, hardened lumps, or other defects that may adversely affect its performance. Water shall only be added as necessary to facilitate placement and compaction.

The material shall comply with the grading requirements and Plasticity Index (PI) in line with Table 3 and the mixture shall achieve the applicable Type A or Type B thermal resistivity classification specified for the project.

5.3 Topsoil for Reinstatement

Topsoil used for reinstatement and landscaping works associated with electrical infrastructure shall comply with the requirements of TCCS Municipal Infrastructure Technical Specification MITS 09A – Topsoil.

Topsoil shall be fertile, friable, free-draining, and free from contaminants, rubbish, building debris, roots, gravel, rocks, stones, deleterious materials, and viable seed, including weed species such as couch grass, phalaris, paspalum, nut grass, and broad-leaf weeds.

The total dissolved salt content shall not exceed 100 ppm when tested using a 1:5 soil-water extract. The pH shall be between 6.0 and 7.5 when tested using a 1:5 soil-water extract.

The hydraulic conductivity shall exceed 5 mm/h when moderately compacted. For the purposes of this Specification, a moderately compacted soil for turf shall be achieved by 16 drops from a height of 150 mm on soil at field capacity. The water holding capacity shall be not less than 12% at field capacity at 1 m suction. The particle size distribution of the soil shall be in accordance with the following Table 4:

Table 4. Topsoil Grading Requirements

AS Sieve Size	% Passing by Mass
2.36 mm	100
1.18 mm	90 – 100
600 µm	70 – 100
300 µm	30 – 95
150 µm	16 – 60
75 µm	6 – 45

Topsoil shall be sourced, tested, handled, stockpiled, and placed in accordance with TCCS MITS 09A and shall only be used within designated surface reinstatement and landscaping areas. Topsoil shall not be used as bedding, surround, or backfill material within the electrical cable zone.

5.4 Crushed Rock for Zone Substation and Switchyards

Crushed rock used within switchyards shall consist of durable, hard, angular, quarried rock free from clay, dust, organic matter, deleterious substances and other contaminants.

Unless otherwise specified, the material shall comprise 20 mm nominal size crushed blue metal, non-plastic or an approved equivalent. The material shall be free draining and suitable for vehicle access, plant operation and maintenance activities within the substation or switchyard. The rock shall be resistant to weathering, degradation and breakdown under service conditions.

The crushed rock surface layer (with 100mm thickness) shall have:

- A minimum resistivity of 3000 Ω·m.
- A nominal particle size of 20 mm.

The Contractor shall provide test certificates demonstrating compliance with the specified grading (as in Table 5) and resistivity requirements prior to installation.

Table 5. Crushed Rock Grading Requirements

AS Sieve Size	% Passing by Mass
53.0 mm	100
37.5 mm	30 – 60
26.5 mm	0 – 20
19.0 mm	0 – 5
4.75 mm	0 – 2

5.5 Scalping (crushed rock)

Scalping's shall be crushed rock sub-base or suitable natural gravels. Stone shall be hard and durable, and the materials shall be free of clay lumps and organic matter. Particle size distribution shall comply with the table for Grading 'C' materials as specified in AS 1289.3.6.1-2009.

The material shall conform to relevant clauses of AS 1141.31-2015 and AS 1289.3.6.1-2009. If non-plastic, the material shall have a maximum dry compressive strength of not less than 1.0MPa (RMS T114).

5.6 Fine Crushed Rock (DGB20 road base)

All requirements specified in this clause shall apply to the material both before placement and after compaction in the Works. The particle size distribution of the compacted material shall comply with the grading limits specified in AS 1289.3.6.1 as detailed in Table 6.

Table 6. Fine Crushed Rock Grading Requirements

AS Sieve Size	% Passing by Mass
26.5	100
19.0 mm	95 – 100
13.2 mm	78 – 92
9.5 mm	63 – 83
4.75 mm	44 – 64
2.36 mm	30 – 48
425 µm	14 – 22
75 µm	6 – 10

The material shall comply with the following physical properties:

- Liquid Limit (LL) not exceeding 23% when tested in accordance with AS 1289.3.1.1.
- Plasticity Index (PI) not exceeding 6% when tested in accordance with AS 1289.3.3.1.
- Linear Shrinkage not exceeding 3% when tested in accordance with AS 1289.3.4.1.

Where the material is non-plastic, the fraction passing the 19 mm sieve shall have a maximum dry compressive strength of not less than 1.7 MPa when tested in accordance with RMS Test Method T114.

The material shall also satisfy the following durability requirements:

- Wet Strength not less than 100 kN when tested in accordance with AS 1141.22.
- Misshapen particles determined using a 2:1 ratio, not exceeding 35% when tested in accordance with AS 1141.14.
- Water-soluble sulphate content, expressed as SO₄ by mass, not exceeding 0.1% when tested in accordance with AS 1289.4.2.1.
- Total sulphur content, expressed as S by mass, not exceeding 0.05% when tested in accordance with AS 1141.36.

The material shall be free from organic matter, clay lumps, vegetation, waste materials and other deleterious substances that may adversely affect its performance or durability.

5.7 Crusher Dust

Crusher dust shall consist of quarry fines produced from the crushing of sound, durable rock and shall be free from organic matter, clay lumps, vegetation, waste materials, and other deleterious substances.

The material shall be of low plasticity and comply with the following grading requirements:

Table 7. Crusher Dust Grading Requirements

AS Sieve Size	% Passing by Mass
4.75 mm	100
2.36 mm	85 – 100
75 µm	0 – 15

The material shall be non-plastic or have a Plasticity Index (PI) not exceeding 3 and shall be capable of achieving a dense, stable and uniform compacted layer.

6 Product Verification and Testing Requirements

6.1 General

The following clauses detail the testing requirements for the quarry products. The tests shall confirm the ability of the quarry products and raw material to meet the technical requirements as listed in this specification.

The supplier shall provide two copies of certified test reports.

At any time during the supply of the material, the Evoenergy's Standards Engineer may consider it necessary to confirm performance of the product by re-testing or conducting additional tests.

6.2 Thermal Resistivity (TR) Testing

Thermal resistivity testing shall be undertaken to verify the suitability of bedding, backfill, or sand for underground cable installations. Testing shall be performed in accordance with ASTM D5334-08 or ASTM D5334-14, Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock.

The results from this method (ASTM D5334) are for thermal conductivity, and it will be necessary to take the reciprocal of this value to calculate the thermal resistivity (TR), which is the value generally used in Australia for cable installations. The following references must be used in place of the comparable US standards, where referenced in ASTM D5334:

- AS 1289.5.1.1-2017: Method of Testing Soils for Engineering Purposes – Soil compaction and dry density Tests.
- AS 1289.2.1.1-2005: Method of Testing Soils for Engineering Purposes – Soil moisture content tests
- AS 1289.1.1-2001: Method of Testing Soils for Engineering Purposes – Sampling and preparation of soils
- IEEE 442-2017: Guide for Thermal Resistivity Measurements of Soils and Backfill Materials

For materials submitted for approval (thermal testing) or routine compliance testing, the following information shall be provided:

- Thermal resistivity at the specified compaction density.
- Moisture content of the compacted sample.
- Standard Proctor maximum dry density and percentage compaction achieved.
- Thermal resistivity in the fully dried-out condition.
- Dry density of the test sample.

For thermal testing, the fully dried-out thermal resistivity shall also be determined at 95% and 90% Standard Proctor density.

Samples shall be representative of the proposed material source. Test reports demonstrating compliance with the specified thermal resistivity requirements shall be submitted prior to the use of the material in the Works. Where there is a change in material source, composition, or characteristics, additional testing shall be undertaken to verify ongoing compliance. The supplier must submit two (2) copies of thermal test reports and certificates to the Evoenergy's Standards Engineer for approval.

6.3 Crushed Rock Resistivity Testing

Crushed rock supplied under this Specification shall be tested to verify compliance with the specified electrical resistivity requirements. Testing shall be undertaken with consideration to:

- AS 1289.4.4.1 for the determination of electrical resistivity of soils and granular materials, where applicable.
- IEEE Std 81, Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials.

Representative samples shall be obtained from the proposed source material. The test report shall include:

- Quarry source and sample identification;
- Particle size distribution of the tested material;
- Sample preparation method;
- Moisture content and moisture condition of the sample at the time of testing;
- Test temperature;
- Test method used;
- Electrical resistivity result expressed in $\Omega \cdot m$; and
- Laboratory accreditation details.

A certified test report demonstrating compliance with the specified resistivity requirement shall be submitted prior to approval of the material source. Where there is a change in quarry source, material composition, grading,

processing method or other characteristic that may affect electrical resistivity, additional testing shall be undertaken to verify continued compliance.

6.4 Sampling and Test Frequency

The supplier shall provide copies of production test records demonstrating compliance of the supplied materials with this Specification. Production test records shall be no more than six (6) month old at the time of delivery.

Materials delivered to Evoenergy shall be sampled and tested at the following frequency:

- One (1) set of samples, selected at random, from the first load of quarry product delivered to the site;
- One (1) additional set of samples, selected at random, for each subsequent 1,000 tonnes (or part thereof) of quarry product delivered; and
- Thereafter, one (1) set of samples, selected at random, for each subsequent 2,500 tonnes (or part thereof) of quarry product delivered to the site.

Additional sampling and testing shall be undertaken whenever any of the following occurs, whichever occurs first:

- A change in material source;
- A change in quarry processing methods; or
- The nominated tonnage threshold is reached.

6.5 Testing Authority

Type testing shall be undertaken by any of the following laboratories:

- 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.

Certification to AS/NZS ISO 9001 alone shall not be accepted as evidence of testing competency or laboratory accreditation and is not sufficient for acceptance of test results under this Specification.

6.6 Batch Tests

A batch shall be defined as a quantity of material produced from the same source, using the same processing method and supplied under essentially uniform conditions. Unless otherwise approved by Evoenergy, a batch shall not exceed:

- 1,000 tonnes of bedding sand;
- 500 tonnes of sand-cement bedding; or
- 1,000 tonnes of crushed rock surface material.

One representative sample (in line with Clause 6.3) shall be obtained from each batch and tested for compliance with the requirements of this Specification. Testing shall include, as applicable:

- Particle size distribution;
- Plasticity Index (PI);
- Liquid Limit (LL);
- Moisture content;
- Thermal resistivity (where specified);
- Compressive strength (for sand-cement bedding, where specified); and
- Surface layer resistivity (for switchyard crushed rock, where specified).

A new batch shall be deemed to exist where there is a change in:

- Material source or quarry;
- Material type;
- Processing method;
- Mix proportions; or

- Any characteristic that may affect compliance with this Specification.

Test results shall be submitted to Evoenergy prior to delivery or placement of the material in the Works. Non-conforming batches shall not be incorporated into the Works without written approval from Evoenergy.

This is a typical utility-style definition and gives you a clear trigger for TR retesting whenever the source, grading, or mix changes.

Batch testing certificates must be sent to FATesting@evoenergy.com.au

7 Technical Support

The Supplier shall provide details of technical support available to service the contract. The information and evidence to be provided shall include:

- Number of technical support staff available to provide technical support to Evoenergy
- Proposed plans for providing onsite technical support to Evoenergy
- Tenderer's KPI's for dealing with requests for technical support, i.e. time limit for confirmation of request for support and resolution of issues.

The supplier shall also provide a quality control checklist for the receipt of the product into Evoenergy stores. The checklist shall also include a further secondary checklist for the review of second-hand product that maybe return to stores to determine the products suitability for reuse wherever possible.

8 Quality Assurance

Manufacturers and suppliers of materials provided under this Specification shall operate and maintain a Quality Management System that complies with the requirements of AS/NZS ISO 9001, Quality Management Systems – Requirements.

Evidence of current certification by an accredited certification body shall be provided to Evoenergy upon request. The scope of certification shall be relevant to the manufacture, processing, supply, testing, or distribution of the materials being supplied.

Where certification is not held, the manufacturer or supplier shall demonstrate to Evoenergy's satisfaction that equivalent quality management processes and controls are in place.

9 Workplace Health and Safety

Safety data sheets (SDS), where applicable, must be supplied for each of the items. Safety precautions such as use of personal protective clothing and equipment relevant to the end user of the product must be included with the installation instructions.

Preference will be given to products that are less hazardous and require less personal protective equipment. Evoenergy reserves the right to request the testing of products or component parts to ensure that Workplace Health and Safety requirements are met. The supplier shall bear the cost of such testing. This testing may be requested at any time prior to or during the period of the contract.

Any hazardous chemical that may be offered in the tender submission, must comply with the requirements of the Globally Harmonised System (GHS) of classification and labelling of chemicals.

9.1 Asbestos

All materials and equipment used for construction of Evoenergy's assets are to be free from asbestos and/or asbestos related products. Suppliers are expected to comply with the Dangerous Substances Act 2004, the Work Health, and Safety Act 2011 together with the Work Health and Safety Regulation 2011 and confirm in writing that all products supplied to Evoenergy contain no asbestos related materials.

9.2 Disposal

Consideration will be given to the lifecycle of the products offered to and used by Evoenergy. Preference will be given to products that can be first reused or recycled. Alternatively, all products offered shall be suitable for disposal in regular landfill and without special treatment. If disposal needs to be effected by other means, the supplier shall provide details. The supplier must detail disposal requirements in a separate document as part of any submission.

10 Definitions and abbreviations

Term	Definition
AC	Alternating Current
AS	Australian Standard
AS/NZS	Australian Standard / New Zealand Standard
ASTM	ASTM International Standard (formerly American Society for Testing and Materials)
RMS	NSW Roads and Maritime Services
IEEE	Institute of Electrical and Electronic Engineers
IEC	International Electrotechnical Commission

11 Version control

Version	Details	Updated
1.0	Initial document	Wayne Cleland; 01/10/2014
2.0	Safety in Design Assessment by Northrop Engineers; Updated to latest technical standards, Reviewed by WC requested updates	Northrop; 30/10/2014
2.1	Safety in Design Assessment by Northrop Engineers; Complete requested updates	Northrop; 4/11/2014
3.0	Formatting of the document	J Atanasievska; 14/08/2015
4.0	Document updated for Rebranding to 'Evoenergy'; C. Desai	Wahid Ibrahim; 15/01/2018
4.1	Minor Update, Reference and template updated	Nadeem Azizi; 16/06/2023
5.0	Major Update	Nadeem Aziz; 30/07/2026

12 Document control

Document owner	Document custodian	Published date	Review date
Group Manager Asset Management	Principal Engineer Standards Specifications	14/08/2026	14/08/2031