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Equipment Technical Specification

Padmount substation plinth and culvert

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ETS 0072 PADMOUNT SUBSTATION PLINTH AND CULVERT

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1.0 PURPOSE

To set out in detail the minimum technical requirements for plinths and culverts to support distribution padmount substations and switching stations in the Endeavour Energy network.

2.0 SCOPE

This specification covers the basic design, manufacture, testing at manufacturer's works and delivery of plinths and culverts.

It is the manufacturer's responsibility to provide the engineered design suitable for the application required by Endeavour Energy.

On site and constructional requirements, such as installation and easement requirements are set out in detail in:

Padmount substations and switching stations - MCI 0006

It is not the intention to specify the manufacturing, testing and material requirements in detail. However, the equipment shall be manufactured to Australian Standards and the highest quality processes.

All equipment shall be manufactured and tested to the standards with the year of publication listed in below listed in 3.0 below.

The supplier shall state any non-compliance with this specification in any tender submission and any alternative offers shall be submitted in full and separately from the main offer. Any proposed variations from this specification shall be referred to Network Substations Manager for approval prior to acceptance.

3.0 REFERENCES

- Company Policy 9.2.5 – Network Asset Design
- Company Policy 9.2.10 – Network Asset Ratings
- Company Policy 9.7.1 - Network Asset Construction
- Company Procedure GRM 0003 – Risk Management
- Company Procedure GSY 0026 – Work Health and Safety Risk Assessment
- Company Form FSY 0138 – Risk Register
- Environmental Management Standard EMS 0001 – Environmental impact assessment and environmental management plans
- Electricity Supply Act 1995 (as amended)
- Work Health and Safety Act 2011 (NSW)
- ENA National Electricity Network Safety Code (Doc 01-2008)
- Company Network Management Plan December - 2013 Review
- AS 3000-2000 – SAA Wiring Rules
- Mains Construction Instruction MCI 0006 – Underground distribution construction standards manual
- Earthing Design Instruction EDI 100 – Distribution earthing design, construction and test
- SDI 101 – Distribution substations general details and minimum requirements
- ETS 0077 – Padmount substation cubicles
- Equipment Technical Specification ETS 0068 – Distribution indoor and padmount substation 12-24kV switchgear
- ETS 0069 – Distribution indoor and padmount substation low voltage switchgear
- ETS 0070 - 11kV and 22kV padmount and indoor distribution transformers

- Branch Form FAE 3024 – Padmount substation plinth and culvert product approval form
- AS ISO 1000-1998: The international system of units (SI) and its application
- AS 1012.1- 2014: Methods of testing concrete - sampling of concrete
- AS 1478.1-2000: Chemical admixtures for concrete, mortar and grout-Admixtures for concrete
- AS 1597.1- 2010: Precast reinforced concrete box culverts-Small culverts
- AS 1627.4- 2005: Metal finishing-Preparation and pre-treatment of surfaces-Abrasive blast cleaning of steel surfaces
- AS/NZS 2312.2-2014: Guide to protection of structural steel against exterior atmospheric corrosion by the use of protective coatings-Hot dip galvanizing
- AS 2758.0-2009: Aggregates and rock for engineering purposes-Definitions and classification
- AS 3600-2009: Concrete structures
- AS 3610-1995: Formwork for concrete
- AS 3799-1998: Liquid membrane – forming curing compounds for concrete
- AS 3972- 2010: General purpose and blended cements
- AS 4100-1998: Steel structures
- AS/NZS 4671-2001: Steel reinforcing materials
- AS 4680-2006: Hot dip galvanised (zinc) coatings on fabricated ferrous articles
- AS 62271.1-2012: High-voltage switchgear and controlgear - Common specifications
- AS/NZS ISO 9001:2008 : Quality management systems - Requirements

4.0 DEFINITIONS AND ABBREVIATIONS

Padmount substation

An electrical substation that houses transformers, HV and LV switchgear inside an enclosure, which is designed to prevent the ingress of moisture from rain and storms but is subject to water rise at ground level and high levels of humidity. The enclosure can be made from fibreglass, stainless steel or aluminium.

Switching station

An electrical substation that houses HV switchgear only inside an enclosure, which is designed to prevent the ingress of moisture from rain and storms but is subject to water rise at ground level and high levels of humidity. The enclosure can be made from fibreglass, stainless steel or aluminium.

CPEng - Chartered Professional Engineer
EDI - Earthing Design Instruction
ETS - Equipment Technical Specification
MCI - Mains Construction Instruction
MDI - Mains Design Instructions
MMI - Mains Maintenance Instructions
NATA - National Association of Testing Authorities
SDI - Substation Design Instructions
SMI - Substation Maintenance Instructions

Also refer to SDI 101 for General definitions.

5.0 ACTIONS

5.1 General

5.1.1 General

Plinths and culverts are used throughout Endeavour Energy's network as part of standard construction process.

The product supplied shall conform to the current requirements of all relevant Australian Standards and this specification.

The equipment supplied shall meet the highest standards of engineering, design and manufacturing practices.

All items making up the product, including lifting points, reinforcing, keyways, ferrules, end sheets and concrete shall be installed outdoors and will be below ground level.

The supplier shall provide everything necessary, including any special tools, usually supplied for the safe movement of the product, whether directly specified or not.

The design and construction shall be in accordance with the technical requirements stated. All materials shall be of a type and quality that will give a normal life expectancy of 50 years.

Equipment/components from third party suppliers, such as lifting points, fibreglass end sheets, keyways and the like shall not be modified without prior written approval from the Network Substations Manager.

Note: *All values submitted to tender and in Product Approval Forms shall be guaranteed values and will be treated as such in the evaluation, and when assessing whether the delivered product meets this specification.*

5.1.1 Service conditions

Table 5.1-a: *Service condition*

Description	Criteria
Normal service condition	Outdoor
Altitude	<1000m
Maximum ambient temperature	45 deg. C
Minimum ambient temperature	-10 deg. C

5.2 Network operating conditions

5.2.1 Site conditions

The equipment will be mounted outdoors in contact or below ground level. In most instances the equipment shall be in a dusty and moist environment. The culvert is completely buried in wet soil and is typically subjected to filling and draining of free ground water, the plinth is also in contact with wet soil and grass. They will be located in the public domain and subject to harsh conditions and vandalism.

All equipment shall be suitable for this environment.

During tender evaluation preference will be given to equipment with robust construction.

5.2.2 Rating/Overload capacity

The substation and switching station plinth shall be suitable for mounting on an invert culvert or similar construction.

The total mass of a switching station, including the plinth but excluding the culvert, shall not exceed 700kg. The plinth shall be designed for transporting and lifting HV switchgear and cubicle with a mass up to 400kg.

The total mass of a padmount substation, including the plinth but excluding the culvert, shall not exceed 8,500kg. The plinth shall be designed to be suitable for transporting and lifting transformers up to 5,000kg and HV and LV switchgear of 400kg each and associated cubicle.

The following table provides some detail as to the makeup of the current load for a padmount substation that needs to be lifted, transported and installed on a culvert but these figures may be increased at any time up to the maximum load of 8500kg.

Typical mass of current padmount components (approx.)

Item description	Mass (kg) 500kVA	Mass (kg) 1000kVA	Mass (kg) 1500kVA
Transformer	2500	4000	5000
Plinth – Concrete/steel	Concrete only –1420	Concrete only –1420	Steel only – 300
Cubicle – Fibreglass	160	160	160
HV switchgear	350	350	CB – 350
LV switchgear	250	250	250
HV cables	4	4	6
LV cables	17	33	42
Approx. total - Fibreglass cubicle	**4699**	**6215**	**6108**
Cubicle – S/Steel	369	396	396
Approx. total - steel cubicle	**4908**	**6451**	**6344**

5.2.3 Interchangeability

In order to manage network risks associated with equipment failures and spares management, the product and its parts must meet the mandatory dimension, technical and configuration requirement detailed in this specification and its associated drawings referred in clause 5.4.

5.3 Health, Safety and Environmental requirements

5.3.1 Work Health and Safety Requirements

Equipment shall be designed in accordance with the NSW Work Health and Safety Act 2011 and NSW Work Health and Safety Regulation 2011 as well as relevant Safe Work Australia and NSW WorkCover codes of practice and relevant safety standards. Compliance to the above shall require the designer and supplier to identify and consult and design to reduce risks associated with its product to a level that is as low as reasonably practicable for the lifetime of the equipment. The lifetime shall include risk considerations for, but not be limited to the design, manufacture, delivery, installation, erection, commissioning, use, ongoing monitoring, maintenance and repair, decommissioning, dismantling, storage and eventual disposal of the equipment.

The supplier under this specification shall develop a risk assessment to meet the minimum requirements of Endeavour Energy Company Procedure GRM 0003 – Risk Management. The risk assessment for the equipment shall be submitted with the tender and will also be reviewed, as part of the tender review.

If the designer of the equipment identifies reasonably practicable risk measures that differ from the minimum requirements stated in this specification, such measures shall be stated in writing for review by Endeavour Energy.

5.3.2 Special environmental requirements: toxicology safety

The supplier shall provide with the offer, full details, including composition and toxicological information, regarding the health and safety aspects of the materials offered in their products.

Recommended procedures shall be provided for the safe handling, safe operation and maintenance of products supplied. The means of disposal of the materials shall be clearly stated.

Material safety data sheets (MSDS) shall be provided, with copies available on site, for materials that are supplied and subject to safety considerations in handling and use.

All equipment provided shall be asbestos and PCB free including lifting bolts, washers and the like.

The above information is required as part of the offer and will be reviewed as part of the tender process.

5.4 Technical requirements

5.4.1 General

The equipment and its components shall have the following performance characteristics and ratings.

Table 0-a: *Technical requirements*

Item description	**Requirements**		
1 - General requirements – All Equipment to comply to the following:	Plinth	Culvert	-
Plinth and culvert design to be carried out and approved by a structural engineer to be suitable for the loads identified in this specification	Yes	Yes	-
Expected life of all equipment (yrs)	50	50	-
2 - Culvert	Padmount	Sw/Station	-
Applicable standards	AS1597.1	AS1597.1	
Reference drawing	075027	075027	-
Material	Concrete	Concrete	-
Dimensions			-
• Length (mm)	2800	880	-
• Width (mm)	1235	1235	-
• Height (mm)	1165	1165	-
• Mass (approx.) (kg)	2280	720	-
Lifting point rating (tonnes min)	2.5	2.5	-
End sheet material	Fibreglass or rigid PVC	Fibreglass or rigid PVC	-
End sheet quantity	2	2	-

3 - Plinth	Padmount	Steel Padmount	Sw/Station
Applicable standards	AS1597.1 and AS3600	AS4100	AS1597.1 and AS3600
Reference drawing for design	245886	264892	292827
Reference drawing for lifting	078481	078481	-
Material	Concrete	Galv. Steel	Concrete
Dimensions			
• Length (mm)	3190	3170	950
• Width (mm)	1370	1350	1370
• Height (mm)	170	125	170
• Mass (approx.) (kg)	1500	300	290
Lifting point rating (min) (tonnes)	2.5	2.5	2.5
Cable access key material	Glass reinforced concrete	Galv. Steel	Glass reinforced concrete
Cable access key mass (max) (kg)	8	8	8
Cable access key wall thickness (mm)	8-10	3	8-10

All bolts, screws and nuts shall be ISO metric. All bolts shall be no longer than necessary. All bolts nuts and washers used shall be hot-dipped galvanised or 316 stainless steel. All nuts shall be fitted with approved positive locking devices. Chemical locking is not permitted.

Bolts or studs of diameter less than 10mm shall not be used without the approval of the Network Substations Manager.

Sharp edges and corners shall be rounded off to avoid the risk of injury.

The general arrangement and configuration of all individual components shall allow for easy dismantling and removal without the need for dismantling of other components.

Welded surfaces shall be free of scale, dirt, grease, paint or rust. The welding sequence to be adopted shall be such as to reduce distortion to a minimum. All slag shall be carefully removed after each run and all joints shall be seal welded.

All similar parts shall be accurately machined and set up by the aid of jigs, so that they can be interchangeable. All surfaces that will be connected together, or which have to be accurate for the purpose of sealing, levelling or setting up during erection, shall be accurately machined. Accurately set and machined dowels or holes shall be provided to allow correct and accurate fitting of all components.

All metalwork shall be hot dipped galvanised in accordance with AS/NZS 4680 or 316 stainless steel unless specific approval to deviate is obtained from the Network Substation Manager.

5.4.2 Plinth

5.4.2.1 *General*

The plinth shall be designed by a structural engineer and tested to meet all the criteria of this ETS and carry the loads as indicated in clause 5.2.2.

Concrete plinths are used as the standard equipment mounting for unit up to and including 1000kVA substations (> 4000kg), steel plinths are used for padmount substations greater than 1000kVA and some other special situations.

Endeavour Energy has used a range of plinths over the years with four (4) types and three (3) sizes (see list below). All new designs will need to conform to the size 14-16 design for padmounts, but occasionally there may be a requirement for older designs.

- Size 14-16 concrete plinth (new design) – Drawing no. 245886
- Size 14-16 steel plinth (new design) – Drawing no. 264892
- 11kV concrete plinth (old design) – Drawing no. 061776
- 22kV concrete plinth (old design) – Drawing no. 077312

For switching stations all new plinths shall be manufactured as shown in the following drawing:

- 11/22kV size 14-16 switching station concrete plinth – Drawing no. 292827

The plinth is used as the base of a padmount substation or switching station on which all equipment is assembled and transported as a complete unit , and is designed to sit on top of the invert culvert as detailed in Drawing no's 075027 and 076665.

The design of the plinth should take into account that it is exposed to the elements and is also partly in contact with the soil. It is expected that all substation plinths supplied to this specification shall have a life of at least 50 years. The supplier shall state particulars of guarantees offered.

The following clauses are generally based on the presumption that the plinth is constructed from concrete, however, alternative materials will be considered where the following can be demonstrated:

- Moisture is prevented from affecting the operation/life of the equipment. A moisture barrier shall be provided between the switchgear and the culvert.
- The design is suitable for fastening down a variety of transformers and switchgear.
- The plinth is suitable for transport and installation of the complete substation.

The plinth is to be provided with fittings suitable for securing a range of switchgear and transformers as shown in the drawings. All Unistrut channels and threaded inserts shall be positioned level with the top surface of the plinth.

5.4.2.2 *Steel plinth construction*

Where a steel plinth is required, the following minimum criteria shall be met:

- Drawing 264892 is an indicative design only and a complete set of drawings from a structural engineer with CPEng shall be supplied by the manufacturer.
- All parts shall be hot dipped galvanised after fabrication to a minimum thickness of 85μm.
- The main structural support members shall be a minimum 125 x 65 x 8mm thick.
- The ends shall have removable sections (min 600mm) for cable entries, with access for removal of the end from above and on the inside of the frame.
- The plinth shall be designed to meet all the criteria of Drawing no. 264892 shown in this document.
- All holes indicated as being threaded shall be supplied as either captive nuts, Nutserts or the like and will need to be approved before acceptance of the product, tapped and galvanised threads are not acceptable.

5.4.2.3 *Concrete plinth construction*

Where it does not affect the structural strength of the plinth the electrical conductivity of the cement should be minimised.

The plinth shall have a steel trowel finish and be free from cracks and defects. All reinforcing and concrete coverage shall be suitable for the design.

The plinth shall be fitted with a removable lightweight concrete keyway to fit the dimensions shown in the drawings. The keyway shall provide a clear opening and shall be installed in the centre of the plinth as shown on the relevant drawings. It shall not be possible to remove the keyway with the cubicle in position.

The plinth shall be constructed in accordance with the drawings nominated. The plinth shall be constructed using cement to AS 3972. The aggregate shall consist of clean, hard, durable material, natural or crushed free from harmful substances and evenly graded. Maximum size of aggregate shall be 10mm. All aggregate shall comply with AS 2758.0.

Reinforcement shall be accurately positioned and securely fixed during pouring of the concrete. The minimum concrete cover over any reinforcing shall be 40mm unless otherwise approved by Endeavour Energy. Wire reinforcing mesh and steel-reinforcing bars shall comply with AS/NZS 4671.

A drawing shall be submitted by the manufacturer for approval showing details of all reinforcing, lifting points, ferrules, Unistruts and openings. All ferrules shall be installed so that they cannot be pulled out or rotated when loaded. Preference would be given to ferrules that are tied into the reinforcing.

Admixtures may only be used as a working aid and not as a means of reducing cement content. Admixtures shall comply with AS 1478.1. Details of chemical admixtures shall be submitted to Endeavour Energy for approval.

The characteristic concrete strength, at 28 days shall be a minimum of 32MPa but typically 50MPa is required to ensure lifting point strength is adequate.

Moulds and formwork shall generally comply with AS 3610. They shall be of sufficient strength to avoid distortion during pouring and curing.

5.4.2.4 *Curing and protection of concrete*

Fresh concrete shall be protected from premature drying and excessively hot or cold temperatures. The concrete shall be maintained at a reasonably constant temperature with minimum moisture loss for the curing period. The concrete shall not exceed 38 deg. C or fall below 4 deg. C for a minimum of one hour after placing, regardless of curing option selected.

The curing period shall be continuous until the cumulative number of days or fractions of days during which the air temperature in contact with the concrete is above 10 deg. C, is not less than the following:

- Concrete made with normal Portland cement - seven (7) days.
- Concrete made with high early strength cement - three (3) days.

Curing methods may include the following, unless otherwise specified:

- Ponding or continuous sprinkling with water.
- An impermeable membrane.

- An absorptive cover kept continuously wet.
- Steam curing to AS 3600.
- An approved curing compound to AS 3799.

Finished concrete surfaces shall be protected from damage such as rust, stains, chemical attack, rain, and running water.

No plinth shall be delivered to Endeavour Energy until it has fully cured for at least 28 days.

5.4.2.5 *Concrete finish*

The top and sides of the plinth shall have a steel trowel finish free from cracks or defects. Depressions or ridges shall not exceed 2mm.

All sharp edges shall be removed.

5.4.3 Culvert

Culverts shall be designed by a structural engineer to meet all the criteria of this ETS.

The culvert is required to support the plinth and all equipment .

Where it does not affect the mechanical strength of the culvert the electrical conductivity of the cement should be minimised.

Concrete is the standard construction material for culverts. Culverts shall be manufactured in accordance with AS1597.2, with modifications as required for special fixing and chamfering as detailed in this specification and associated drawings.

Drawing no. 075027 gives details of the dimensions for both invert culverts and associated end sheeting.

End sheeting is generally made from fibreglass or rigid PVC. The sheeting to be supplied is required to be fitted to the ends of the culvert and is required to be able to withstand the backfilling and compaction of soil after excavation and installation of the culvert.

The invert culverts shall be designed to comply with the installation method detailed below. The culverts shall be capable of withstanding transport and substation installation loadings.

The manufacturer shall provide drawings showing dimensions and reinforcing details. The manufacturer shall also provide details of materials and curing where they differ from those detailed for the plinth.

The transformer, switchgear and other substation components are assembled onto the substation plinth in a workshop. The complete substation plinth is lifted as shown in Drawing no. 078481 and transported to site.

The culvert is installed in accordance with Drawing no. 076665. The assembled substation or switching station plinth and equipment is then positioned on the culvert. The total mass of the substation, not including the culvert, is not more than 8,500kg, and for switching stations, not including the culvert, is not more than 700kg.

Further details and viewing of culvert and substation installation can be arranged by contacting Endeavour Energy.

5.4.4 Lifting points

For concrete construction the lifting points shall be embedded in the concrete. The type of lifting points shall be galvanised rigging foot anchors suitable for edge lifting the total mass of the package, which is inclusive of the electrical equipment, as indicated in this ETS.

The foot anchors shall be installed in the concrete plinth with the specified reinforcing cage as indicated in drawing 245886 or as directed by the foot anchor manufacturer.

The standard lifting method for concrete plinths and culverts is to use 2.5T panel swivel lifting clutches to suit Reid SwiftLift or similar foot anchors.

For steel plinths the lifting points shall be as shown in drawing 264892 and certified by a structural engineer to be suitable for the expected loads and adequately balanced.

5.5 Quality assurance

Quality assurance certification is required to establish the manufacturers ability to design and consistently manufacture product to this specification. The supplier and all its contractors shall have a quality system which complies with the requirements of AS/NZS ISO 9001 or other comparable Australian or International equivalent.

All nominated drawings and documents that have to be reviewed by Endeavour Energy are to be submitted as complete packages using document controls systems such that all the relevant information to enable the design to be reviewed is available. Design suitability approval will not relieve the supplier of its responsibilities for the correctness and appropriateness of the design of their design or their responsibility to conform to this specification.

5.5.1 Quality assurance plan

A quality assurance plan is to be provided as part of the tender; it shall be a document subject to approval of Endeavour Energy and shall contain as a minimum the following information:

- The supplier’s organisational structure for the works.
- A planned outline meeting the requirements and all stages of the scope and specification.
- An index showing all existing procedures, inspection and test plans and drawings.
- AS/NZS ISO 9001 certification for itself and subcontractors.
- A plan detailing the design, ordering of materials, manufacturing and test plans.

5.5.2 Equipment performance history

The following information shall also be submitted;

- Details of technical back-up facilities available.
- Details of equipment operating history, including how many in service, where, and for what period, plus reference contact names and numbers.

5.5.3 Failure mode analysis and preventative maintenance

The supplier shall indicate and provide updates to Endeavour Energy for the mean time between failures (MTBF) of the equipment and its components including the recommended maintenance regime and maintenance tasks and intervals. This regime shall be based on the mean time between failure (MTBF) and the critical failure modes identified by the failure mode, effects and criticality analysis (FMECA) of the equipment. Details substantiating the FMECA analysis shall be included in the offer.

5.5.4 Design for transport

The product and associated components shall be of a robust design and safeguarded for transportation, capable of withstanding any shock to which it may be subjected to during transport

taking all planned transport modes into consideration. Necessary mechanical withstand capability shall be built into the design. All equipment damage shall be the responsibility of the supplier

5.5.5 Packing

The supplier shall suitably label each product complete with all other accessories, such as bolts, nuts and parts.

All measures shall be taken to prevent damage occurring during packing, transporting and dismantling.

The following shall be written in BLACK lettering (50mm high) on each unit:

- Endeavour Energy.
- Contract number.
- Supplier's name.
- Mass.
- Product description
- Date of manufacture.

5.6 Testing

5.6.1 Type *tests*

Applicable type tests shall be carried out for each of the components of the plinth or culvert. Where special tests are listed they shall also be carried out.

Every type tested shall first have withstood satisfactorily the application of all the routine tests outlined in section 5.6.2 below. The following type and special tests shall be carried out as indicated below:

Table 0-a: *Type tests*

Item no.	Description of test	Test method reference	Acceptable value
1	General tests for concrete plinths and culverts	AS1597.1 and AS3600	As detailed in AS1587.1 Clause 3.3
2	General tests for steel plinths	AS4100	As detailed in AS4100 Clause 17
3	Plinth structural test	Endeavour Energy test process clause 5.6.1.1	No permanent structural damage to the unit
4	Plinth lifting test		No cracking or deformity around lifting point
5	Removable key		Mass and wall thickness within specified limits No cracking when subjected to impact
6	Culvert structural test		No permanent structural damage to the unit
7	End sheet test		Max 50mm deflection with 100kg load

5.6.1.1 *Test method*

Type test requirements are:

- A structural test shall be performed to demonstrate the ability of the plinth and culvert to withstand a static load over its expected life.
- A structural test shall be performed to demonstrate the ability of the plinth and culvert to withstand breakage or deformity during short circuit forces of a transformer and transport when fully laden.
- A structural test shall be performed to demonstrate the ability of the plinth to be lifted with twice the maximum working load (approx. 13,000kg) applied without breakage or deformity to the plinth or lifting points. The lift test shall be carried out to reflect the lifting method as shown in Drawing no. 078481.
- Removable keys shall be tested for mass, wall thickness and durability where durability will be subject to impact simulating vandalism. Acceptance shall be at the Manager Network Substations discretion.
- End sheets are subjected to load from soil compaction. The end sheet shall not deflect more than 50mm when a load of 100kg is applied to a circular surface area of 300mm diameter at any point over the surface when the sheet is suspended at both side edges by no more than 50mm.

If only one of the two (2) components is to be provided (plinth or culvert) then the test shall still be carried out with both components to demonstrate the suitability of the components to work with the other components. The manufacturer shall be responsible for obtaining the other components for the test.

The expected result of the simulated test is that the plinth and invert culvert can:
- Carry the 6,500kg of equipment static applied load
- Plus an additional 6,500kg to replicate the potential dynamic load.

Therefore, the total load to be applied to the plinth will be 13,000kg.

The 13,000kg load shall be added in increments of not more than 10 seconds, holding at each 2,000kg step for one (1) minute, and holding at 13,000kg for 10 minutes, without permanent structural damage.

For the test unit shown, the maximum size of concrete block shall have a similar footprint to a transformer (min 600mm wide by 1400mm long by 1100mm high) and would contribute approximately 2,200kg. The remaining load would be applied with the hydraulic ram. Other test methods may be considered on application.

For the switching station the same test shall be used, but the total applied load shall be 1,000kg, which will be held for 10 minutes.

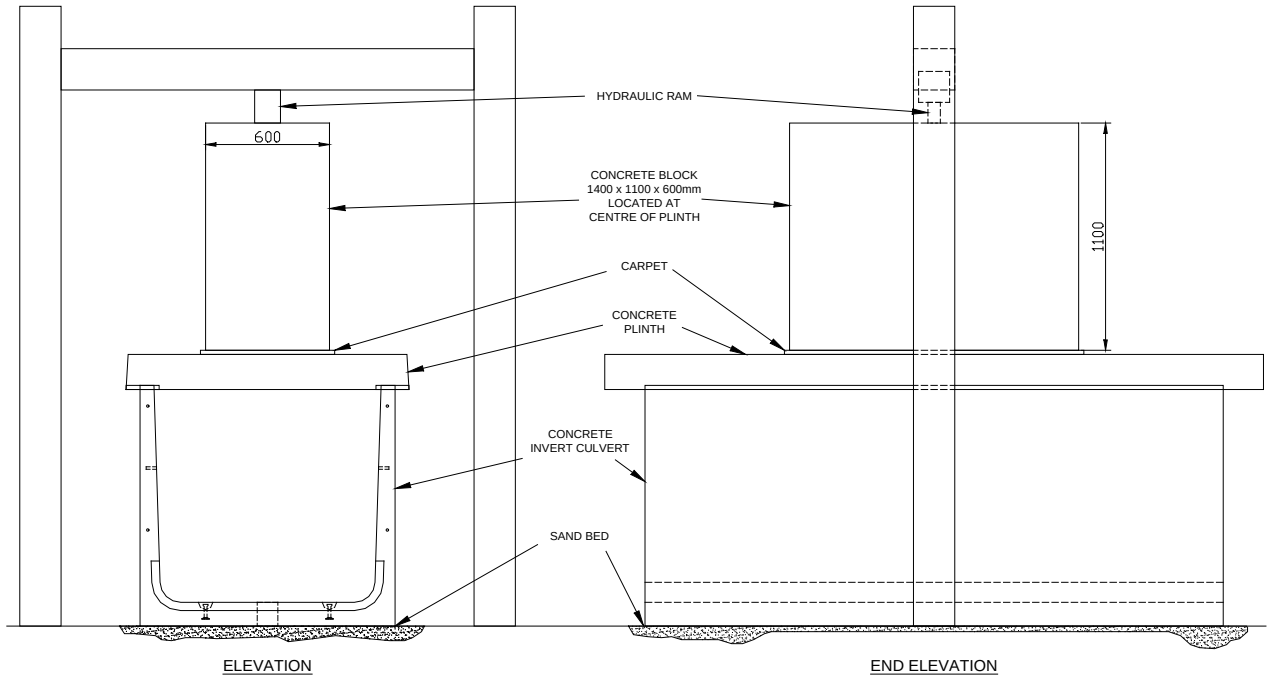


Figure 1 – Typical plinth and culvert test rig setup

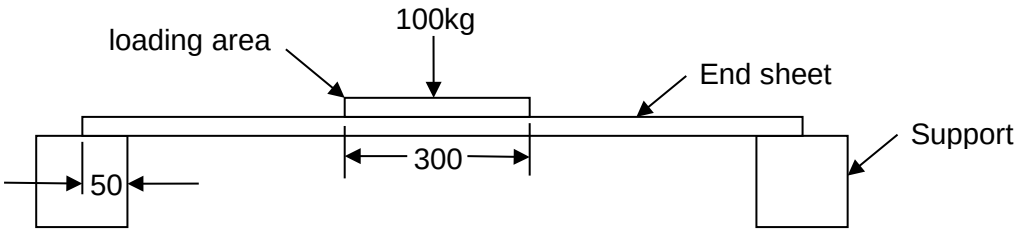


Figure 2 – Typical end sheet test setup

5.6.2 Routine tests

Routine tests will not usually be required on the combined plinth and culvert, but may be occasionally carried out as a type test by Endeavour Energy to ensure compliance to design.

Routine tests on the individual plinth and culvert components shall be carried out as indicated below.

Table 0-b: *Routine tests*

Item no.	Description of test	Test method reference	Acceptable value
1	General tests for concrete - Plinth and culvert	AS1597.1 and AS3600	As detailed in AS1587.1 Clause 3.3

5.7 Drawings

The following drawings form part of this instruction.

5.7.1 Current designs

Drawing	Amend.	Title
245886	D	Size 14 & 16 padmount sub precast concrete plinth construction detail
264786	A	Size 14 & 16 padmount substation exploded view
264892	**B**	**Size 14 & 16 padmount substation steel plinth construction detail**
292827	A	Size 14 & 16 HV switching station precast concrete plinth construction detail
075027	J	11/22kV padmount substation invert culvert details
076665	E	Invert culvert footing installation
078481	D	Package padmount substation lifting arrangement

5.7.2 Superseded designs

Drawing	Amend.	Title
061776	D	11kV padmount substation precast plinth construction detail
077312	C	22kV padmount substation precast plinth construction detail

5.8 Product approval

5.8.1 Product approval process

The equipment shall be evaluated under the product approval process set out in PAE1004. The Network Substation Manager will approve the equipment for use on the network.

5.8.2 Product approval and audit form

Complete information on the equipment shall be provided on Branch Form FAE3024.

An engineering certification shall be provided for this design stipulating the total load that can be lifted for the complete package substation, including the plinth, cubicle and switchgear, but excluding the culvert, in accordance with the lifting equipment indicated in Drawing no. 078481.

6.0 AUTHORITIES AND RESPONSIBILITIES

Chief Engineer shall have the authority and responsibility for:

- Approving technical specifications, including any variations.
- Making all decisions concerning compliance in respect to this specification.
- Approving nominations of Endeavour Energy's representatives.
- Delegating any of these authorities and responsibilities to the Network Substations Manager.

Manager Primary Systems shall have the authority and responsibility for:

- Reviewing this specification and making recommendations to the Chief Engineer.
- Making recommendations concerning compliance in respect to this specification.
- Making nominations of Endeavour Energy's representatives.

Manager Project Development shall have the authority and responsibility for:

- Determining the equipment procured complies with the requirements of this specification.
- Checking FAT and site test reports and seek dispensation from Primary Systems as necessary for marginal non-compliances.

Network Substations Manager shall have authority and responsibility for

- Reviewing all test reports and alternative proposals submitted, and making recommendations to the Manager Primary Systems.
- Clarifying all the technical aspects of this specification to the stakeholders.
- Approving the relevant actions required and outlined in this specification

Project Manager shall have authority and responsibility to check that

- All equipment installed complies with the requirements of this specification.

Strategic Category Manager shall have the authority and responsibility to check that

- The equipment purchased through the tender process complies with the requirements of this specification.

Manufacturers/suppliers shall be responsible for:

- Managing awareness of their responsibilities under this specification.
- Managing that the supplier/s under their control have provided suitable training for their staff.
- Oversee that an effective safety, environmental and quality auditing system is in place.
- Implementing this specification 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 Substations Manager

Documentation Distribution Coordinator **:** Branch Process Coordinator