MAINS CONSTRUCTION INSTRUCTION

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MCI 0006 Underground distribution construction standards manual

Section 7 – Substations & Switching Stations

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7.0 SUBSTATIONS & SWITCHING STATIONS

7.1 Actions

The design, construction and commissioning of assets shall be carried out in accordance with Endeavour Energy's Health and Safety Management Systems, Policies, Procedures and Standards.

Systems shall be implemented and maintained to consider the range of human capacity, both physically and mentally, during the design of assets, plant and equipment.

This section of the Underground Construction Manual contains all the drawings that are required to construct a standard distribution padmount or indoor substation, or switching station in Endeavour Energy's network. It does not contain the information required to design these substations or include specific project information.

The topics following are included as a guide to provide the minimum necessary background or clarification to the drawings. Further information on the minimum design requirement required by Endeavour Energy is detailed in MDI 00028.

7.1.1 General construction requirements

For complete details on general items including the following topics it is essential to refer to Section 3 – General construction requirements:

All terminations shall be cleaned/ scrubbed with a wire brush, electrical jointing compound applied to surfaces to be jointed, all burrs shall be removed from lug barrels.

All lugs are to be correct for their function and location ie Coastal. They shall be tightened to the correct torque value, correct size die used and correct number of crimps made.

All cables shall be sealed and where necessary shorted and tagged for identification purposes.

Cable clamps are to be used, saddles are not permitted.

All doors shall be fitted with a danger high voltage sign, substation number and emergency contact telephone number. All signs shall be free of obstructions so that full legibility exists at all times.

7.1.2 Minimum access requirements

7.1.2.1 General

Access requirements shall be in accordance with AS 2067 in addition to the following requirements.

Substations must be located at the front property boundary with unrestricted 24 hour a day employee and vehicle access to the substation directly from a public street.

Driveways are not regarded as public street access except where access is available by a vehicle driveway directly to the substation and the substation is located on the perimeter of the drive way, this may also be regarded as street level access if granted dispensation by Endeavour Energy.

All secure access areas (for example gates) shall use Endeavour Energy's standard key. Other acceptable access arrangements (if approved by Endeavour Energy) are:

- A chain with provision for Endeavour Energy and the customers locks in series.

- For solid doors or motorised gates, then a security lock box and a key shall be required along with personnel access gates. Security lock boxes shall be in a readily accessible location and be large enough to contain the security key and have an Endeavour Energy lock on the box.

Where direct access is not available, personnel and equipment access requirements will be required as set out below.

Padmounts, including the easement, shall not be located in or under part of any building, or on corners of roadways, without approval from the Network Substation Manager, refer to clauses 7.4.1 and 7.1.4 for more details.

In all situations where multiple items of equipment are installed, provision will be made to allow a single transformer, switchgear or padmount to be installed or removed without affecting other transformers or equipment.

Access areas shall be located so that they provide two (2) safe means of entry to and exit from the substations at all times. This may mean that bollards or safety rails will need to be erected to protect the persons entering or leaving the substation.

Where fencing around a padmount substation or a switching station is required a suitable gate shall be provided. The type of fence and the gate shall be approved by the Network Substation Manager. Refer to drawing 289702 for examples.

Where a substation location is not immediately apparent from the street, a sign may need to be erected indicating the substation location at Endeavour Energy Contestable Works Officer's/ Project Manager's discretion. This shall be determined on a project basis taking into account security and visibility.

7.1.2.2 Personnel access

A permanent, all-weather access route at least 1.2m wide shall be provided to the substation. Access shall be available for 24 hour use by personnel using, where necessary, Endeavour Energy's standard key.

Service areas shall generally be in accordance with clause 5.5.4 of AS 2067 except for the requirement stated below.

All aisle shall be no smaller than 750mm wide and areas for evacuation shall be no less than 600mm wide even whilst removable parts are in position or with doors open.

Where fall hazards exist, it is required by the Building Code of Australia or as indicated by Endeavour Energy, stairs and handrails shall be installed to provide safe access to, from, within and surrounding the substation (ie. any deviation of 700mm in surface levels will be considered a hazard).

Stairs for substations at levels other than ground level shall be a minimum of 1000mm wide. For raised padmounts a ladder access (min 650mm wide) can be used as the second form of escape when approved by the Network Substation Manager (refer also to clause 7.4.2).

7.1.2.3 Personnel access (additional requirements – indoor substations)

Two (2) access doors are required on each substation room. They shall open outwards and be free of any encumbrances to the outside of the substation room. These doors where possible shall be on opposite sides of each substation room, including multiple room substations. The equipment access doors may be used for general access also.

The areas external to the substation and in the immediate vicinity of each access door shall be set out in a manner that prevents the access doors and passageways being obstructed by stores, equipment, vehicles, and the like. Thresholds to door exits shall have landings not steps. Where required, barriers (such as bollards) and warning signs indicating No Parking, or other signs adequate to the particular situation, shall be erected and maintained by the customer at all times.

Access to these doors may be provided by way of passageways from the street, or an open area such as a car park, which has open access from the street. Access by way of hatchways and/or ladders is not acceptable. Passageways shall have the following unrestricted clearances.

Height - 2400mm. **Width** - 1000mm.

Where the passageways are provided with doors, for example, fire passages, the doors are to be fitted with dual entry mortice locks (capable of accepting locks as indicated in clause 7.5.5) to allow shared access for the customer and Endeavour Energy's employees. Endeavour Energy's lock cylinder will be installed in the top position.

Exit passageways shall be fire rated in accordance with the Building Code of Australia.

Cable basements are not allowed to be installed any more but access to existing cable basements shall be by way of a staircase located clear of any equipment. Handrails shall be provided along the full length of each staircase or elevated platform.

7.1.2.4 Heavy equipment access

The following provisions are required for all substation sites (refer also to Figure 33 - Truck detail -Type 1 and Figure 34 - Truck detail - Type 2):

- A sealed access road to the substation for 24-hour use for unloading and loading of equipment. Weights of up to 8000kg (complete package substation weight) will be moved from trucks or low-loaders by means of mobile cranes (point loads of up to 11000kg from any one-crane outrigger pad with a size of 550x550mm may be experienced). Access roads must be designed to cater for maximum allowable axle loadings as well as point loads as indicated.

- Endeavour Energy's two (2) standard truck mounted crane are classed as a "General purpose" vehicle and have a Gross Vehicle Mass (GVM) capacity of approx. 30 tonnes. The number of wheels on the type 1 and type 2 vehicle axels are as shown on the drawings.

- The access road must be a minimum of 3500mm wide and cater for vehicles with a total height of 4400mm along the total access to the substation. The unloading/loading area in the substation shall be wide enough to accommodate the extended outrigger of 6.5 m and withstand the point and axle loads mentioned above.

- Minimum headroom of 5500mm in the vicinity of the substation to allow unloading and installation of equipment. A suitable 'I' beam and lifting facilities (at the cost of the customer) may be considered if this requirement cannot be met.

- The access shall be suitable for a fixed truck and trailer style vehicle (Type 1 vehicle) with a minimum turning circle inside radius of 8.3 metres (22.6m overall), a width of 2.8 metres including mirrors and 10.3 metres long. The maximum gradient of access way in front of the substation shall be 1:15 or 3.9 degrees. Some vehicles are up to 11.3m long but are a truck trailer combination (Type 2 vehicle) which provides a

better turning radius. If the length is seen as a problem in the loading or unloading of equipment then this shall be addressed in the design.

- The crane on the trucks will have a reach rating of approx. 25 metre-tonne.
- The crane stabiliser leg width when fully extended is up to approx. 8.5m.

Typical transformer and truck height details are shown below:

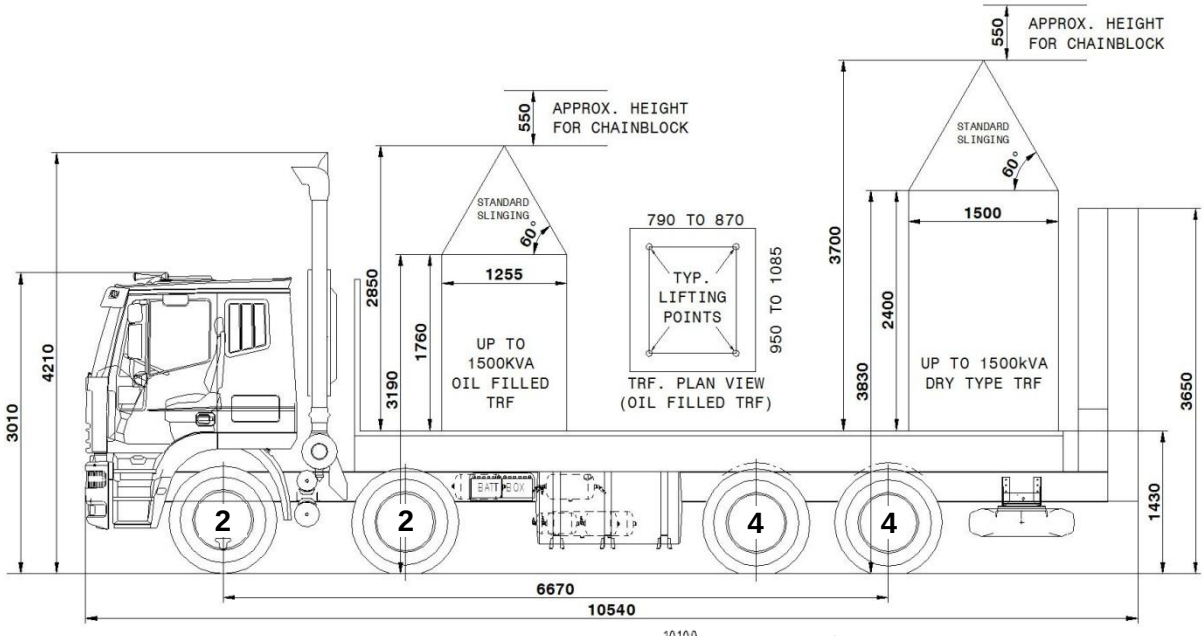


Figure 33 - Truck detail -Type 1

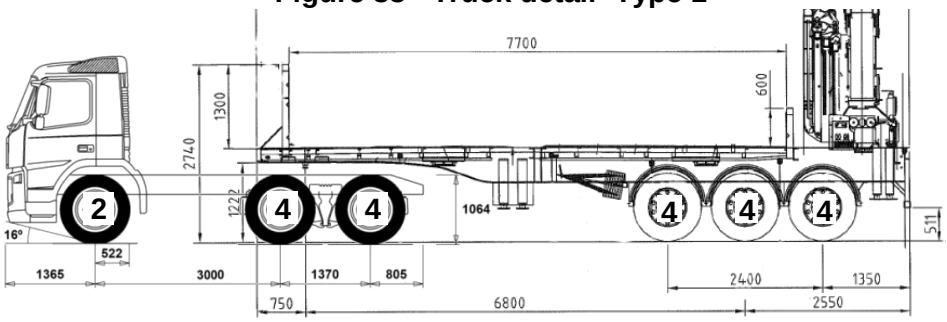


Figure 34 - Truck detail - Type 2

7.1.2.5 Heavy equipment access (additional requirements – indoor substations)

In addition to the normal access requirements up to and around an indoor substation, there are also several different equipment access requirements that need to be considered in conjunction with the building design and layout.

There needs to be a flat level surface capable of supporting without damage a transformer weighing 5,000kg in front of the substation door (or transformer set down area for a girder and trolley system) that shall be 1.5m x 1.5m square.

When required by the design, the customer shall at their cost supply and permanently install and maintain in working order a suitable lifting beam, geared girder trolley and, unless specified otherwise, a chain block/electric hoist, to suit installation of equipment with a minimum mass of 5000kg to its installed position. The chain block and lift equipment shall

be able to be securely locked away in its own enclosure inside the substation and any special lifting equipment required is to be provided and maintained in working order by the customer at the customer cost.

A lifting hook (100mm diameter eye) shall be installed immediately adjacent to the beam to enable lifting/removal of the chain block/electric hoist. The lifting hook shall be designed to suit the mass of this lifting equipment.

The location of the lifting beam and hook will be shown on the layout drawing. The overall height of the transformer and slings is 2800mm for oil type transformers and 3700mm for dry type transformers. Where lifting equipment is required the room shall be designed to cater for this requirement, for example, the room height shall be 3700mm, plus chain block, plus lifting beam and any other obstructions, which may need to be lifted over during installation.

The substation building shall have adequate space so that transformers and other equipment can be installed or removed vertically or horizontally without moving adjacent equipment, de-energising any assets other than those being moved or the need to lift the equipment over any other equipment within the substation.

No changeover will be allowed from one lifting device to another. Loads must be on a landing before being transferred to another lifting device.

All methods of lifting must be submitted for approval by Network Substation Manager.

Other means of lifting than those cited will also be considered. In such cases, the customer shall provide details to the Network Substation Manager for specific approval in accordance with the dispensation process.

Manual lifting facilities are generally required unless specified otherwise.

The customer shall submit a letter of certification signed by a qualified structural engineer verifying that all lifting facilities and fixings are capable of holding the appropriate masses. The customer shall also show what suitable methods have been put in place for maintaining the lifting equipment.

Substations at levels other than ground

On some ground level and on almost all substations located at a level other than ground or street level, special requirements will need to be implemented to raise or transport the equipment to the substation level.

Before any approval of substations at other than ground level the Network Substation Manager must be satisfied that the proposed method is satisfactory and the customer will install and maintain in working order all equipment to be used in future for maintenance/replacement purposes.

Given the increased risk of and response to fire at non-ground level substations the transformers must be dry or suitable K-class oil having a high flash point (>250^{0}C).

Suitable lifting devices may include:

- Fixed crane.
- Mobile crane.
- Dedicated service elevator.
- Dedicated substation lifting device.
- Extendable platforms.
- Extendable lifting beam.

- Chain block/electric hoist.
- Any other approved device.

Minimum requirements of some of the methods have been stated in this section. However, the customer is free to design and submit any proposal for lifting of the substation equipment, including transformers to the substation level. Designs must include a detailed work method statement, safety aspects, specification of installation equipment, street access requirements, necessary approvals required before work can commence, time schedule, risk assessment and risk mitigating procedures. Any other relevant information must be included so that Endeavour Energy must be satisfied that the proposed method is satisfactory and will be able to be used in future for maintenance/replacement purposes.

Some guidance is provided below but a detailed design shall be provided to Endeavour Energy in every circumstance.

- **Fixed crane**
  Large buildings are generally equipped with cranes mounted on the rooftop, providing lifting arrangements for heavy loads on to site. These may be suitable for construction and maintenance of a substation. This is most likely to be used in conjunction with a fixed or extendable platform.

- **Mobile crane**
  A mobile crane may be suitable if the substation room is located up to 25m from street level and is accessible by road. Consideration must be given to the following:

  - The street access required for the mobile crane.
  - Weight of the heaviest (usually the transformer) equipment to be lifted.
  - Crane boom angle.
  - Obstacles at street level, such as overhead lines, ground conditions, vegetation, other buildings etc.

  An extendable landing platform may be required in some locations where the headroom of the transformer room is insufficient. An external wall of the room will need to be removable. This removable wall can be used as a ventilating louvre.

  Where suitable, forklifts may be used.

  Proposal to use a mobile crane must be accompanied by a detailed work method statement, including crane specification, crane set up time, number of streets requiring closure, approvals from local councils, etc.

- **Chain block/electric hoist**
  A chain block or an electric hoist is suitable only for lower levels. This is most likely to be used in conjunction with a fixed or extendable platform. Electric chain blocks/trolley systems shall have a backup supply other than from the substation transformer that is out of service.

- **Service elevator**
  If a service elevator is available, designed to accommodate and sufficiently rated to carry the substation equipment, including a transformer, it can be used. Details of loading and unloading equipment are to be clearly demonstrated.

- **Transfer into substation room**
  Suitable facilities shall be provided to transfer the equipment from the lifting device into the substation room. This may be in the form of a:

- Platform.
- Hatch.
- Hook.
- Winches.
- Any other approved means.

- **Direct placement**
  If the substation ceiling is high enough, a crane may place the transformer directly inside the substation room. In this case, consideration must be given to the height of the transformer, chains, hooks and crane boom, etc.

- **Transformer hatch**
  Depending on the building site, a transformer hatch may be appropriate. A transformer hatch will allow a crane (fixed or mobile) to lower a transformer through the ceiling and directly into the substation room.

- **Platforms**
  Platforms may be fixed or extendable. These shall be designed to carry the full weight of the substation equipment, including transformers up to 5000kg.

7.1.3 Easements and covenants

The customer shall provide suitable easements, free of all encumbrances and other services, for padmount substations, underground mains and associated earthing grids.

In areas of high electrical soil resistivity, larger earthing easements may be required.

Covenants for restricted use are also required around padmounts in accordance with MDI0044.

Easements for substations shall be located outside of any Clear Zones in accordance with MDI0028 section 3.19.

7.1.4 Protection from vehicles

Substations are required to be located so they will not be subject to damage by vehicles. Where this is impractical locations requiring specific dedicated protection shall include, but not be limited to, the following:

- Loading zones (shops, factories, and commercial areas).
- Car parking areas.
- Around rubbish bin storage areas.
- Directly adjacent roundabouts, corners and 'T' junctions.
- Along main traffic routes.
- As determined by Endeavour Energy's Contestable Works Officer/Project Manager.

The protection shall be installed outside the standard easement and shall be in the form of (in order of preference):

- Armco style railing or similar for high hazard areas (to be designed and constructed in accordance with AS/NZS 3845:1999)

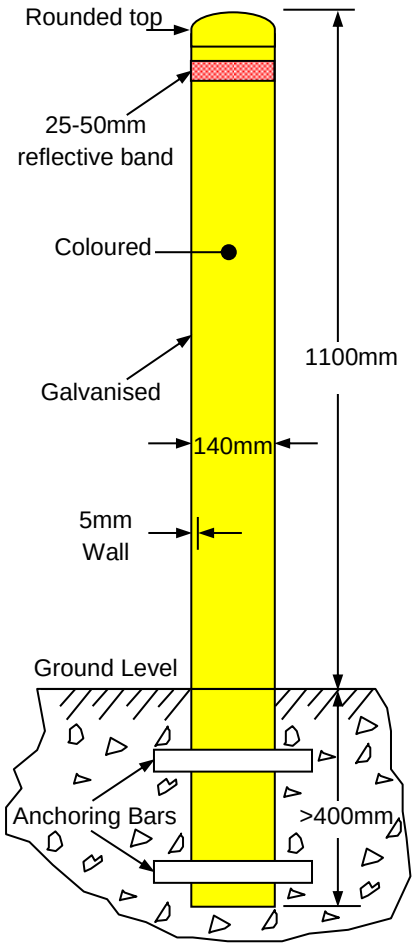


Figure 35 - Typical bollard detail

- Posts (bollards) consisting of:
  - Refer to Figure 35 - Typical bollard detail
  - Heavy duty galvanised steel pipe 140-150mm dia x 5-6mm thick.
  - Concrete filled.
  - Powder coated standard Safety Yellow.
  - 25-50mm reflective band around top of post.
  - Rounded top to prevent injury or damage to objects that may contact bollard.
  - Project 1.1m to 1.2m above ground.
  - Minimum 400mm concreted in ground with concrete anchoring bars to prevent easy removal.

  Prefabricated bollards similar to Centurian 140 (Part No. C140BG) are acceptable. Centurian 140 bollards are available from Barrier Security Products Pty Ltd.

- Minimum 230mm high kerb - subject to approval by Endeavour Energy's Contestable Works Officer or Project/Operations Manager. Where the location is such that there is a risk of vehicles backing up to the kerb, not less than 1.5m of clearance is required between the kerb and the substation footing.

Easements are for safety, access and operational requirements, therefore protection devices shall not be located inside the standard substation easements.

7.1.5 Condensation problems

Where switchgear is used that has electrical contacts that are open to the environment (for example, Magnefix MD4 or similar) the following precautions need to be taken to limit the build-up of condensation.

The HV cable penetration must be sealed with only approved spray foam HILTI 116 or HILTI 126 or Ramset Fomofil or suitable alternative as approved by Network Substation Manager.

Large penetrations are to be sealed by laying down a sheet of twin wall Polypropylene (Plastic cardboard) and sealing the gaps around the cable. For small penetrations check that inside surfaces of the penetrations are free of liquids, dust and any other loose material and fit cardboard formwork into the penetration to a minimum depth of 75 mm (This will confirm that the expansion of the foam exceeds the surface of the penetration).

Note: Cardboard is not included in the standard spray foam kit.

Trimming of formwork around cables will be required. Moisten the area to be sealed with light spray of water; which will enhance the curing process of the foam.

Assemble the spray foam kit as outlined in the details provided with the kit. Read supplied directions carefully. Apply spray foam in a uniform manner.

Always wear protective eyewear, gloves and clothing when operating the spray foam equipment. Use only where there is adequate ventilation. Avoid skin contact. Read all instructions and first aid directions supplied with equipment.

To minimise condensation problems within substations, the inside roof surface of each cubicle (for padmounts and switching stations) is finished with a white pigmented, self-extinguishing, anti-condensation layer.

Fully sealed switchgear (Schneider RM6, Siemens 8DJH, ABB Safelink, and the like) does not require the cable penetration to be sealed.

7.1.6 Flooding and drainage

Substations are to be located such that the risk of flooding or stormwater damage is minimal.

As a minimum the level at the top of the transformer footing, HV and LV switchgear, shall not be lower than the 1:100 year flood level.

All drains within the substation site area or in the vicinity shall be properly maintained to avoid the possibility of water damage to Endeavour Energy's equipment.

In areas where, as determined by the Network Substation Manager, there is a high water table or a heightened risk of flooding, indoor substations will not be permitted.

All materials used in the construction below the substation (ground level) shall be capable of withstanding prolonged immersion in water without swelling or deterioration.

7.1.7 Consumers mains

The installer shall be responsible for providing and installing the consumer LV mains and cable support clamps for fixing to the Unistrut type rail, provided on the low voltage switchgear.

Crimp type cable lugs in accordance with Drawing no. 078239 are to be provided by the installer and crimped onto the consumer's mains.

Single core cables that are connected to switchgear capable of supplying in excess of 300 Amps shall be designed to eliminate eddy currents. The means of clamping shall be such that the cable is not completely enclosed by a ferromagnetic material i.e. have insulated sections.

The low voltage switchgear is suitable for the connection of single core cables up to 2 x 240mm² per phase when connected to fused feeder disconnectors and up to 4 x 630mm² cables for each phase when connected to circuit breakers.

Where consumer's mains are of a quantity, size or type not suitable for connection to the low voltage switchgear, it shall be the installer's responsibility to supply and install at their cost a suitable connection box, complete with all necessary termination facilities. Cables compatible with the low voltage switchgear shall be installed between it and the connection box. The connection box shall be installed external to the substation easement.

Consumers' mains connected to low voltage load break switches (that have circuit breakers on the primary side of transformer) are limited to a maximum 10 metre cable length. These consumers' mains shall be mechanically protected so that the risk of damage to the cables is negligible. Refer to ETS 0069 for further information.

Any cable entry to the substation basement or trench by consumers' mains shall be sealed, after installation of cables, with a sealant that is impervious to oil and water and has a fire resistance level of no less than 120/120/120, for example, Dow Corning Fire Stop Foam 2001 or Hilti CP636 Fire Prevention Mortar or suitable alternative approved by Network Substation Manager.

7.1.8 Earthing

All earthing shall be in accordance with EDI 100 and Section 9 - Earthing of this instruction.

7.1.9 Inspection and testing

7.1.9.1 Inspections

On receipt of 48 hours' notice, the relevant Endeavour Energy representative (as stated in Section 2.9- Inspection of works) shall be given the opportunity to check the set out of all trenches and conduits, before backfilling or concreting is commenced. It is the responsibility of the installer to contact the relevant Endeavour Energy representative.

The installer will be required to draw a proving mandrel through conduits as indicated in Section 4.4- Conduit and cable installation. Suitable exposure of the conduits shall be the installer's responsibility.

The relevant Endeavour Energy representative (as stated in Section 2.9 - Inspection of works) shall be notified to arrange a final inspection and approval of the substation. Failure to comply with this requirement may also affect the program for providing electricity supply.

7.1.9.2 Testing

All testing and pre commissioning shall be in accordance with SDI120 and Section 10 - Testing of this instruction.

7.2 Padmount and indoor substation protection

7.2.1 Standard fuse and CB sizes

The following Table 9 and Table 10 detail the size of low and high voltage fuses and CBs to be used with the appropriate switchgear, having regard to the transformer capacity and protection grading.

For further details of requirements for the size and type of distribution protection, and for any alternative combinations to those listed here that will need to be approved, contact Endeavour Energy's Protection Manager.

The low voltage fuse and CB ratings shown are the maximum permissible to grade with the high voltage protection as listed, lower rating low voltage fuses and CBs may be used as considered appropriate based on load to be protected.

In padmount substations, the following is to be adopted as a standard practice.

a) Category 1(**Cat 1**) switchgear shall be used for all URD installations and they can use fuses up to 315A. This includes new installations and replacement of 250A units due to overloading (except as indicated in (b) below).
If there are two (2) cables on a distributor, and the 315A fuse is still insufficient to supply the load, 400A fuses may be used in the short term on the three phases of that distributor, but not on any other distributor in that substation. Where 400A fuses are used, it shall be entered into the asset management system as a defect for rectification (for example, correct the network loading problem).

b) For **Compact** switchgear, 250A is the standard. 315A can be used in the short term but shall be entered into the asset management system as a defect for rectification (for example, replace switchgear or correct the network loading problem).

c) If Category 2 (**Cat 2**) switchgear, has already been installed in URD areas, it can have fuses up to 315A fitted. Cat 1 is the standard for URD installations up to 500kVA and Cat 2 shall not be used for these transformers. Where 400A fuses have been used, they shall be replaced with 315A units. Where 400A fuses are required, it

shall be entered into the asset management system as a defect for rectification (for example, correct the network loading problem).

d) Category 2 (**Cat 2**) switchgears installed in industrial or commercial areas can use fuses up to 400A.

Note: When replacing a fuse with a different size, all 3 phases shall be changed.

Table 9 - 11kV Padmount and indoor substation fuse selection chart

Transformer size KVA	Maximum LV fuse residential	Maximum LV fuse Commercial / Industrial	HV fuse rating	
			HRC	DOF **
300 - 315	315 Amp *	400 Amp *	50 Amp	40 Amp
500	315 Amp *	400 Amp *	63 Amp	63 (80) Amp
750-1000	315 Amp *	400 Amp *	100 Amp	(100) Amp
1500	N/A	LVCB or switch	CB only	N/A

Table 10 - 22kV Padmount and indoor substation fuse selection chart

Transformer size KVA	Maximum LV fuse residential	Maximum LV fuse Commercial / Industrial	HV fuse rating	
			HRC	DOF **
300 - 315	315 Amp *	400 Amp *	25 Amp	20 Amp
500	315 Amp *	400 Amp *	32 Amp	N/A
750 -1000	315 Amp *	400 Amp *	50 Amp	N/A
1500	N/A	LVCB or switch	CB only	N/A

Notes
* Maximum permissible fuse rating for underground residential areas is 315 Amp.
** DOFs feeding padmounts shall be avoided. Values supplied are for existing installations

7.2.2 High voltage fuses

The high voltage fuses shall comply with AS 1033.1 - fuse type I. IEC 60282 part 1 - fuse type I are identical dimensions. Striker type fuses must be used if required by the switchgear design; otherwise indicator type fuses are preferred. The maximum allowable power dissipation of the fuse is 27 watts (calculated based on resistance at an ambient of 20ºC).

Full range MV fuses are preferred to back up fuses.

7.2.3 Low voltage fuses

Fuses shall be blade type, complying with AS 60269, Part 2.1, Figure 1, Size 2. The utilisation category required is “gG”.

Three sizes are permitted for main feeders – 250, 315 and 400 Amps, as shown in clause 7.2.1 for maximum allowable sizes.

All blade type fuses used on Endeavour Energy’s network shall be of the dead tag type with both ends of the fuses touch safe on all sides.

The fuse must be capable of operating in a range of low voltage switchgear, at the ambient temperatures indicated, without exceeding the temperature limits stated in the testing section of ETS 0071. High watts loss fuses will not be considered.

7.2.4 LV fuse derating in padmount substations (typical values)

Fuse nameplate ratings are not the continuous rating to be applied to a fuse. To provide continuous supply for the design life of a fuse, the current ratings must be modified to take into account various factors such as the overloads, enclosure and operating temperature of the fuse. The fuse derating for padmount and indoor substations are approx. as shown in Table 11.

Table 11 - Padmount and indoor substation fuse derating

Fuse nameplate rating (Amps)	Calculated de-rated current (Amps)	
	Padmount	UID/UCD Indoor
250	210	230
315	260	280
400	330	350

7.2.5 Solid blade links

If required by switchgear design, solid blade links shall have a minimum current rating of 630 Amps and shall be fitted with insulated tags. The physical design of the link shall be suitable for the same contact arrangement as detailed in clause 7.2.3.

7.2.6 High voltage circuit breaker settings

The protection relay on high voltage switchgear is required to grade with Endeavour Energy's upstream feeder protection relay with a sufficient grading margin. Endeavour Energy's Protection Manager shall be contacted for upstream feeder protection relay settings details. Wherever the sufficient grading margin is not achievable, an approval by Endeavour Energy's Protection Manager may be granted on a case by case basis.

7.2.7 Low voltage circuit breaker settings

The settings shown in Table 12 - LV CB settings shall be applied to the circuit breaker upon installation. The type and size of the breaker that is applied to each transformer size is indicative of this Standard.

The protection on the customers low voltage switchboard is to grade with these settings. If the customer or switchboard manufacturer cannot achieve grading with these settings they are to contact Endeavour Energy's Protection Manager.

Where CBs are used for LV supply the Consumers mains are required to be suitably rated to cater for the full load and fault current level of the CB. The LV CB shall first supply the customers own LV board without feeding the customer directly.

Table 12 - LV CB settings

Trf Rating	LV CB Type	LVCB Setting	
300kVA & 315kVA (4.0%)	CM1250	Ir = 0.5, Im = 4, t = B	Pickup = 625 A Short Time = 2,500A
	C1251N	Io= 0.5 , Ir = 1.0, Im = 4 , tm = 0.2, I^2t = OFF	Pickup = 625 A Short Time = 2,500A
	XS1250NE	Io=0.63, I_1=0.8, $I_{2=}$4.00, T_1= 5sec I_3=12, T_2= 0.2sec, I^2t Ramp = OFF	Pickup = 630 A Short Time = 3,150A Instant. = 9,450
	ABB PR232 T7 1250	In = 1250A, 50Hz, I1 = 0.52 x In, t1 = 6s I2 = 1.8 x In, t2 = 0.25s , ∟ I3 = 7.5 x In, InN = OFF	Pickup = 650 A Short Time = 2,250A Instant. = 9,375A
500kVA (4.3%)	CM1250	Ir = 0.8, Im = 4, t = B	Pickup = 1,000A Short Time = 4,000A
	C1251N	Io = 1 , Ir = 0.8, Im = 4 , tm = 0.2, I^2t = OFF	Pickup = 1,000A Short Time = 4,000A
	XS1250NE	Io=1, I_1=0.8, $I_{2=}$4.00, T_1= 5sec I_3=12, T_2= 0.2sec I^2t Ramp = OFF	Pickup = 1,000 A Short Time = 4,000A Instant. = 12,000
	CM1600	Ir = 0.6, Im = 4, t = B	Pickup = 960 A Short Time = 3,840A
	ABB PR232 T7 1250	In = 1250A, 50Hz, I1 = 0.8 x In, t1 = 6s I2 = 3 x In , t2 = 0.25s , ∟ I3 = 9.5 x In, InN = OFF	Pickup = 1,000 A Short Time = 3,750A Instant. = 11,875A
750kVA (5.0%)	CM1600	Ir = 0.8, Im = 4, t = B	Pickup = 1,280 A Short Time = 5,120A
	CM2500	Ir = 0.5, Im = 4, t = B	Pickup = 1,250 A Short Time = 5,000A
	XS2500	Io=0.63, I_1=0.8, $I_{2=}$4.00 T_1= 5sec, I_3=12, T_2= 0.2sec I^2t Ramp = OFF	Pickup = 1,260 A Short Time = 6,300A Instant. = 18,900A
1000kVA (5.3%)	2 x LV CBs max 735A each	Use appropriate setting for each manufacturers CB type as shown for 500kVA transformers	
	CM2500	Ir = 0.6, Im = 4, t = B	Pickup = 1,500 A Short Time = 6,000A
	XS2500	Io=0.63, I_1=1.0, $I_{2=}$4.00, T_1= 5sec I_3=12, T_2= 0.2sec, I^2t Ramp = OFF	Pickup = 1,575 A Short Time = 6,300A Instant. = 18,900A
	NS3200N Micrologic 5.0A Rating 2000A	Ir = 0.8, tr = 8, Isd = 4, tsd = 0.2, Inst = 10	Pickup = 1,600 A Short Time = 6,400A Instant. = 20,000A
1500kVA (6.25%)	CM3200	Ir = 0.8, Im = 4, t = B	Pickup = 2,560 A Short Time = 10,240A
	NS3200N Micrologic 5.0A Rating 3200A	Ir = 0.8, tr = 4, Isd = 3, tsd = 0.2, Inst = 10	Pickup = 2,560 A Short Time =7,680A
	ABB SACE S8H PR212 3200A	I1 = 0.8, t1 = B (6s), I2 = 2 t2 = C (0.25s) , ∟, I3 = 10	Pickup = 2,560 A Short Time = 6,400A
	ABB SACE T8L PR331/P 3200A	In = 3200A, Hz = 50, In N = OFF L | I1 = 0.80 x In, t1 = 3s S | I2 = 2.4 x In, t2 = 0.2s , ∟ I | I3 = 9 x In G | I4 = OFF, T4= 0.1s	Pickup = 2,560 A Short Time = 7,680 Instant. = 28,800A
	XS3200	Io=1.0, I_1=0.8, T_1= 1sec $I_{2=}$2.00, T_2= 0.2sec , I_3=10 I^2t Ramp = OFF	Pickup = 2,560 A Short Time = 6,400A Instant. = 32,000A

7.3 Substation transformers, HV and LV switchgear and cabling

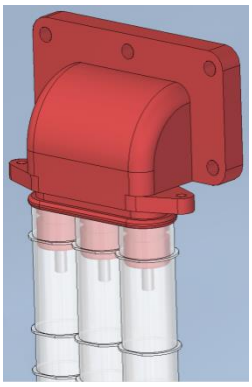
7.3.1 Transformers

Only approved transformers shall be used in padmounts and indoor substations and they shall be of the same construction and in accordance with ETS0070.

Three (3) types of transformers are available for use and they are:-

a) Mineral oil
b) FR3 natural ester oil (Environmentally sensitive, fire risk areas and indoor subs)
c) Dry type - on approval (indoor use only).

Older 11kV padmount transformer may have a spout lug connection on the HV end with insulated sleaves over the connection, newer designed padmount transformers all have bushing wells or plugs suitable for 250A screened elbows.



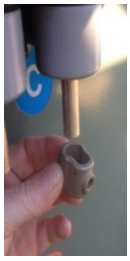


Figure 36 - Typical old style transformer HV spout connection

Figure 37 - Typical new style transformer 250A HV bushing well connection

New design transformers shall be used in all installations. Only in maintenance/upgrade cases when a new design will not practically fit can an old design transformer be used. Refurbished/used transformers may only be used by Endeavour Energy for internal maintenance/upgrade projects.

7.3.2 Switchgear

Only approved switchgear shall be used in padmounts and indoor substations and they shall be of the same construction and in accordance with ETS0068 for HV switchgear and ETS0069 for LV switchgear.

7.3.2.1 HV Switchgear

All new and replacement switchgear shall be three phase metal clad and arc vented switchgear suitable for standard 11kV and 22kV cables as required up to 300mm^2.

Extensible switchgear (assembled in one [1] complete switchboard) is no longer approved for new installations, and may only be used for extensions of existing switchgear or when assembled into approved modules.

Each transformer shall have its own independent switchgear group and there shall be no more than three (3) feeders for each transformer group.

Switching stations shall have a max of four (4) switches or feeders in each group.

7.3.2.2 LV Switchgear

All new and replacement LV switchgear shall be fully insulated touch safe and be suitable for LV feeder cables up to 240mm^2.

Two (2) hole lugs shall be used on all phase connections for low voltage switchgear except Cat 1 switchgear that can use single hole lugs.

7.3.3 Cabling and terminations

Only approved cables and termination shall be used in padmounts and indoor substations and they shall be in accordance with Section 6 of this manual and:-

- ETS0054 for 11 and 22kV cables
- ETS0055 for LV cables
- ETS0084 for joints and terminations

7.3.3.1 HV Feeder cables

Prior to terminating any feeder cable it shall be confirmed that the cable earthing is required to be bonded to the distribution MEN system or isolated.

All three (3) core feeder cables shall be trifurcated into single cores before terminating into switchgear. These tails shall be a minimum 3.2m long and all cores shall be clamped in the base of the switchgear (Siemens 8DJ10 & 8DJH-C are exempt from clamping in base of switchgear due to termination height). All single core cable lengths shall be clamped at intervals of approx. 1.5m with a floating clamp to prevent mechanical damage though movement during faults.

Where any paper insulated cable is to be cut and relocated into a substation, or the existing HV switchgear is replaced, a transition joint from paper to XLPE cable shall be used and located outside the padmount culvert or in a suitably supported location for indoor substations.

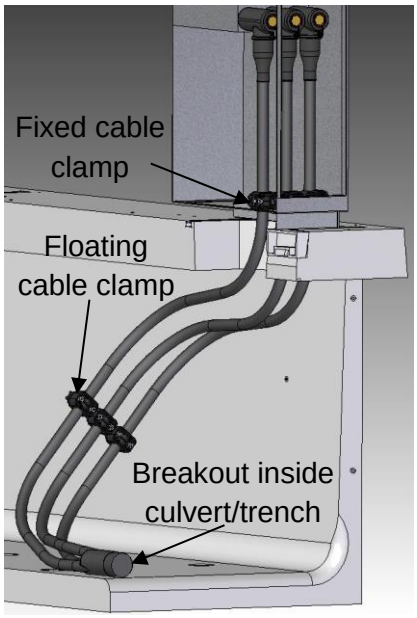


Figure 38 - Typical cable breakout

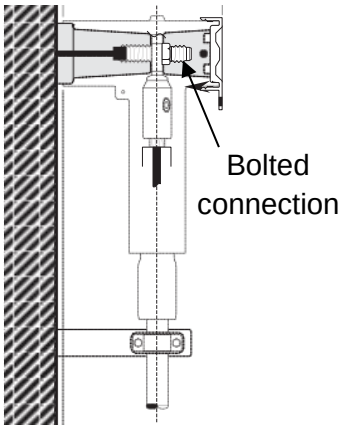


Figure 39- Typical CB/Feeder screened elbow

All new HV feeder cable terminations shall be made using a bolted or screw type connection.

For more details on HV cable terminations refer to Section 6.

Screened elbows are the preferred method of termination, check that the correct elbow is used when the earthing is required to be isolated from the MEN system.

HV cable(s) interconnecting a group of HV switchboards/ switchgear shall be rated to accommodate the largest incoming cable rating.

7.3.3.2 HV Switchgear to transformer cables

Terminations on new metal clad switchgear are:
- Fused unit - 250A screened elbows - pin type (preferred all new designs)
- Fused unit - 250A single hole lug (to suit some older designs)
- CB units - 630A screened elbows - screwed type

Connections between the high voltage switchgear and distribution transformer shall be:

- Fuse protected cables - Single core XLPE insulated 25mm^2 copper or 35mm^2 aluminium cables with individual copper screens having a minimum three (3)kA/1sec fault rating for switchgear; or,
- Circuit breaker protected cables - Single core XLPE insulated 70mm^2 copper cables with individual copper screens having 10 kA/1sec fault rating.
- For standardisation only 22kV cable shall be used on all transformer connections.
- For some older installations where there is an 11kV transformer with a connection that is a spout lug and the switchgear end is an 11kV spout lug or lug palm. In these cases approved 11kV cable may be used.

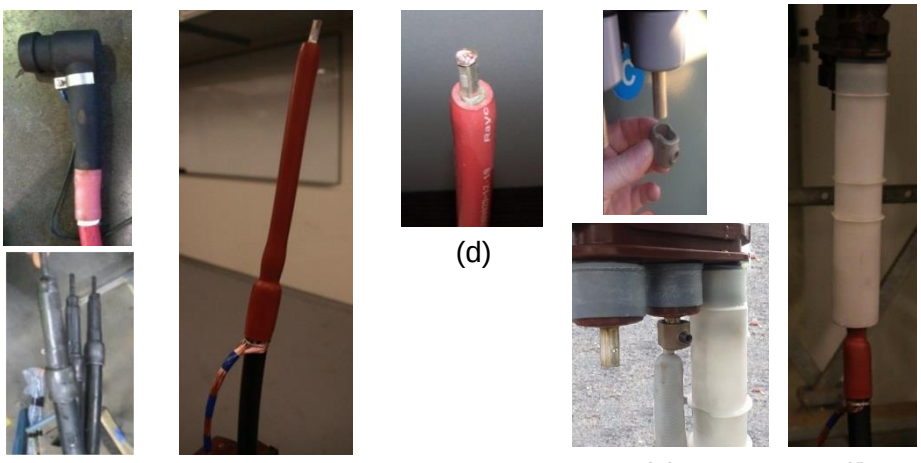
Table 13 - Typical cable connection summary

Switchgear	Min cable size (mm^2)	Switchgear end connection	Transformer end
Holec MD4	16-25mm Cu or 35mm Al	Spout lug	Note 1
Safelink ABB	25mm Cu or 35mm Al	Lug M12	Note 1
Metal clad Fuse	25mm Cu or 35mm Al	250A-Screened elbow Pin type	Note 1
Metal clad CB	70mm Cu	630A-Screened elbow Screw type	Note 1

Note 1:- All new transformer ends shall be 250A-Screened elbow Pin type, old transformers can have Spout lugs as shown in Figure 36.

If a cable needs to be constructed or modified to suit a spout lug then the following process shall be followed:

a) Remove the screened elbow and any reducer sleave on the transformer end of the cable.
b) Re-terminate the cable with an appropriate size indoor cable termination (S/C-SZ11122).
c) Hex crimp an appropriate sized tinned copper sleeve to the end of the cable.
d) Cut the crimp so that it is approx. 25mm in length.
e) Reuse the transformer ring clamp to connect the cable to the Reyrolle block.
f) Install phase insulating tubes back on to block.



(a) (b) & (c) (d) (e) (f)

Figure 40- Spout lug termination

If a lug is required on the end of a cable to connect to a palm then the same process would occur but replace the copper sleeve with an appropriate sized lug.

The cables earth screen shall be connected to the earth terminal at both the switchgear and transformer ends.

The cable shall allow for the minimum cable bending radius for the installation. For indoor substations the cable will need to suit the bending radius of the conduits as shown on the layout drawings. For padmount substations the cables need to be more flexible with a tighter bending radius due to the compact design.

For indoor substations the cables at the transformer end shall be supported as detailed on Drawing no. 061736.

Screened elbows for transformer and fused switchgear connections (250A elbow) are typically only suitable for cables up to 90mm^2. If the switchgear fuse/CB unit is located some distance away (ie remote switchroom to transformer room) from the transformer location a standard 240/300mm mains cable may not be able to be used and it will be necessary to have a suitable cable with adequate mechanical protection installed that will suit these connections.

The fuse/transformer screened elbow connection is a pin type design (see Figure 41). There have been occasions when the elbow has not been fitted correctly and the pin has not lined up with the centre of the connection. In these cases the pin has actually stretched the boot and slid down the side of the joint. It is necessary to check the connection and to confirm the retaining clip is fitted and there are no deformations of the boot prior to commissioning or serious damage can occur.

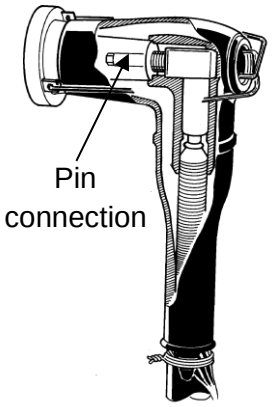


Figure 41 - Typical fuse/transformer screened elbow

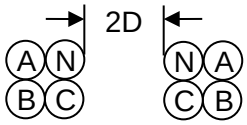
7.3.3.3 LV Switchgear

All new and replacement LV switchgear shall be fully insulated touch safe and be suitable for LV feeder cables up to 240mm^2.

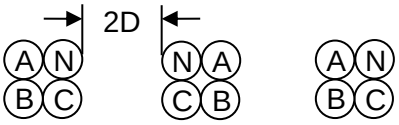
Cables between the transformer and switchgear shall be made with flexible cables.

Where the LV switchgear is located in a separate room or too far away from the transformer then a transition box may be required at the request of the Network Substations Manager.

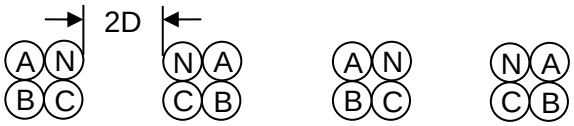
Single core LV cables from the transformer to the remote located LV switchgears shall be laid in quadrature with 2 times the cable diameter separation between each group (multiple single core cables of each phase and neutral bundled together) and arranged as shown in Figure 42 and as detailed in AS3008 appendix D.



Two (2) cables per phase



Three (3) cables per phase



Four (4) cables per phase

Figure 42 - Typical cable arrangement for multiple cores per phase

For loads less than 330A in padmounts and 350A in indoor substations, fuse strips are used. For individual customer circuit loads greater than this, circuit breakers are required.

All terminations to the transformer are to be insulated with Endeavour Energy approved boots. Terminations to LV cables are to have insulation up to the palm.

Only dead tag fuses shall be used in LV rated switchgear.

7.4 Padmount substations

7.4.1 Segregation requirements for other structures

Padmount substations shall be located where practical at the front property boundary.

There are a number of restrictions to construction near substations. Figure 43 shows the overall view detailing individual requirements where easements and covenant are required. Refer to EDI 100 for further information on easement and covenants required for general earthing and metallic fences /structures in substations with separate earthing.

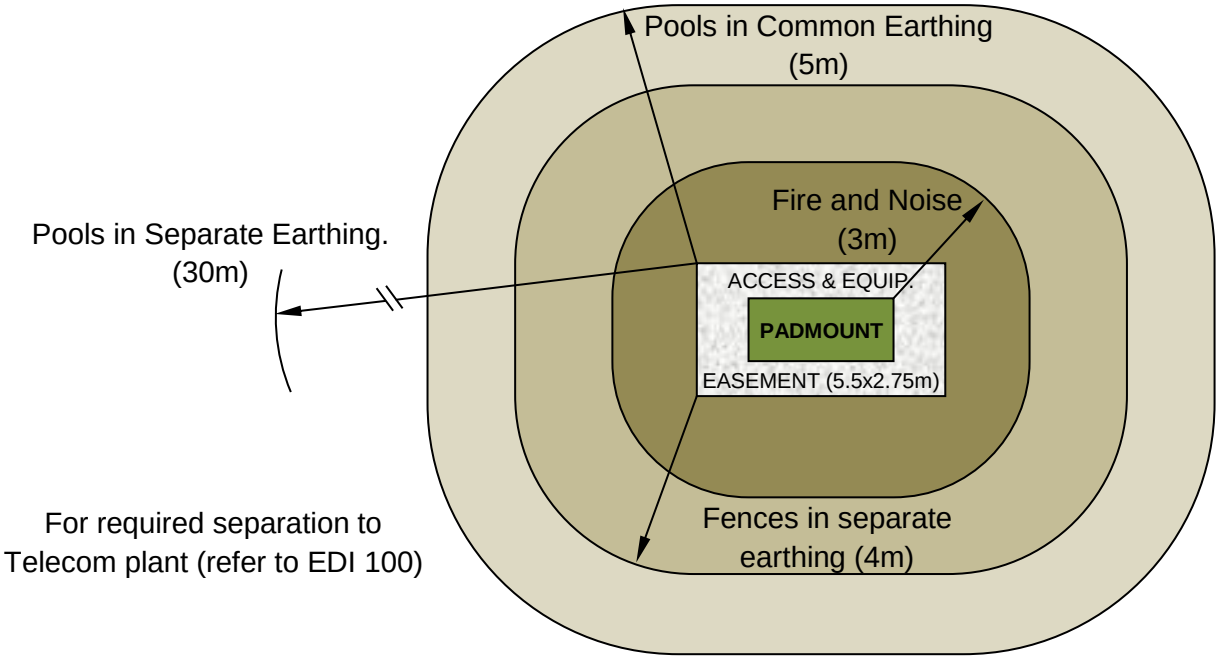


Figure 43 - All restrictions (Easement and covenants will be required)

7.4.1.1 Noise

Padmount substation sites shall comply with a nominal three (3) m noise separation between the substation and any building/living area. This three (3) m will usually satisfy acceptable noise levels in residential premises. Where a suitable fire/baffle wall is erected (by a developer/customer without cost to Endeavour Energy and with a certified sound report) the noise restriction may be reduced accordingly if approved by Endeavour Energy.

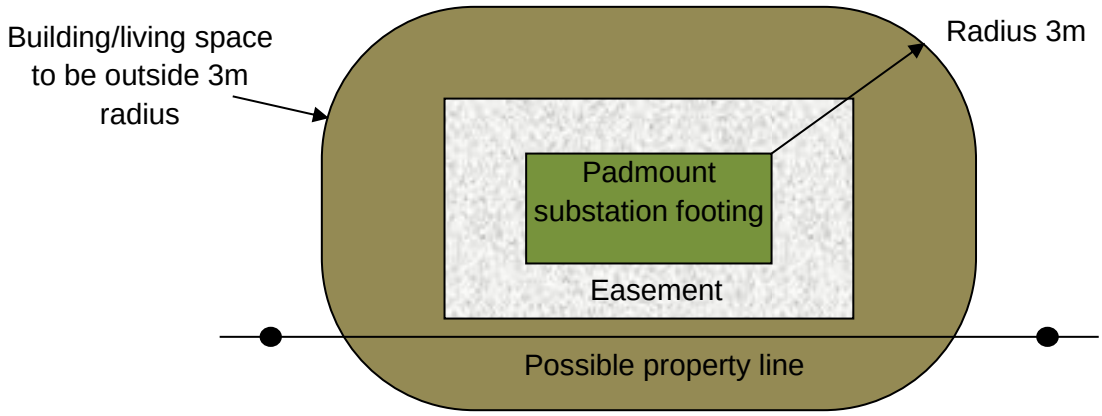


Figure 44 - Minimum clearance to building/living areas

7.4.1.2 Fire

Padmount substations require separation from neighbouring areas and buildings that are subject to fire risk. Separation may be by means of adequate clearances or building components having minimum fire resistance level (FRL) as set out in Figure 45.

Fire ratings shall be achieved by static means (that is, walls or distance) rather than active system (that is, deluge showers and the like).

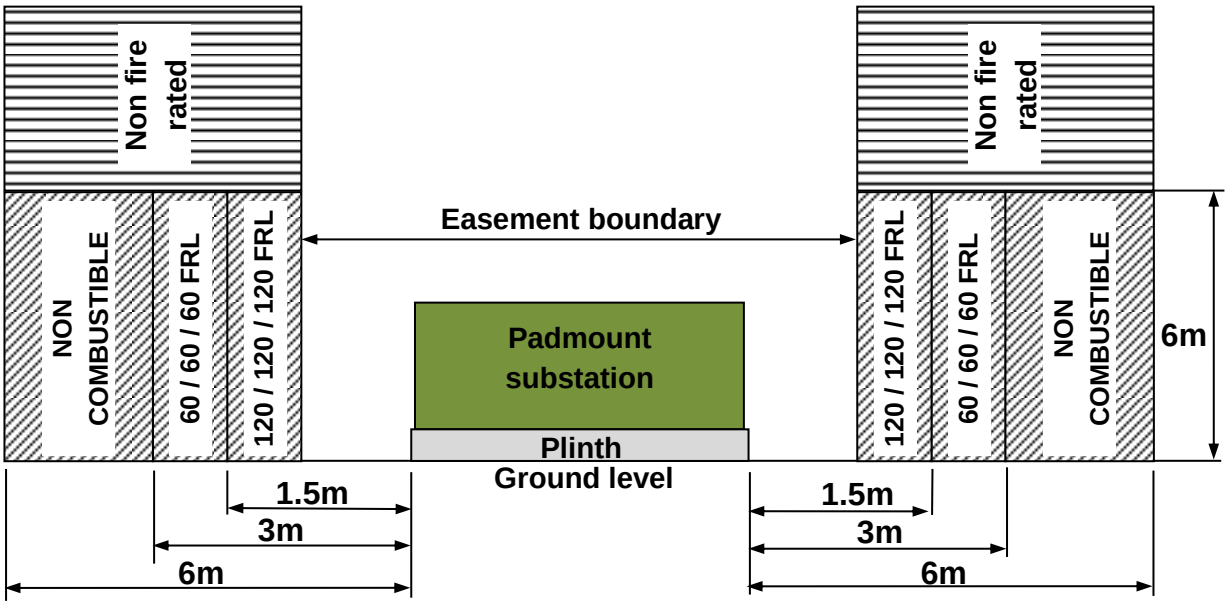


Figure 45 - Minimum FRL clearances for components

FRL means the grading period in minutes. The three (3) figures represent structural adequacy/integrity/insulation.

FRL of the materials, components and structures of the walls (barrier) shall be determined in accordance with the tests prescribed in AS 1530.4:2005 and the details below:

a) When a padmount substation is located under the overhang of a building, the substation may be considered to be within the building and the elements of the

building above and adjacent to the substation must have an FRL of 120/120/120. In these circumstances, a ruling must be obtained from the relevant government body.

b) Personnel access doors and fire exit doors to a building are not permitted within three (3) metres of the padmount plinth.

c) The material used in the construction of buildings between 3m and 6m shall be non-combustible, class 1 and 10 buildings are exempt but shall be considered.

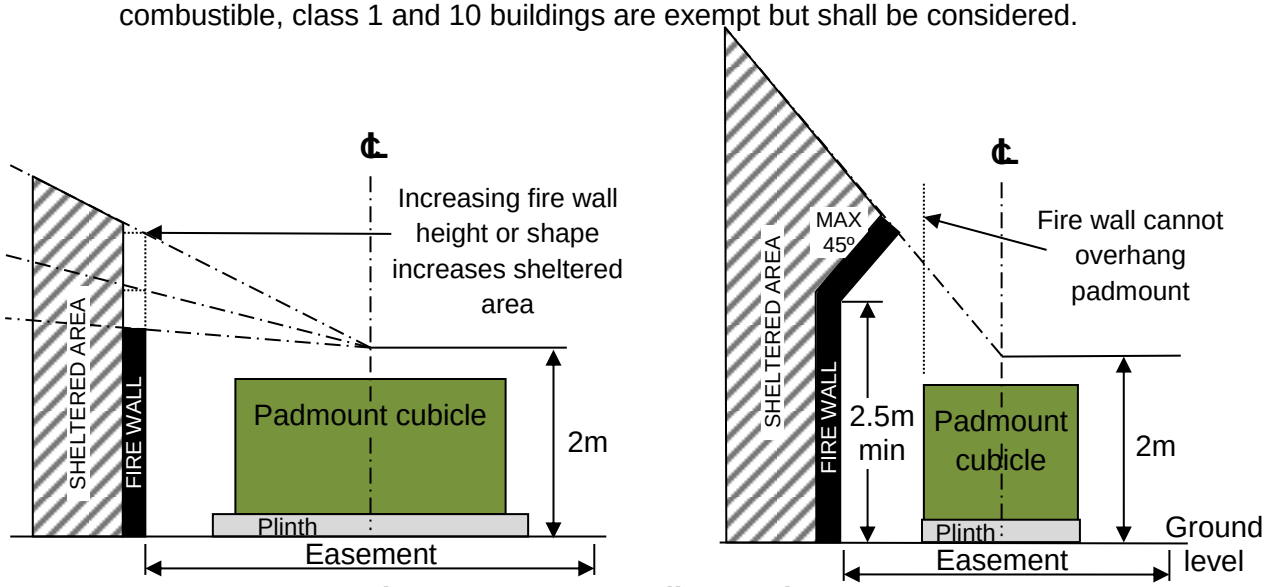


Figure 46 - Screen wall examples

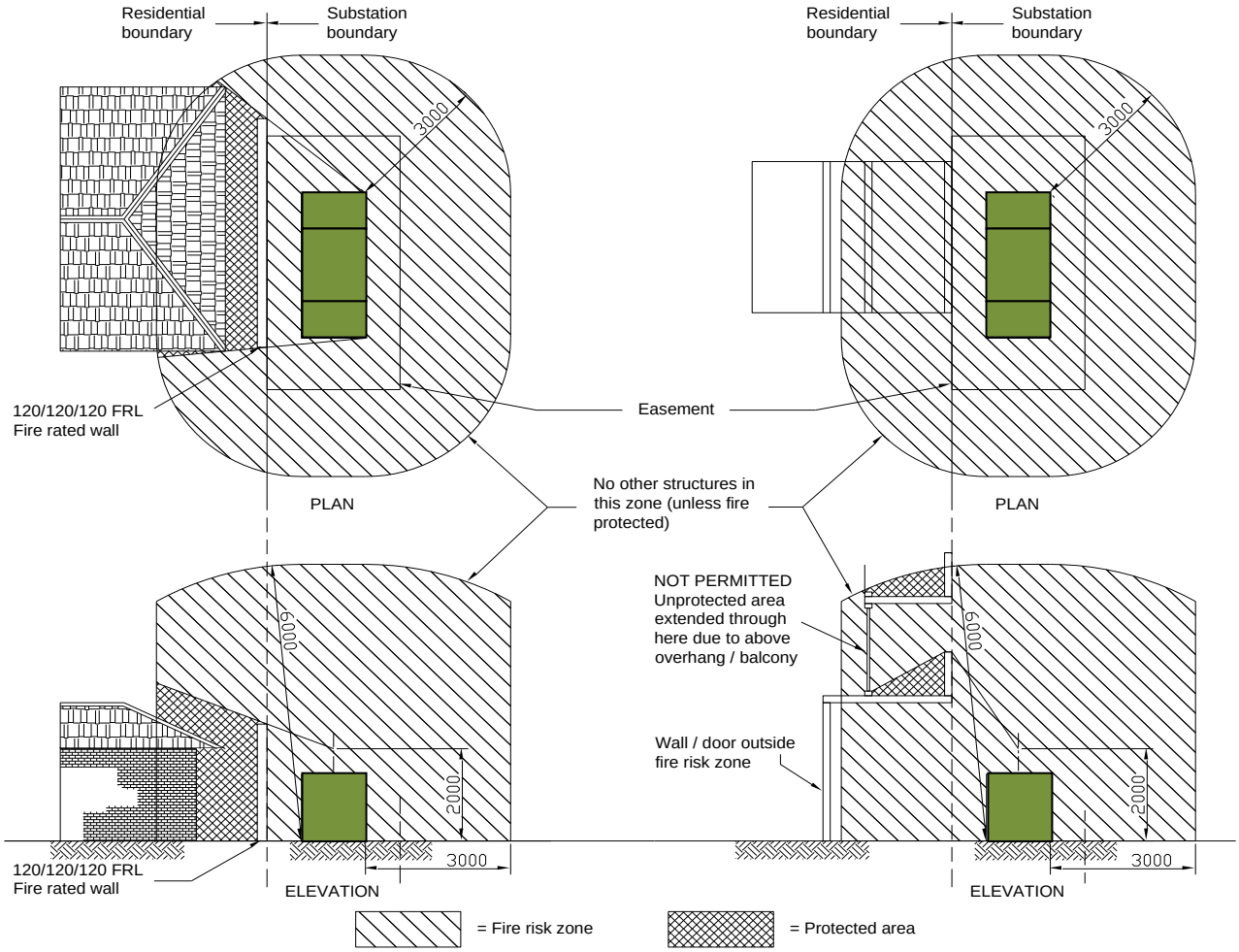


Figure 47 - Typical effect of screen walls

Where minimum clearances cannot be achieved, non FRL openings, for example, windows, may be permitted within the fire rated area of Figure 45 provided that suitable screening walls are installed to create sheltered areas. Such openings shall be within these sheltered areas as shown in Figure 46. Screen walls shall have a 120/120/120 FRL.

Screen walls shall be located outside the standard easement and no structure shall overhang the easement. No structure shall overhang a protected area that could trap smoke or fire and cause it to enter any openings in any structures.

7.4.1.3 Earthing

An accredited designer shall complete the design of the earthing system. More specific details of earthing constructions can be found in EDI 100 and the Earthing section of this manual.

Refer to EDI 100 for exclusion zones in respect of telecommunication equipment, fencing, conductive structures, metallic pipe lines, swimming pools and spa.

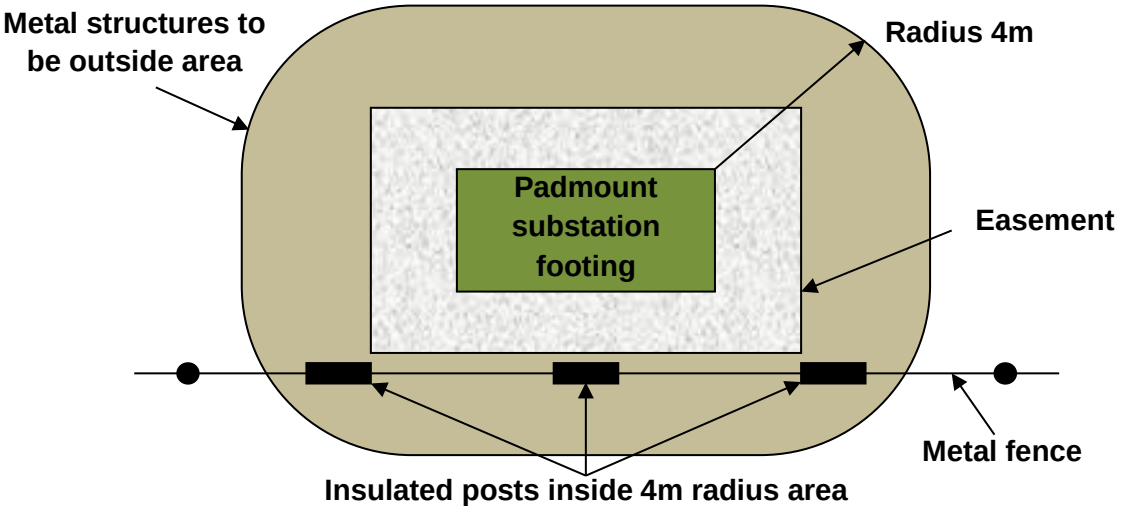


Figure 48 - Metal fence or metal clad building exclusion area

7.4.2 Substation site

7.4.2.1 Site contours and retaining walls

The easement represents the minimum working area required for normal operation of the substation and the following requirements must be adhered to:

- Substation site shall be flat and level over the entire easement area. It is the responsibility of the ASP to determine the easement location. Endeavour Energy will assess the easement based on the location, access and other conditions as indicated in this standard.
- Where it is necessary to carry out excavations to provide a level site, the batter adjacent to the site shall be no steeper than 1 in 3 for at least 1m outside the easement.
- Where a step is used adjacent and outside the easement the maximum step size (up or down) permitted is 300mm in each 1000mm.
- Retaining walls are to be used only when absolutely necessary. Retaining walls may be up to 700mm in height (maximum of 1000mm after approval from Network Substations Manager) constructed from concrete or brick, but not treated pine. Where required, they shall be constructed outside the standard easement and at the

ASP's cost. The retaining wall must comply with the relevant building codes and local government requirements. For drops greater than 300mm a hand railing shall be installed unless otherwise approved by the Network Substations Manager

- Where necessary, the substation easement location and size shall be altered and increased as shown so that the retaining wall (or vehicle impact protection device, such as bollards) is wholly within the one property boundary and the easement includes the retaining wall (or vehicle impact protection device). If this condition cannot be met, an alternative may be considered on application. The property owner is responsible for maintaining the retaining wall however Endeavour Energy reserves the right to make alterations.

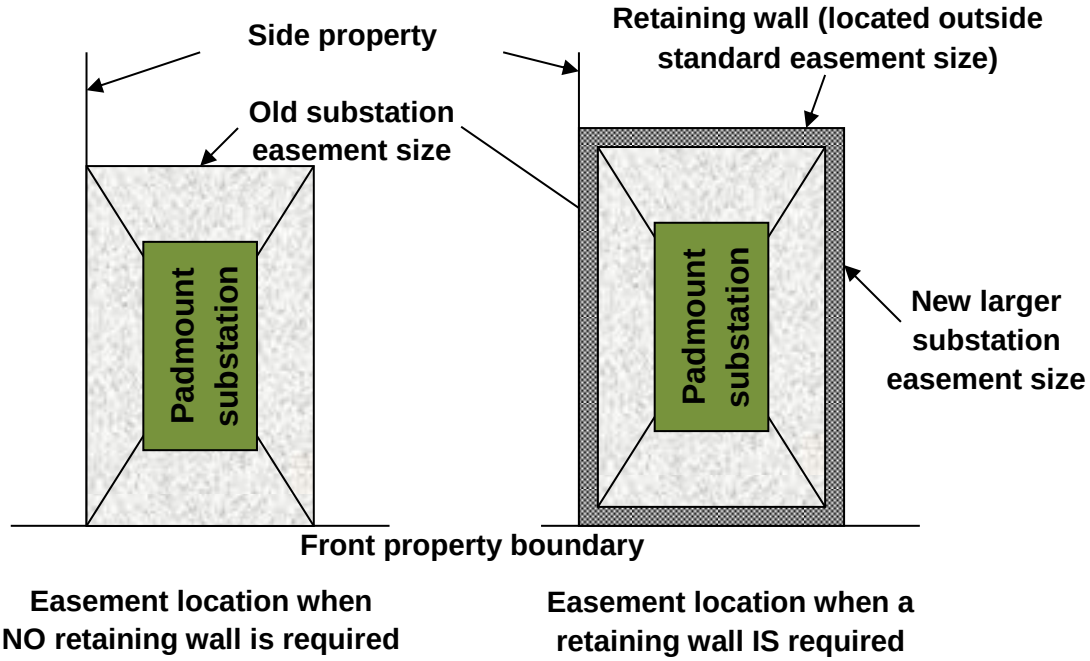


Figure 49 - Easement location details

7.4.2.2 Foundation requirements

The substation site is required to be stable and clear of any obstruction that could interfere with the installation of the earthing electrodes that may extend to a depth of 30 metres.

Drawing no. 076665 details the padmount substation culvert footing installation.

Where there is any doubt as to the suitability of the site (for example, old fill material), either test bores or a geo-technical report shall be carried out.

If the substation is to be located on a suspended slab, and there is a basement level car park, lift room, and the like below, provision must be made to prevent any oil spillage into them and they shall meet the requirements for an indoor substation. The costs of such modifications are to be met by the customer.

In such a situation, the customer shall provide physical support, mechanical protection and 120/120/120 (minimum) FRL for Endeavour Energy's incoming cables.

If modifications to prevent oil spillage are not practicable, then before finalising the design, approval will be required from the Network Substations Manager for either a padmount substation with a low flammability (FR3) transformer of it may be necessary to have an indoor substation with dry type transformer.

If the substation is to be located on or adjacent to a concreted area or any other hard surface or an area with restricted access for cabling such as raised platform substation, then 1.0mx1.0mx1.0m internal dimension access pits and lids shall be provided for the entry of HV and LV cables as shown in Figure 50. Pits and lids shall be constructed and labelled in accordance with the details in section 4 - Trenching, conduits and cable installation.

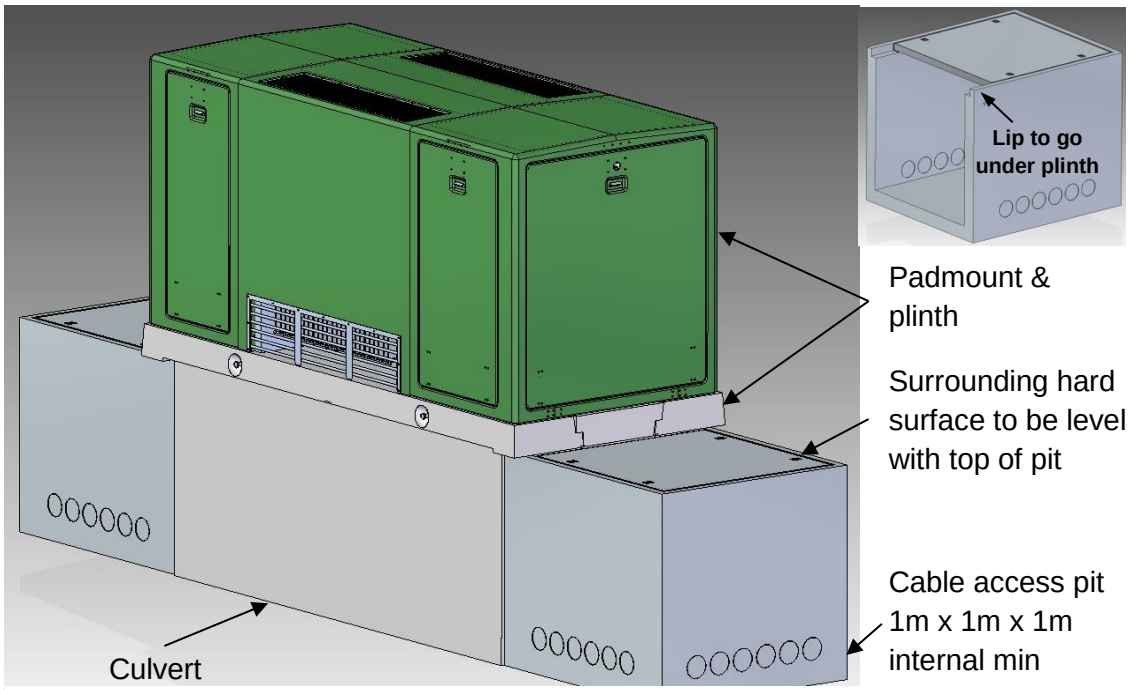


Figure 50 - Example substation with access pits

Figure 51 - Example substation raised above 1:100 flood level

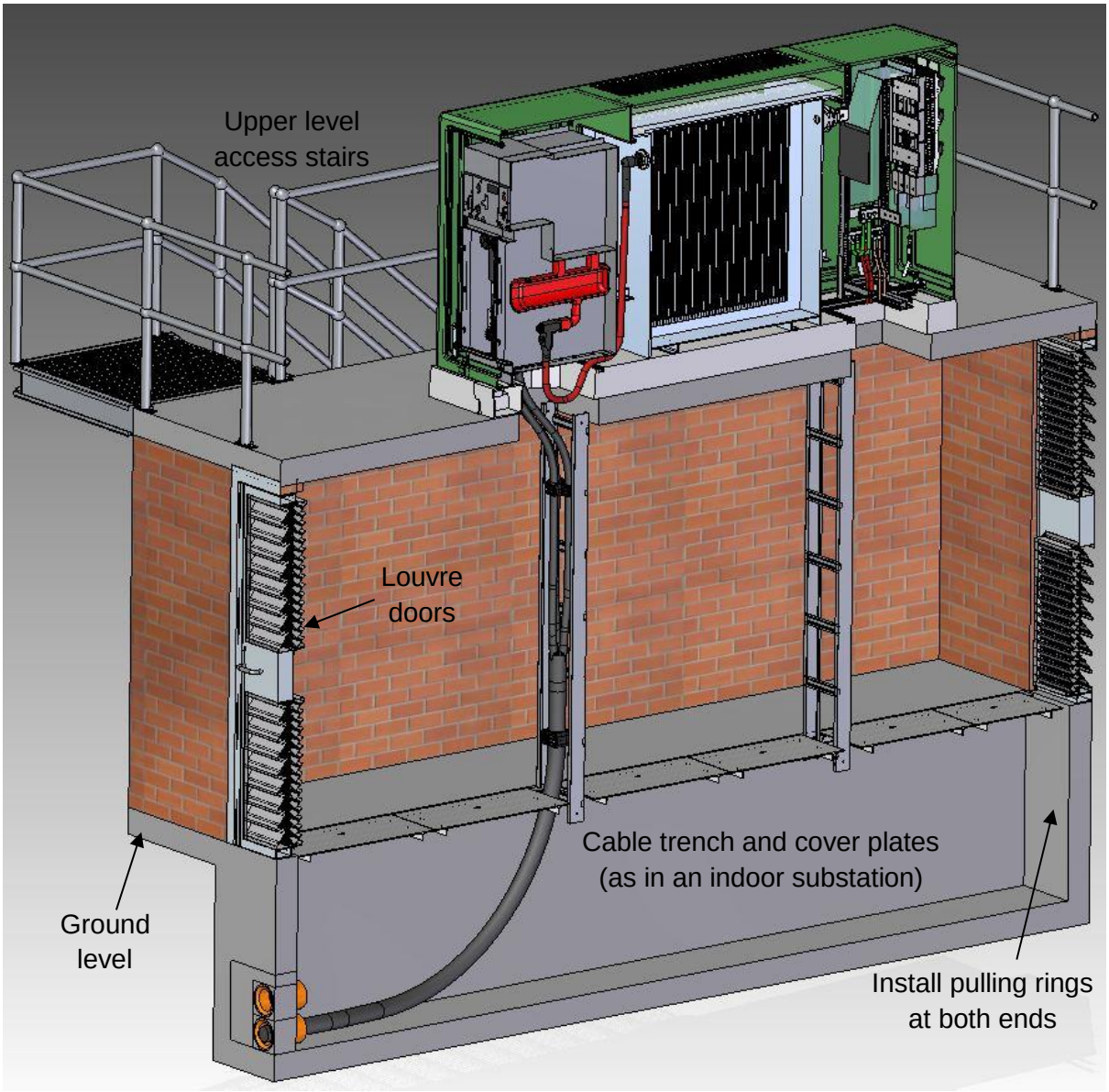


Figure 52 - Section view of example raised sub

If a basement is used under a raised substation for cable access then the basement shall have two (2) doors with a concrete floor. The floor and trench shall be sloped and drained to a suitable location to prevent water pooling or silt forming. A couple of points for natural drainage shall be provided to drain the trench. Approval by the Network Substation Manager is required if drains are installed and as a minimum all drains would need to be fitted with flame traps. The room shall be vented to help remove moisture from the room.

On the inside of the door there shall be a chain across the door to prevent entry. The chain shall be fixed at one end and have a simple hook on the other end to allow access. On the chain there shall be one sign that indicates Danger High Voltage and another sign indicating there may be trip hazards inside.

Cables shall typically enter the cable trench flat and then be laid up to the cable tray as a three (3) core cable with a bending radius suitable for the cable. If the raised platform is less than two (2)m then the cables can also be trifurcated on the trench floor and the single cores will need to be secured together at intervals of approximately 1m.

The cable shall be supported by a secure and earthed cable tray system from the floor to the roof of the basement with cable clamps at intervals of approximately 1m for the complete length to the switchgear. The cable tray system shall be hot dipped galvanised and strong enough to withstand the weight and forces developed in the cable during faults. Details of the cable tray system shall be provided for approval by the Network Substation Manager.

Pulling rings shall be installed in both ends of the trench to allow cables to be installed.

An earthing design is required for each raised substation and would generally be in line with an indoor substation.

7.4.2.3 Landscaping

The finished surface of the substation easement shall be such that it can be readily removed and/or restored. Materials such as grass, asphalt, pine bark, wood chip, blue metal, and the like are acceptable.

Screening vegetation is to be maintained in such a manner that it will allow employee access at all times. Shrubs shall be planted a minimum distance of 800mm plus half of the full-grown canopy width from the substation.

7.4.2.4 Avoidance of services and encroachments

Services such as drains, piping, or wiring are not permitted to pass through either the substation easement or the ground below it, even in those cases where an easement may not be required these requirements still remain. Sewers may only pass through the substation easement adjacent to the street boundary and only when the substation site has been lengthened accordingly. Refer Drawing no. 016665.

Neither overhead nor underground gas mains/pipes shall pass through the fire restriction area (three [3] metres) around the substation.

A 10 metre clearance distance shall be maintained between substation and fire hydrants, booster valves, and the like in accordance with AS2419.1.

To allow suitable and safe operation of the equipment, hazardous materials shall not be stored closer than four (4) metres to padmount substations. Rubbish and other combustible items must be protected by a suitably fire rated cover if stored within three (3) metres of the padmount substation.

7.4.2.5 Cubicle doors with restricted access

In some situations the width of the switchgear in padmounts requires that the cubicle doors be modified to allow extra room. This modification includes the removal of the spring latch and the fitting of a fixed bracket as shown below. This will allow an extra 40-50mm of space.

The bracket is fitted to the door after the switchgear and cubicle is installed using a spanner.

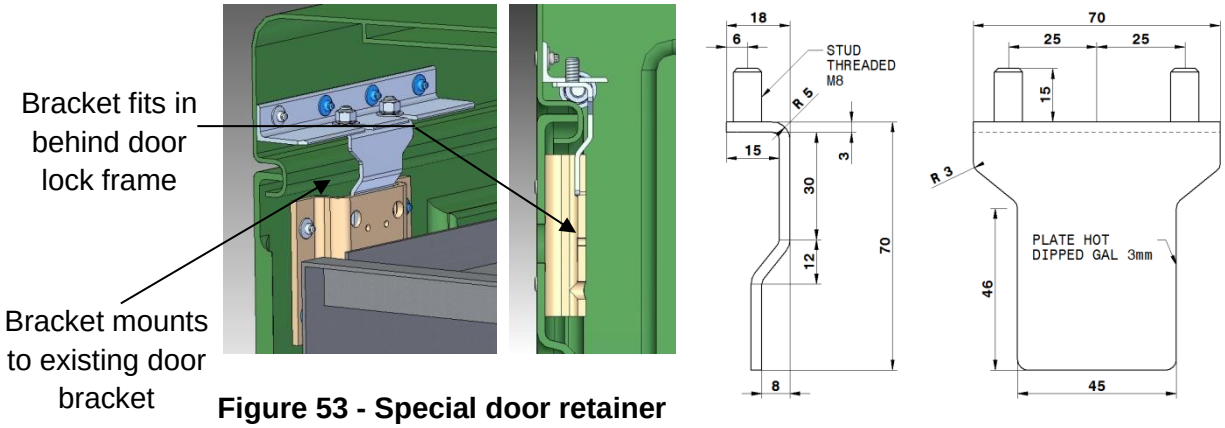


Figure 53 - Special door retainer

7.5 Indoor substations

7.5.1 Substation location

Where a substation is required within a customer's premises, it shall be located entirely at street or ground level with personnel and plant access off same level. Any deviation from this shall require the Network Substation Manager's approval in writing.

If a deviation is approved the HV switchgear shall still be located at street or ground level (with access at that level) and the transformers may be at another level.

Due to fire and safety requirements, dry or transformers filled with K-class oil having a high flash point (>250^{0}C) will be required in all indoor substations within or located on the external wall of other buildings or where tenants may be below or affected by fire. The selection of a dry or high flammability transformer shall be at the Network Substation Manager's approval.

7.5.2 Construction drawings

All construction shall be carried out in accordance with Endeavour Energy's approved construction drawings. Construction drawings shall include as a minimum all Endeavour Energy requirements as set out on the Endeavour Energy standard layout drawings.

The dimensions shown on the Endeavour Energy layout drawings indicate finished sizes required in the building and allowance must be made for wall and floor finishes. Standard substation layout drawings are also issued to customers to enable preparation of architect's drawings.

Where special alcove type switching rooms have been approved for use, the design shall be in accordance with drawing no. 053914.

Construction of the substation shall not begin before written approval of the construction drawings is received. If construction begins without approval, Endeavour Energy will hold itself free to refuse to accept the substation building if the work carried out is not suitable for its requirements.

Dry type transformers may require special consideration for room dimensions.

7.5.3 Access requirements

Refer to clause 7.1.2 – Minimum access requirements for details of the minimum access requirements to be followed.

Emergency escape lighting and signs as required in AS 2293.1 shall be provided at all exits of the building.

7.5.4 Building walls, floors, ceilings and basements

7.5.4.1 General

The design of the substation room must be carried out by a qualified; practising structural engineer and shall comply with the requirements of the Building Code of Australia and AS2067. Construction is to be of adequate strength to protect the customer's property in the rare event of equipment failure. The following clauses and clause 7.5.18 – Fire protection and rating requirements detail the minimum building criteria.

The building shall be suitable to withstand an internal pressure of minimum 2.0 kPa.

All necessary horizontal and vertical dampcourses shall be provided and the chambers shall have dry wall, floor and ceiling conditions before acceptance for installation of substation equipment.

The waterproofing of the substation chamber and the entrance and exit chambers shall be such that its effectiveness shall not be impaired by the drilling and fixing of expansion bolts for the attachment of equipment to walls, floor or ceilings.

Those parts of a substation construction, which are below ground, must include vertical and horizontal moisture barriers, and the use of drained cavities is required. The substation floor and walls must be suitable for withstanding hydrostatic pressure, incorporating waterproof membrane at construction joints.

Where required, wall anchors and/or pulling ring sockets shall be installed in the floor or walls, in the position shown on the layout drawings and in a manner to achieve any working load specified.

7.5.4.2 Walls

All walls shall be suitable to withstand an internal pressure of minimum 2.0kPa. Typically this would be achieved with solid filled concrete walls, double brick wall, or core filled concrete block walls.

a) Internal

Provided the following types of walls are erected in a tradesman like and professional manner and cleaned, then cement rendering is not required:

- Face bricks with ironed joints.
- Solid concrete block work with ironed joints.
- Concrete walls using dressed formwork.
- Concrete rendering, when required, shall be a 3:1 sand cement mix.

Internal walls must be of solid construction to maintain the fire resistance level when drilling and fixing expansion bolts for the attachment of equipment.

b) External (exposed to weather)

External walls shall preferably be of cavity construction; however, approval for alternative construction methods, such as high density concrete panels, will be considered, subject to testing to satisfy Network Substations Manager, Asset Standards and Design that they are impervious to moisture.

7.5.4.3 Floors

The floor slab shall be designed and constructed to carry the substation equipment distributed as shown and of mass indicated on the layout drawings.

The floor shall consist of reinforced concrete slab on ground construction incorporating trenches and conduits. In some instances suspended slab construction may be used, depending upon the substation design.

Generally, the substation floor level at the equipment access door shall be within the range of 150mm to 200mm above ground or road level adjacent to the door for weatherproofing.

All corners formed within trenches shall be well rounded and smooth, finished off-dressed formwork or rendered with 20mm waterproof cement render.

Trenches or penetrations shall be provided with aluminium tread plate covers to dimensions and quantities as specified on the drawings. Each section shall have two lifting eyes to the detail supplied, and two suitable lifting handles shall be provided. Steel chequer plate covers are not permitted.

The following tolerances apply to the floor grade unless specified otherwise on the layout drawings:

- ± 2.0mm over any 1500mm diameter circle.
- ± 4.0mm over the entire floor.

Topping shall be finished to a true and even surface of a steel trowel. The finished surface shall be uniform in appearance, dense and smooth, suitable for moving equipment across it by use of Aero-Caster load modules. Any surface irregularities shall be filled with Silastic compound filler prior to sealing the floor with penetrating sealers (not topical sealers).

7.5.4.4 Ceilings

Concrete (as part of another building)

The ceiling finish shall be of dressed formwork or rendered as for walls.

Roofing (as a standalone building)

For substations separated from the customer's building, the roof may consist of metal decking on metal or timber framework, in lieu of concrete, with an approved manufacturer's 60/60/60 FRL gypsum plasterboard ceiling. A vapour barrier shall be incorporated between the ceiling and metal decking. The use of the concrete roof of a substation for a garden or landscaping area is not permitted.

7.5.4.5 Cable basements

Substations with cable basements are not permitted. If a standard cable trench in accordance with the indoor substation design and drawing 297547 cannot be provided then a dispensation shall be requested through the normal process.

7.5.5 Doors

7.5.5.1 General

Doors are to be of minimum sizes as indicated below. Doorways are to be clear openings free of all projections.

All door jambs (fixed door frames) shall be made of steel and be earthed. All metal doors shall be earthed using a flexible copper braids to connect them to the door jambs.

All doors of a substation shall be of solid core construction unless specified otherwise. All doorways opening to any other part of the building must be protected with self-closing minimum 120/120/30 FRL doors. These doors and their door jamb shall be tight fitting and of an approved fire underwriters type. All doors opening to the outside of a substation shall be weather proof.

Thresholds to external doorways shall be provided with a suitable means of weatherproofing such as a 25mm step.

Where the personnel door is a louvre, a minimum clear space of 200mm above and below and 100mm past the end of the lever handle shall be provided to allow for unobstructed access. Alternatively the lever handle may be extended such that it clears both stages of the louvres.

All doors, including personnel doors, shall be fitted with a minimum of three (3) hinges. More hinges may be required for larger doors to give correct support. All hinges shall be fitted with removable stainless steel pins.

Any ventilation opening adjacent to any door lock shall be fitted with a suitable barrier to prevent unauthorised opening of the door lock and prevent vandalism to the door lock.

For doors with louvres refer to clause 7.5.17.

7.5.5.2 Hardware

A deadlocking latch bolt, operated by a handle from inside and key from outside, is to be fitted to each personnel door or designated leaf of the equipment access doors.

The following hardware and lock cylinders shall be fitted:

Personnel (timber) doors:	Lockwood 3572SS mortice lock	
	Inside furniture:	1905/90
	Outside furniture:	1801/90 or D handle
	Lock cylinder:	D2

Louvre doors can have either the above or;

Aluminium doors:	Lockwood 3582SS mortice lock	
	Inside furniture:	5905/70
	Outside furniture:	5801/70 or D handle
	Lock cylinder:	D2

Door handles are required to have adequate clearance to allow a gloved hand to operate them. Therefore, a minimum of 45mm clearance between the inside of the handle and the door shall be allowed in accordance with AS 1428.1:2009.

Door handles shall be located at a height above the flat ground level of between 900mm and 1100mm in accordance with AS 1428.1:2009.

A full-length barrier is to be fitted to the leading edge of each personnel door or designated leaf of the equipment access doors to prevent unauthorised opening of the door lock.

7.5.5.3 Lock cylinders

The hardware provided must be capable of being fitted with the following cylinders.

Lockwood 570 series - oval type (for 3572 series locks).

The Abloy “D2” cylinder is to be used to lock an Endeavour Energy Indoor substation.

7.5.5.4 Personnel door

The minimum size shall be 820mm wide by 2040mm high. All personnel doors shall open outwards and be capable of being opened from inside the substation by means of quick release emergency panic locks that is, fitted with a single action escape door lock.

7.5.5.5 Equipment door

This door may be either a roller shutter as specified below, or 180° opening hinged weatherproof and vermin proof louvre doors. Unless specified otherwise on the layout drawing, a minimum clear dimension shall be maintained of 2000mm wide by 2700mm high for transformers and equipment.

In the event of equipment failure, the equipment door is a means of providing pressure relief for the substation, therefore minimising structural damage.

The roller shutter shall be manufactured from 50mm or 75mm wide 1mm thick aluminium slats, finished to customer specification. The door shall be coated with a minimum 18 microns thick Kalcolor bronze anodising.

The roller shutter overall curtain width must be 12mm less than the doorway clear opening (refer Figure 54) and shall be fitted with padlocking facilities on the inside on both edges, which will accept Endeavour Energy’s padlocks having a 10mm shank. The roller shutter curtain shall be provided with a chain drive.

Hinged louvre doors, unless specified otherwise, shall be fitted with padlocking facilities on the inside bottom of each door, which will accept padlocks having a 10mm shank. Pad bolts fitted to the top of each leaf shall be accessible without the use of a stepladder.

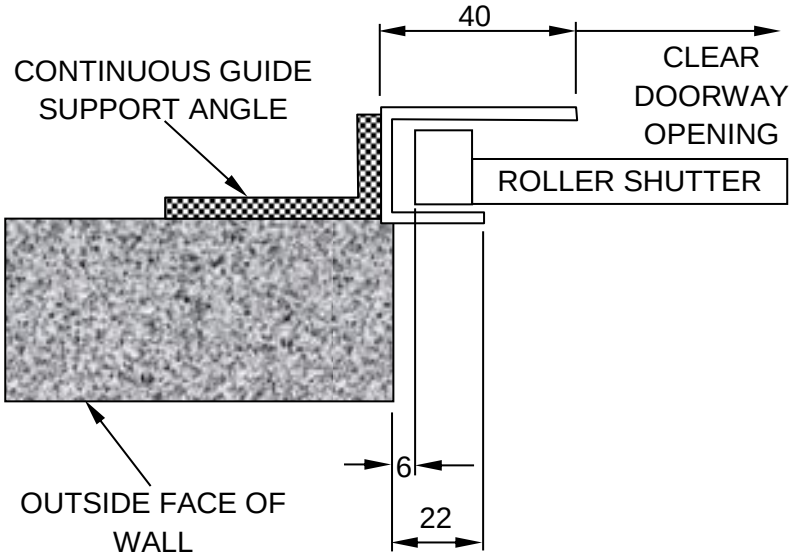


Figure 54 - Roller shutter door guide installation details (one side only shown)

7.5.5.6 Hatchway access substations

Installation of substations with hatchway access is not permitted.

7.5.6 Conduits, cable supports and enclosures

7.5.6.1 General

All electrical conduits, cable enclosures, cable trays and supports for cables shall be provided as specified. Cable pits may be required where a change in direction or level occurs. In certain locations these may require concrete Gatic style covers.

Endeavour Energy Asset & Network Planning will specify the number and size of conduits required:

- Where conduits pass through external walls they must be installed in a manner that prevents the ingress of water into cavities, pits, trenches or the substation chamber. Also at these locations all conduits greater than 100mm shall be fitted with bellmouths.
- Where Endeavour Energy's incoming conduits are required to pass through open spaces such as basement level car parks, and the like, they shall be fire rated to a minimum of 120/120/120 FRL and mechanically protected. "Danger" signs shall be fixed to the full length of all conduit routes at approx. 1.5m spacing. In instances where the conduit route deviates to avoid beams, columns, and the like, concrete encasement is required. Refer to Section 3 – General construction requirements for more details.
- Minimum cover to the top of HV conduits from ground level shall be 750mm. If this dimension cannot be achieved, concrete encasement will be required.
- Unless otherwise specified, all conduit bends are to be a minimum 1000mm radius. For some cables such as mains cables with larger bending radii (2000mm min when mechanically installed) the size of the conduit bends will need to be increased to suit the cable.

Conduits between substation rooms shall be concrete encased and sealed to prevent fire travelling between rooms or inflicting damage to adjacent cables when a fault occurs in any one of the cables.

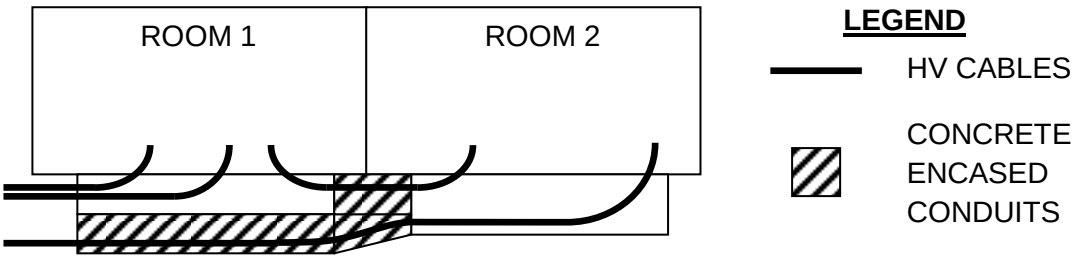


Figure 55 - Typical protected cable detail for multiple rooms

Cables are usually run along footpaths in a 600mm wide allocation, 300mm out from the property boundary. As these cables have a 2000mm minimum bending radius, it is necessary to commence bending within the customer's property. Therefore, where conduits pass through the wall of a building constructed within 800mm of the boundary, it will be necessary to construct a cabling alcove in this wall. Refer clause 7.5.6.2 Conduit specifications and Drawing no. 054738 for typical details.

7.5.6.2 Conduit specifications

Conduits shall conform to the requirements of Section 4.4 - Conduit and cable installation of this manual.

a) Types allowable for power cables shall be UPVC or Polyethylene nominal bore 125mm or 150mm smooth bore-smooth wall heavy duty underground conduit laid with appropriate sand bedding, without any further mechanical protection.

b) Type allowable for other uses within the substation shall be heavy-duty, complying with AS 2053 (Light and Power Layout).

7.5.6.3 Cable riser (where cables/conduits are not concrete enclosed)

Full access to cables is to be provided at all times. Doors extending the full height and width of the riser shall be provided. The height of the cable riser can be divided into multiple door panels provided the fire rating is not reduced at panel joints and any frames between panels do not impede access to cables. The doors are to provide a minimum 120/120/120 FRL.

The doors shall be arranged such that they provide full access when they are fully open. It is preferable to have a 180^{o} swing on these doors. Each door leaf is to swing on its frame using heavy-duty non-corroding metal. The width of the riser may be covered by single or double doors.

A clear area of at least one (1) metre is required in front of cable riser doors. Where multiple transformers are being fed, each set of cables shall be separated within the cable riser so that fire in one set does not spread to other sets or alternatively each set of cables may be placed in separate cable rises.

After installation of cables in cable risers, floor fire barriers shall be fitted. These shall be installed at all cable floor crossings/passing. The fire rating shall not be less than the fire rating of the riser. The barriers shall be easily removable and any supporting framework shall not interfere with cables and shall not diminish the floor opening.

LV control cables shall be laid in separate conduit risers.

7.5.6.4 Inspection

On receipt of forty-eight (48) hours' notice, Endeavour Energy's Network Connections employee may check the set out of conduits, before concreting is commenced. It is the responsibility of the builder to contact Endeavour Energy for this inspection.

The builder will be required to draw a proving mandrel, provided by Endeavour Energy, through the conduits where considered necessary, after the conduits has been laid. Suitable exposure of the conduits shall be the builder's responsibility.

7.5.7 Drainage

7.5.7.1 General

Substation basements, HV trenches and substation floors are to be gravity drained to a point free from risk of surcharge. HV trenches shall be drained in straight runs by minimum 50mm diameter copper or rigid PVC pipe. Where this is impractical a collection sump system may be provided if approved by Network Substation Manager.

Drainage openings in basements and trenches shall be provided with grates to prevent blockage.

LV trenches shall not be connected to the drainage system unless connect by a flame trap.

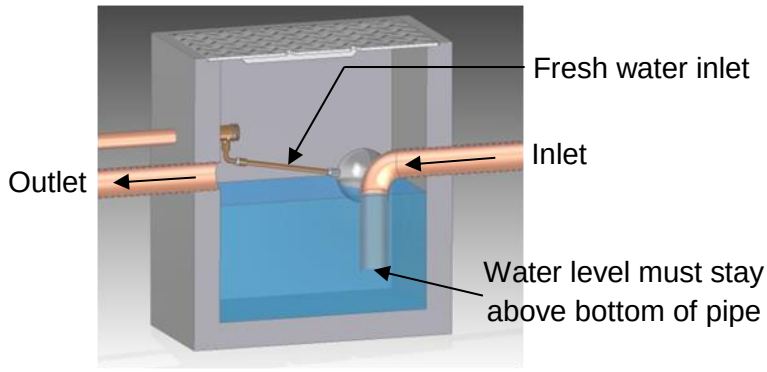


Figure 56 - Example flame trap

7.5.7.2 Basements and trenches below potential water table

In situations where the lowest level is below the level to which the water table may rise under any conditions, the underfloor area of the substation shall be filled with permeable material and drained to a point free of surcharge or otherwise to a sump external to the substation. The sump shall be fitted with an automatic discharge pump, with authorised persons only having access to the switch arrangements and the sump managed by the customer only.

The customer shall be responsible for providing, installing, wiring and commissioning all the power supply arrangements for this pump, with authorised persons only having access to the operating switches.

7.5.8 Fluid spillage/bunding

Provision shall be made within the substation for the containment of fluid spillage from the transformer(s), in the unlikely event of a fluid (oil) filled transformer tank failure. Spillage from transformers shall be contained within each transformer area by steel bund walls in accordance with clause 7.5.22 – Transformer bund wall.

7.5.9 Retaining walls

Where a retaining wall is necessary, the substation internal wall will be separated from the retaining wall by a cavity. This cavity is required to extend below the substation basement or trench floor level and be gravity drained to a point free of surcharge, or otherwise to a sump as described under clause 0 - Drainage.

7.5.10 Vermin proofing

Suitable steps shall be taken to check that the substation, when completed, is vermin proof.

7.5.11 Light and power supply

Lighting and power requirements shall be provided as indicated on the layout drawing. The distribution board within the substation is to be located as shown on the layout drawing and shall be for Endeavour Energy's use only.

The supply is to originate from the customer's distribution board. Circuit breakers or current-limiting fuse links mounted on the distribution board shall protect all circuits. This section of the installation shall comply with the AS 3000.

Cables to HV trenches for heaters, remote control motors, and the like, may be required to come from the distribution board to the HV trench.

Mounting heights above floor level:

- Top of distribution board 2000mm.
- Power points (GPOs) 1000mm.
- Light switches 1350mm.

Light fittings shall be fixed to the ceiling. Where the ceiling exceeds 4000mm, the fittings shall be suspended at 3500mm. Where wall mounted units are approved by Endeavour Energy, they shall be installed at 2200mm.

One (1) emergency exit light shall be installed within the substation adjacent to each personnel door. The 240 Volt supply to these lights shall originate from the distribution board within the substation.

7.5.12 Painting

7.5.12.1 Walls and ceilings

Painting with two (2) coats of white PVA water based emulsion, semi-gloss finish, applied to manufacturer's specification, is required when the following finishes are used:

- Concrete.
- Cement render.
- Concrete block work with ironed joints.
- Brickwork other than face brick with ironed joints.
- Plasterboard.

7.5.12.2 Floor

The building floor with exception of tiled surfaces and the basement floor area shall be sealed using a suitable sealer to minimise the formation of dust.

The sealant shall have the following properties:

- Prevent formation of concrete dust
- Abrasion resistant
- Non-slip
- Non-flammable
- Concrete penetrating type, not just a surface coating
- Resistant to oil and grease
- Chemically stable with concrete floor

The sealant colour required is golden yellow or similar.

The product Cement-aid-Diamite, or an approved equivalent that have the above mentioned properties, can be used for this purpose.

One (1) coat of the above sealant shall be applied to the building floor immediately after the building construction is complete but before any switchgear/equipment is brought into the building for installation. Subsequent coats of the sealant shall be applied prior to commissioning in accordance with manufacturer’s recommendations.

The following paints are suitable for use and others may be considered after submission, Acidol, Amerlock 2K and Durebild STE.

7.5.12.3 Steelwork

All exposed ferrous metalwork; doors and frames shall be galvanised or painted with one coat of zinc rich primer then finished with two coats of enamel paint.

7.5.13 Telephone

When requested by Endeavour Energy, the customer shall install a telephone with a direct line to an exchange in the substation room at no charge to Endeavour Energy. Endeavour Energy will pay the rental and metered calls. A 20mm diameter PVC conduit, approved by the telecommunications authority, shall be provided between the substation telephone point and the main telecommunications distribution frame in the customer's building.

7.5.14 Anti-vibration pads

Provision must be made for lifting transformers onto anti-vibration pads. This can be in the form of a lifting beam or jacks. If jacks are used, and a method other than a lifting beam is used to raise the transformer to the substation room level (platform, direct placement), a lifting beam is not required to be fitted in the substation room.

7.5.15 Rollers and jacking pads

All transformers shall be either fitted with bi-directional rollers or jacking pads to aid relocation inside the substation. Rollers shall be lockable to prevent unwanted movement.

7.5.16 Wall anchors

Wall anchors and/or pulling ring sockets shall be installed in the floor or walls, in the position shown on the layout drawings and in a manner to achieve any working load specified.

7.5.17 Ventilation/pressure relief

7.5.17.1 General

Substations require special attention to ventilation in order to dissipate continuous transformer heat losses and any overpressure developed during faults from equipment.

All louvres and louvred equipment access doors shall be two (2) stage constructions. Where louvres are inaccessible and protected from water spray (for example, three [3] metre high inside a basement) then single louvres may be allowed if approved by the Network Substation Manager.

All louvres shall be of sufficient strength to be vandal proof and corrosion resistant.

Ventilation openings must be vermin proofed using galvanised steel mesh type 'Ornamesh' Cat. No. D1020 (by Lysaght Brownbuilt Industries) or equivalent. Ventilation openings must be weatherproof.

Two-stage louvres shall be installed on all available doors and walls to firstly achieve the maximum **natural** ventilation and pressure relief area irrespective of if forced ventilation is added. Generally, in order to achieve the temperature as specified below, forced ventilation by means of a fan(s) will also be required. Forced ventilation systems shall be designed, supplied, installed and maintained by the customer without the need to enter the substation. The ventilation must be forced into the room not extracted out and be sufficient to maintain a maximum temperature of 5º Celsius inside the substation building, above the air intake temperature.

The design of the ventilation shall be carried out by a certified ventilation engineer with the room operating at maximum load and shall demonstrate the temperatures of the room with and without any forced ventilation system operating. The design shall be submitted showing items such as:

- The maximum temperature inside the room at approx.1.8m above ground level at various external ambient temperatures.
- The ambient temperature shall be based on meteorological data associated with the area the substation is installed ie. no. of days over 30 degrees and maximums.
- Area of natural ventilation provided (the max natural ventilation shall be installed even when forced is being installed so that fans only run on rare occasions)
- A statement that the design is based on the 2 stage louvre actually being installed
- Calculations of air turn over
- If fans are installed how many days they may be in operation based on thermostat settings.
- Based on the above a statement advising if forced or natural ventilation is required.

Intake air must be relatively dust free and as such filters are required, they shall be fitted to the outside of the substation fans and regularly maintained by the customer. Filters are necessary when dust or other substances present in the area could impair the operation of equipment.

An area of 4m² of louvre will generally provide adequate pressure relief for equipment failures.

Roof ventilators may be used where a substation is a freestanding structure.

There are several variations to the two (2) stage louvre, however, the preferred options are shown in Figure 57.

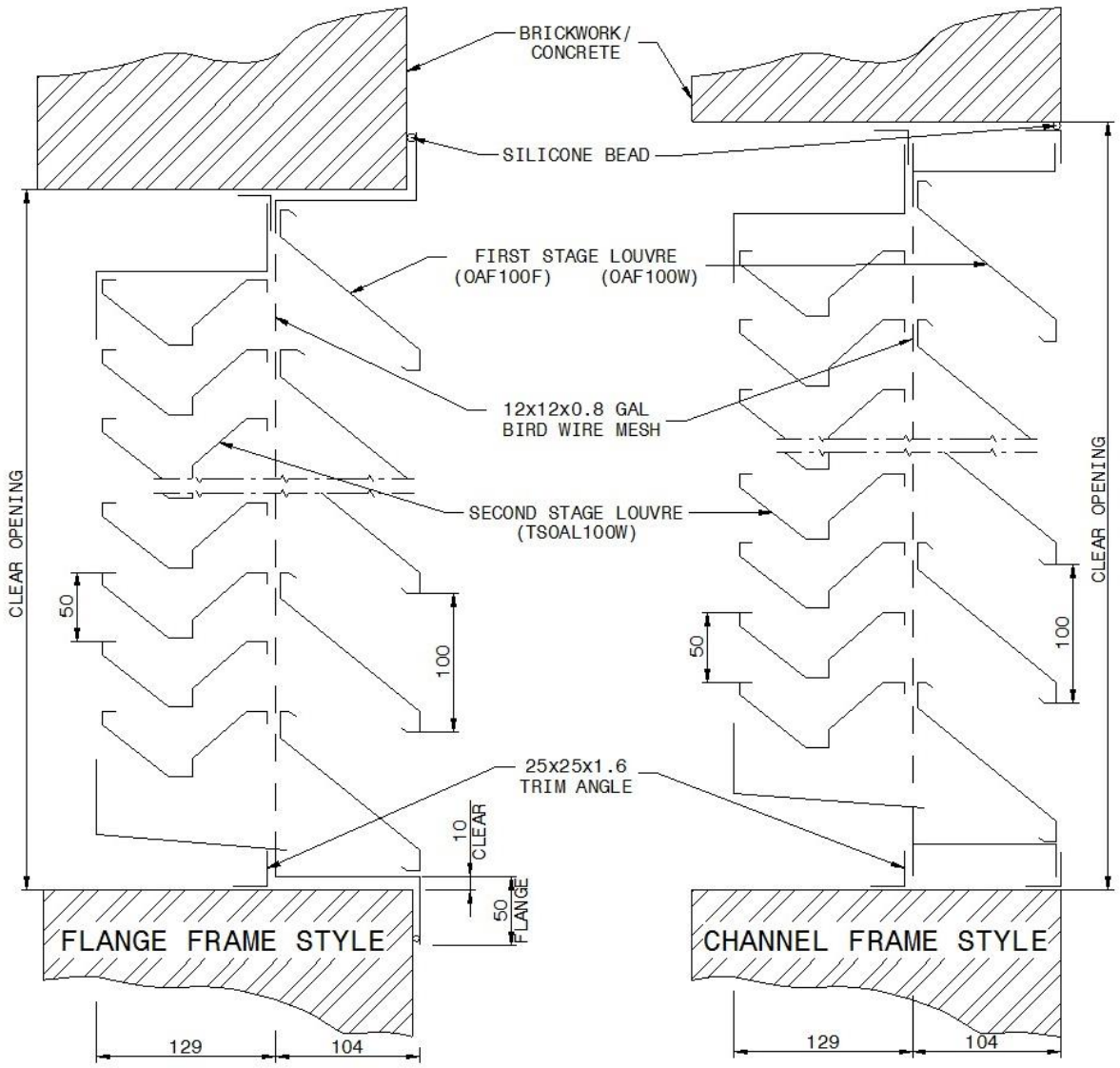


Figure 57 - Example wall louvre

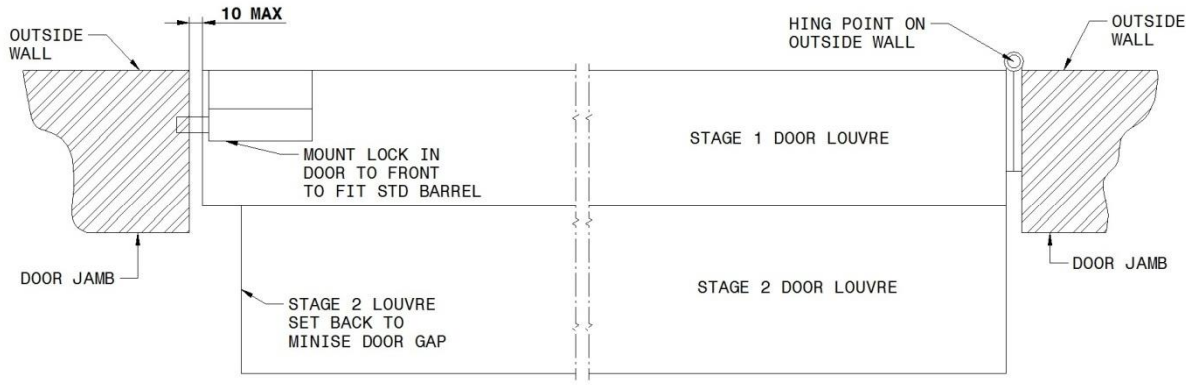


Figure 58 - Example door louvre

On doors it will be necessary to adjust the profile of the edge of the door (chamfered) as shown in Figure 58 to reduce the gap between the door and the frame (when closed) to a maximum of 10mm.

7.5.17.2 Equipment losses

The full load equipment losses to be provided for are 16kW for each oil filled transformer or 20kW for each dry type transformer. The ventilation system shall be designed to cater for the maximum number of transformers the room can accommodate.

7.5.17.3 Location of ventilation openings

Substation ventilation openings (doors or vents) shall be clear of any vents/doors/windows of the nearby buildings by three (3) m horizontally and six (6) m vertically minimum. Refer to AS 2067 and Figure 59 and Figure 60 for fire/smoke risk zones.

Ventilation openings shall be arranged to achieve an even distribution of airflow over the transformer(s) and must be designed such that hot air cannot accumulate at ceiling height.

Where required, the substation shall be provided either with full ceiling height louvres or, where this is not practical, (for example, where the ceiling height is greater than normally required), combinations of high level and low level louvres.

It is stressed that the substation chamber will not be accepted if the above stated conditions are not met.

7.5.17.4 Fire isolating dampers

All ventilating openings from the substation to inside the customer's building shall be avoided, but where approved by the Network Substations Manager, shall be provided with automatically controlled fire isolating dampers. Dampers may also be required on external openings in special cases, for example, where windows and the like are located above or adjacent to substation. These dampers shall be so arranged that they will not operate as a result of abnormal temperatures.

The fire isolating dampers shall be of the type with either curtain or individual blades with fusible link and shall comply with the requirements of AS1682. Intumescent fire dampeners are not permitted as they cannot be tested once installed.

Where dampers project into the substation chamber, they shall, if necessary, be provided with guards sufficient to protect employees from injury. Such guards shall not impair the operation of the dampers. Substations fitted with dampers must also be equipped with a high temperature alarm supplied, installed and maintained by the customer. Refer clauses 7.5.18– Fire protection and rating requirements and 7.5.19- Alarms for details.

7.5.17.5 Duct systems

Ventilation ducts must be of construction conforming in strength and fire rating with the requirements for walls separating the substation chamber from the remainder of the building.

Ventilation ducts shall be drained to a point free of surcharge. Positioning of ducts within the substation may require an increase in substation area so as to maintain clearance from the substation equipment.

7.5.17.6 Forced ventilation

Where forced ventilation is used, the fan(s) shall force air into the room and be started when the maximum temperature in the room reaches 35° Celsius, and may be stopped when the maximum temperature in the room falls below 30° Celsius at 1.6m above ground level.

The ventilation control and alarm system shall comply with the minimum requirements of Drawing no. 040883. The ventilation control may be located outside the substation but the temperature sensor and manual override must be located inside the substation.

Refer clause 7.5.19 - Alarms for alarm control location and notification details.

The forced ventilation electrical supply shall be via a dedicated circuit from the customer's main switchboard.

7.5.17.7 Ventilation alarms

The following are required where forced ventilation is installed:

Air Flow Alarm: Initiated by a sail or pressure switch in the duct work, or a relay, sensing the fan motor supply.

High Temperature Alarm: The temperature sensor shall be set in the range 48 to 50° Celsius. Refer clause 7.5.19 - Alarms for alarm control and notification details.

7.5.18 Fire protection and rating requirements

7.5.18.1 Building requirements

The whole of the substation, entrance and exit passages shall be isolated from the remainder of the customer's building by a minimum 120/120/120 FRL construction, in accordance with the Building Code of Australia and AS 2067 and the following diagrams.

Where dry type transformers are indicated in the following drawings it shall also apply to the approved transformers with K-class oil having a high flash point (>250^{0}C).

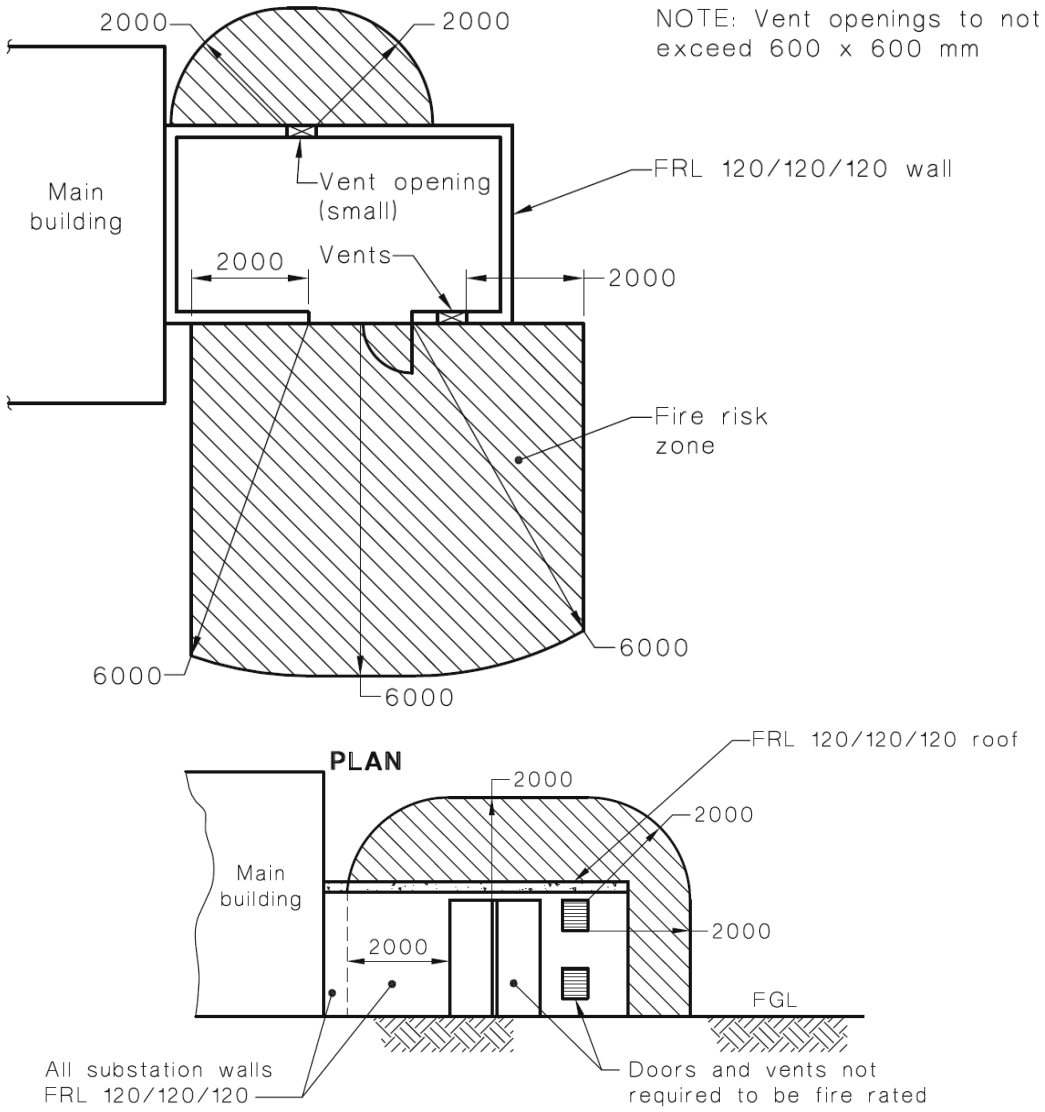


FIGURE C5 ATTACHED OR ADJACENT SUBSTATION WITH FIRE-RATED WALLS AND ROOF AND NON-FIRE-RATED DOORS AND VENTS

Figure 59 - Figure C5 from AS2067

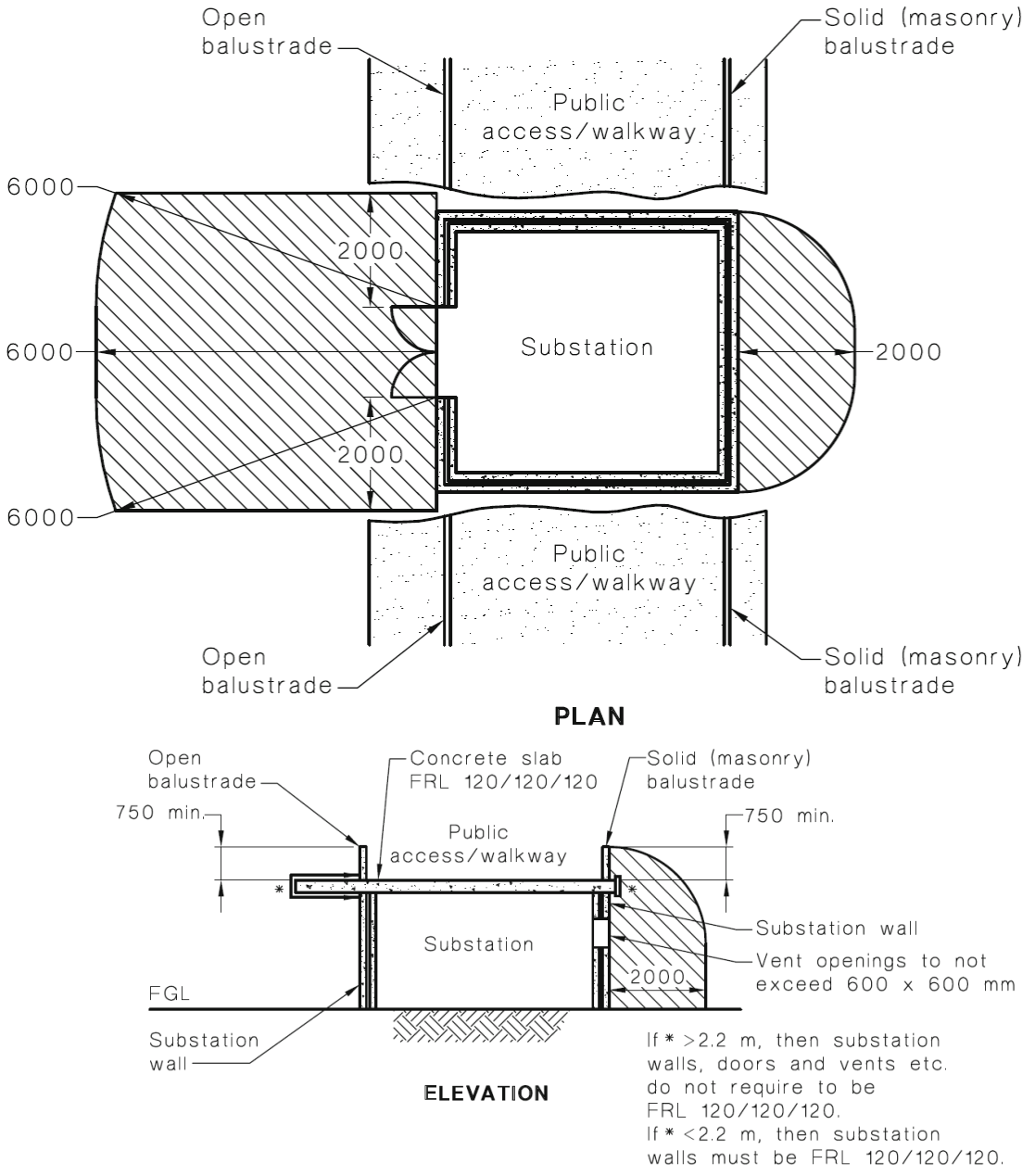


FIGURE C6 INDOOR SUBSTATION WITH PUBLIC ACCESS ABOVE

Figure 60 - Figure C6 from AS2067

7.5.18.2 Extinguishers

Two (2) fire extinguishers are to be supplied and installed by the customer in each room of the substation on suitable wall mounting brackets. The location is shown on the layout drawings and shall be 5.0kg CO2 type. The mounting height is to be 1200mm to top of extinguisher.

Endeavour Energy will maintain the fire extinguishers.

7.5.18.3 Fire alarms

Where fire alarms are required by others to be installed in a customer's premises, the substation shall also be fitted with fire alarms. Fire detectors shall be located over the transformers and switchgear and provide an alarm to the customer's central alarm board. Smoke sensors are preferred, however, other suitable detection devices will be considered. Refer clause 7.5.19 - Alarms for notification of a fire alarm.

7.5.19 Alarms

Where alarms are required in accordance with this Standard, the following shall apply:

7.5.19.1 Control

Controls shall be located in the substation. Remote indicator lamps, warning bells together with mute push buttons shall be located external to the substation in a control room or alarm panel, together with a nameplate. The external mute button to operate only after initiation and shall be capable of resetting automatically every minute. A control switch shall be provided inside the substation to switch off the alarm once the employees commence restoration work.

7.5.19.2 Notification of alarms

Immediate notification of all alarms is required, that is, high temperature, fire and sump pump failure.

The customer shall provide a suitable notice, fixed adjacent to the alarm indicator, advising that Endeavour Energy's System Operator must be notified (phone 131081) immediately on receipt of such an alarm.

7.5.20 Substation building completion

The substation shall be completed in all respects and with suitable access available for delivery and installation of heavy equipment. Endeavour Energy relevant representative (as stated in Section 2.9 - Inspection of works) is to be notified for arrangement of a final inspection and approval of the substation. Failure to comply with this requirement may also affect the program for providing electricity supply.

7.5.21 Substation building maintenance

Endeavour Energy will be responsible for the maintenance within the substation building of fire extinguishers, replacement of fluorescent light tubes and painting of walls, ceiling and floor only. All other maintenance is the responsibility of the customer.

7.5.22 Transformer bund wall

Bund walls are required around all liquid filled transformers. Set out below is the procedure for installing the indoor substation bund wall.

7.5.22.1 Bund wall installation tools and equipment

Listed below are the basic recommended materials required to carry out this procedure for each installed transformer:

- Masonry anchors (Hilti HKD 6 mm flush anchor or equivalent) - 8 off.
- M6 x 30mm long hex head mild steel setscrews - 8 off.
- M6 round flat mild steel washers - 8 off.
- M12 x 25mm long hex head galvanised steel bolts c/w nuts - 12 off.
- 12mm round flat galvanised steel washers - 24 off.
- Sheet metal sections, as detailed in Drawing no. 240118.
- 310ml tube of Sikaflex-11FC - 4 off.
- Mineral turpentine - 500ml.
- Pair of disposable latex surgeon style gloves (box of 100) - 1 off.

7.5.22.2 Installation process

Note: When installing the bund walls in substations with three or more transformers, always start by installing the bund wall(s) on the centre transformer(s) prior to the outer transformers.

Steps:

1) Clean the area. Remove dust, dirt and debris. Wash the area with a damp cloth.
2) Partly assemble the four (4) sheet metal sections around the transformer, using two (2) M12 x 25mm bolts in the top and bottom holes (finger tight) on each section.
3) Position the partly assembled bund wall evenly around the transformer and as close to the low voltage switchgear as possible, without spanning the cable trench. Refer to Figure 61 - Plan of bund wall position and Figure 62 for location of the bund wall.
4) Using a pencil, carefully trace the position of the internal and external edges of the bund wall and the location of the eight (8) holes required for the anchors on the floor.
5) Remove the bund wall from around the transformer and completely disassemble.
6) Drill all eight (8) holes in the floor to suit the hold down anchors.
7) All peeling paint on the floor must be removed where the bund will be located.
8) Check that all mating surfaces of the steelwork and the area marked on the floor are free from dust, debris, grease, oil and water.
9) Insert the eight (8) hold down anchors into the holes in the floor and place one (1) M6 setscrew near each of these anchors.
10) Put a pair of surgeon style latex gloves on - to minimise clean up.
11) Cut the nozzle of the Sikaflex tube to achieve a hole diameter of approximately 8mm and an angle of approximately 30°. Puncture the tube's diaphragm and insert the tube into the caulking gun.

Note: It is essential that there are no gaps left in the sealant and the bead is a consistent thickness when applying the Sikaflex in the following steps.

12) Apply one (1) generous bead of Sikaflex (approximately 10mm diameter) centrally between the lines previously marked on the floor. **Note**: Check that the bead passes around both sides of the holes for the anchors.
13) Working with one piece of steelwork at a time, apply one (1) generous bead of Sikaflex to the underside of the steelwork (face with 8mm diameter holes) in a similar manner to that done on the floor in step 12.
14) Position the steelwork on floor between the marked lines and hold in place by installing the M6 setscrews in the anchors. It is essential that the initial sealant contact between the floor and the steelwork is not broken. **Note**: M6 set screws to be finger tight.
15) Apply an extra generous horizontal bead of Sikaflex along the internal side of the steelwork, between the floor and the return flange.

16) Apply a generous horizontal bead of Sikaflex between the floor and the edge of the channel, from the horizontal bead along the return flange to the bead laid between the lines on the floor (that is, between the bead laid in step 15 and the bead laid in step 12).
17) Apply a generous vertical bead of Sikaflex to the internal side of the return flange, midway between the channel and the M12 bolt holes.
18) Repeat steps 13 through 17 for each remaining piece of steelwork.
19) After all four (4) sections of the bund wall's steelwork have been positioned; insert an M12 bolt from the outside of the bund wall with one (1) flat washer under the bolt head. Then apply a bead of Sikaflex to the inside of the bund wall and around the bolt. Fit the M12 nut finger tight. **Note**: Spring washers are not to be used.
20) Repeat step 19 for all remaining M12 bolts.
21) Check the bund wall for squareness and adjust as necessary.
22) Push the bund wall down to the floor.
23) Tighten all eight (8) M6 set screws to pull the steelwork down firmly onto the floor.
24) Tighten all twelve (12) M12 bolts.
25) Inspect for excess sealant around the internal joints of the bund wall and between the gap in the steelwork at the base of each return flange. If no sealant has squeezed out of any of these areas, then apply a bead of Sikaflex to cover the area.
26) Apply Sikaflex to any visible cracks in the concrete floor on the inside of the bund wall.

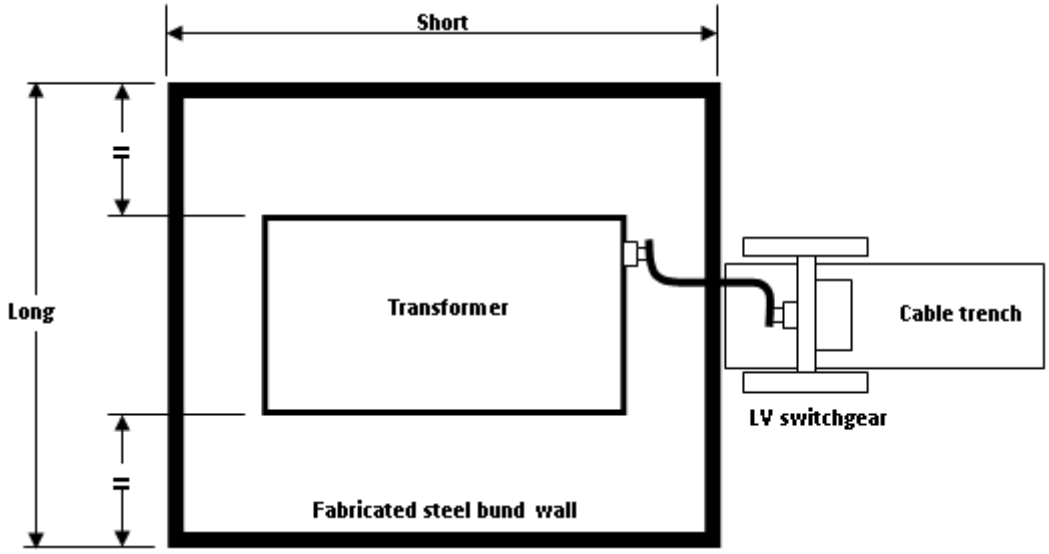


Figure 61 - Plan of bund wall position

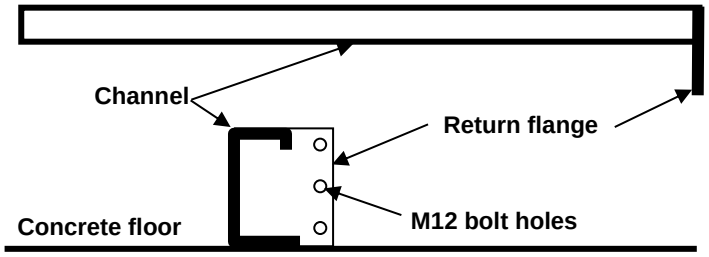


Figure 62 - Bund wall fabrication steelwork detail

7.5.22.3 Sealing conduits within the bund wall enclosure

Listed below are the basic recommended materials required to carry out this procedure for each conduit:

- 310ml tube of “Sikaflex-11FC” - 2 off (Stock code: 1536487).
- Mineral turpentine - 500ml

Steps:

1) Trim the conduit to floor level.
2) If the conduit contains multiple cables, the cables must be separated from each other to allow correct application of the sealant.
3) Insert rags into the conduit to act as a backing, preventing excessive use of the sealant.
4) Thoroughly sweep around the conduit to remove dust, dirt and debris. If sweeping is inadequate, wash the area with a damp cloth. **Note**: Avoid use of excessive water.
5) Check that all surfaces around the conduit and cables are free from dust, debris, grease, oil and water.
6) Apply a generous amount of Sikaflex to the conduit to seal it and protect it from possible exposure to fire. Check that the sealant is worked in between each cable in the conduit.

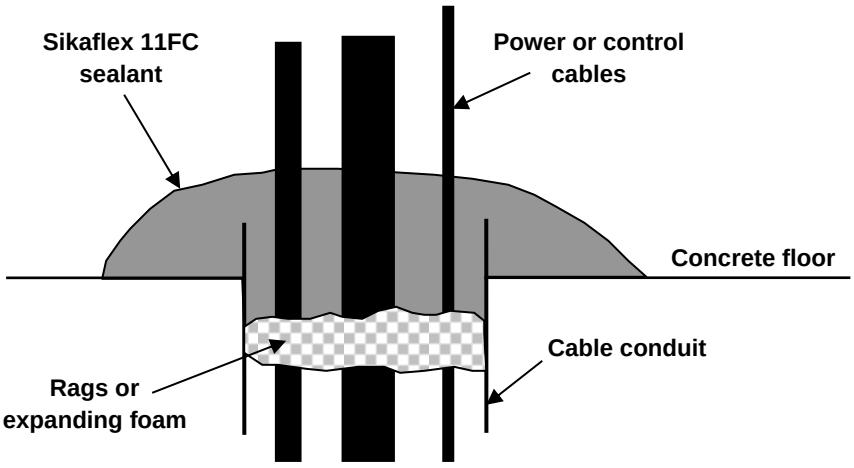


Figure 63 - Cable conduit sealing detail

7.6 Padmount switching stations

When permitted padmount switching substations shall be located where practical at the front property boundary.

For switching stations located in buildings or in alcoves of buildings, refer to the indoor substation section for details.

7.6.1 General construction details

High voltage switchgear shall face the end of the cubicle. It shall be possible to operate all equipment with the end cubicle door open.

7.6.2 Plinth and culvert details

7.6.2.1 Precast plinth and culvert

Precast concrete plinths and culverts shall be used unless approval to the contrary is given by the Network Substation Manager. The plinth and culvert are similar to a standard padmount substation design and cabling can be terminated in the same manner as in a padmount substation.

The plinth and culvert shall be constructed in accordance with Drawing no's 292827 and 075027 respectively. For details on the installation of the culvert and ground preparation, refer to the padmount culvert details, as they are to be the same, although shorter in length.

7.6.2.2 Poured plinth design

Poured concrete plinths have been used in the past and may be required in some special situations after approval from the Network Substation Manager has been given.

7.6.3 HV switchgear

Endeavour Energy requires full rated load make/break switch assemblies for the switching stations. Non-switchable fuse boards are not acceptable.

The maximum number of switches that can be accommodated in a cubicle is four (4). It will be necessary to check dimensions to confirm the latest switchgear will fit in the cubicle being used.

The switchgear is suitable for high voltage cables up to 300mm^2.

7.6.4 Cubicle details

The cubicle must be constructed from fibreglass reinforced polyester resin or approved stainless steel fabrication.

For full details of the cubicle requirements for switching stations refer to Drawing no's 264890, 26489 and 282540. Other requirements are the same as those for padmount substations.

7.7 Substation and switching station drawings

The following drawings form part of this instruction.

7.7.1 Padmount substation – associated drawings

Drawing no.	Amend no.	Subject
016665/1	T	11/22kV padmount substation easement layout sheet 1
016665/2	L	11/22kV padmount substation easement layout sheet 2
061674	E	Padmount substation metal fence isolated panel installation detail
075027	J	11/22kV padmount and switching station invert culvert construction details
076665	E	11/22kV padmount substation culvert footing installation
077555	J	Padmount substation LV Circuit Breaker and Load Break Switch frame arrangement detail
078239	B	Low voltage equipment cable lug critical dimensions
078481	D	Package padmount substation lifting arrangement and detail
245886	C	Size 14 and 16 padmount precast concrete plinth construction detail
245887	G	Size 14 and 16 padmount and indoor transformer typical requirements
264786	B	Size 14 and 16 padmount substation exploded view
264887	B	Size 14 and 16 padmount substation fibreglass cubicle GA
266515	C	Padmount substation LV distribution board frame to suit size 14 & 16 substation arrangement details
289702	A	Fencing for padmount subs Sheets 1 - 7

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AMENDMENTS	
A	ORIGINAL ISSUE
J R No.	900019
G D'RN	R.J.D.
G CH'D	J.K.
G DATE	14-6-90
G JR No	900082
REDESIGNED & REDRAWN. 22kV PLINTH DIMS ADDED.	
S.D.E.	J.K.
H D'RN	D.J.Z.
H CH'D	J.K.
H DATE	23-7-91
H JR No	910121
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J D'RN	P.M.M.
J CH'D	D.J.Z.
J DATE	21-5-92
J JR No	920101
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K D'RN	F.M.M.O.
K CH'D	F.M.
K DATE	16-9-92
K JR No	...
1 OF 2 SHEETS WAS 1 OF 1 SHEETS REFERENCE DRG PAGE NO.S REMOVED	
S.D.E	F.M.
L DR'N	T.A.B.
L CH'D	D.J.Z.
L DATE	15-7-93
L JR No	9300023
C URD DETAIL ROTATED. TITLE AMENDED. NOTE 1 AMENDED. NOTE 6 ADDED.	
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M DR'N	C.R.T.
M CH'D	D.J.Z.
M DATE	28-10-93
M JR No	930206
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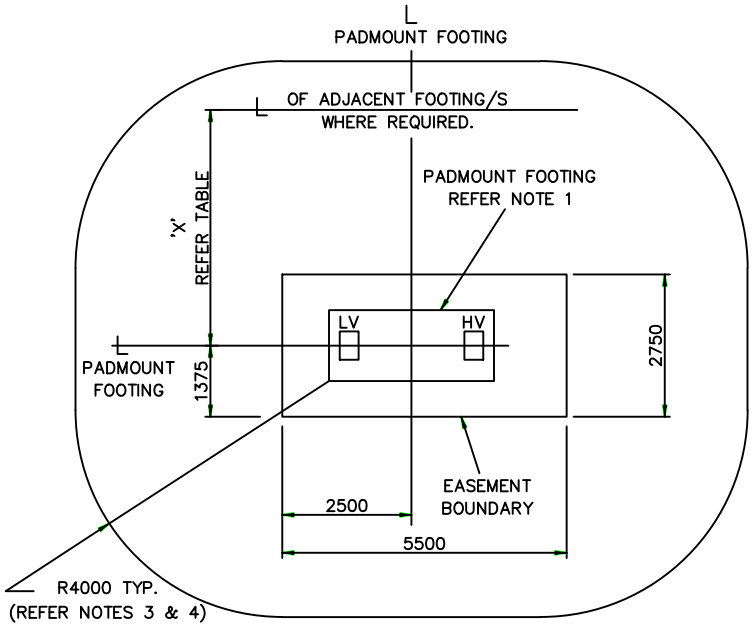
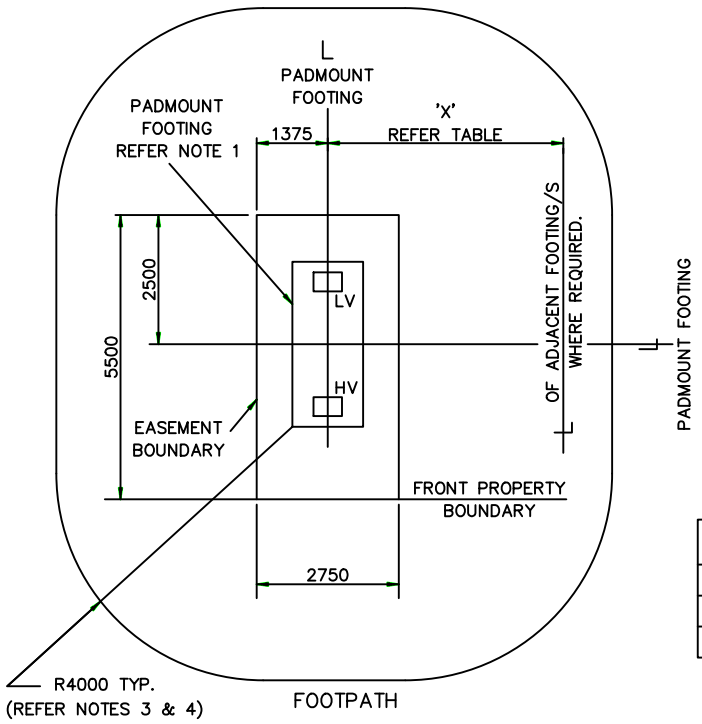
S.D.M.	J.K.
N DR'N	D.J.Z.
N CH'D	D.J.Z.
N DATE	25-8-95
N JR No	950159
D NOTE 2 REVISED. NORMAL INSTALLATION HEIGHT CLEARANCE WAS 3200mm. FOOTING REF DRGS DELETED.	
M.S.S.	J.K.
P DR'N	D.J.Z.
P CH'D	D.J.Z.
P DATE	05-2-96
P JR No	960001
NOTE 1 REVISED. ISSUE ID SDI 104, 114 & 117 DELETED. NOTES 2,3 & 4 SDI 104 WAS SDI 105.	
SEO	S.O.
Q DR'N	R.J.H.
Q CH'D	R.J.H.
Q DATE	04-7-96
Q JR No	960051
E DIM 5500 WAS 5000 (C3). ORIG NOTE 5 DELETED, NOTE Nos REVISED ACCORDINGLY.	
SEO	J.K.
R DR'N	B.G.H.
R CH'D	J.K.
R DATE	20-10-98
R JR No	GZ911100
EASEMENT AREA FINISH NOTE DELETED. CLAUSES REMOVED FROM NOTES 2,3 & 4. NOTE 5 ADDED.	
MNSA	J.K.
S DR'N	R.J.H.
S CH'D	R.J.H.
S DATE	18-6-99
S JR No	WX911159
F 11kV PADMOUNT FTG WAS 2970 x 1290.	
MNAT	J.K.
T DR'N	G.F.
T CH'D	G.F.
T DATE	26-11-15
T JR No	N/A
NOTES 2,3&4 REF. TO SDI104 NOW MCI0006.	
NSM	Colin Crisafulli



COMMERCIAL, HIGH DENSITY & INDUSTRIAL DEVELOPMENT

– ARRANGEMENT CAN BE FOR FOOTPATH ON EITHER LV OR HV SIDE OF PADMOUNT.



MULTIPLE PADMOUNTS WITHIN THE SAME EASEMENT

NO. OF PADMOUNTS	DIMENSION 'X' OF FOOTINGS.	EASEMENT WIDTH
2	1 x 2250	5000
3	2 x 2250	7250
4	3 x 2250	9500

– ALL OTHER DIMENSIONS REMAIN THE SAME.

UNDERGROUND RESIDENTIAL DEVELOPMENT WHERE BUILDING SETBACK EXCEEDS 7.5 METRES & UNDERGROUND INDUSTRIAL DEVELOPMENT

– SUBSTATION TO BE POSITIONED WHEREVER POSSIBLE ON LOW SIDE OF STREET. IF SUBSTATION MUST BE POSITIONED ON HIGH SIDE, DIM 5500 MUST BE INCREASED TO 6500 TO CLEAR WATER BOARD SEWERS.

– SUBSTATION TO BE POSITIONED PREFERABLY WITH HV TO FOOTPATH SIDE (AS SHOWN).

NOTES

1. PADMOUNT FOOTING DIMENSIONS; 11/22kV PADMOUNT – 3190mm X 1370mm
2. HEIGHT REQUIRED ABOVE PADMOUNT FOOTING FOR NORMAL INSTALLATION TO BE 5500mm. WHERE HEIGHT IS RESTRICTED BELOW 5500mm REFER TO MCI0006.
3. EXCEPT AS NOTED IN MCI0006, ANY METAL FENCING, WITHIN THE AREA DEFINED BY A LINE 4000mm FROM FOOTING EXTREMITIES & THE EASEMENT BOUNDARY, IS TO BE CONSTRUCTED SO THAT ADJACENT PANELS ARE ISOLATED FROM EACH OTHER & FROM THE GROUND.
4. EXCEPT AS NOTED IN MCI0006, ANY METAL CLAD BU1LDING SHOULD NOT ENCROACH W1THIN THE AREA DEFINED BY A L1NE 4000mm FROM THE FOOTING EXTREMITIES.
5. IN COMMERCIAL, HIGH DENSITY AND INDUSTRIAL DEVELOPMENT AREAS, A SECOND PADMOUNT SUBSTATION CAN BE LOCATED END ON END WITH THE TWO LOW VOLTAGE ENDS FACING EACH OTHER. IN THIS CASE THE SPACING BETWEEN SUBSTATION FOOTINGS SHALL BE 1500mm, THE EASEMENT WILL THEREFORE BE 2750mm x 10500mm.

Endeavour Energy

ORIGINAL SCALE	1:75
APPROVED	C.Howat
DRAWN	R.J.D.
DATE	23-7-91
CH'D	D.J.Z.

FENCE ISOLATED PANEL INST DET — 061674

REFERENCE DRAWINGS — DRG. NO. — THIS ISSUE PAGE NO

DO NOT SCALE DIMENSIONS IN MILLIMETRES

D.B.Britten/C.H ASSIST. G.M. ENG. 23-7-91

11kV & 22kV PADMOUNT SUBSTATION EASEMENT LAYOUT

SUB 016665 T

SHEET No 1 OF 2 SHEETS

INDEX REF S001E

ISSUE IDENTIFICATION

THIS ISSUE

PAGE NO.

AMENDMENTS	
A	ORIGINAL ISSUE
J R No.	920101
B D'RN	JMcD
B CH'D	SGP
B DATE	21-8-92
B JR No	920194
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S.D.E.	F.M.
C D'RN	FMMO
C CH'D	FM
C DATE	16-9-92
C JR No	..
PAGE NOS REMOVED NOTES AMENDED.	
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D DR'N	C.R.T.
D CH'D	D.J.Z
D DATE	15-7-93
D JR No	930117
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E DR'N	C.R.T.
E CH'D	D.J.Z
E DATE	28-10-93
E JR No	930206
SDI 117 WAS TP9.	
S.D.M.	JK
F DR'N	D.J.Z.
F CH'D	D.J.Z
F DATE	25-8-95
F JR No	950159
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G DR'N	D.J.Z.
G CH'D	D.J.Z
G DATE	05-2-96
G JR No	960001
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H CH'D	R.J.H
H DATE	04-7-96
H JR No	960051
DIM 5500 WAS 5000 (F4).	
SEO	JK
J DR'N	D.G.H
J CH'D	JK
J DATE	20-10-98
J JR No	GZ911100
EASEMENT AREA FINISH NOTE DELETED. CLAUSES REMOVED FROM NOTES 2,3 & 4.	
MNSA	JK
K DR'N	R.J.H
K CH'D	R.J.H
K DATE	18-6-99
K JR No	WX911159
11kV PADMOUNT FTG WAS 2970 x 1290.	
MNAT	JK
L DR'N	GSF
L CH'D	GSF
L DATE	26-11-15
L JR No	N/A
REF TO SDI104 NOW MCI0006.	
NSM	Colin Crisafulli

NOTES

1. PADMOUNT FOOTING DIMENSIONS;
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2. HEIGHT REQUIRED ABOVE PADMOUNT FOOTING FOR NORMAL INSTALLATION TO BE 5500mm.
   WHERE HEIGHT IS RESTRICTED BELOW 5500mm REFER TO MCI0006.

3. EXCEPT AS NOTED IN MCI0006,
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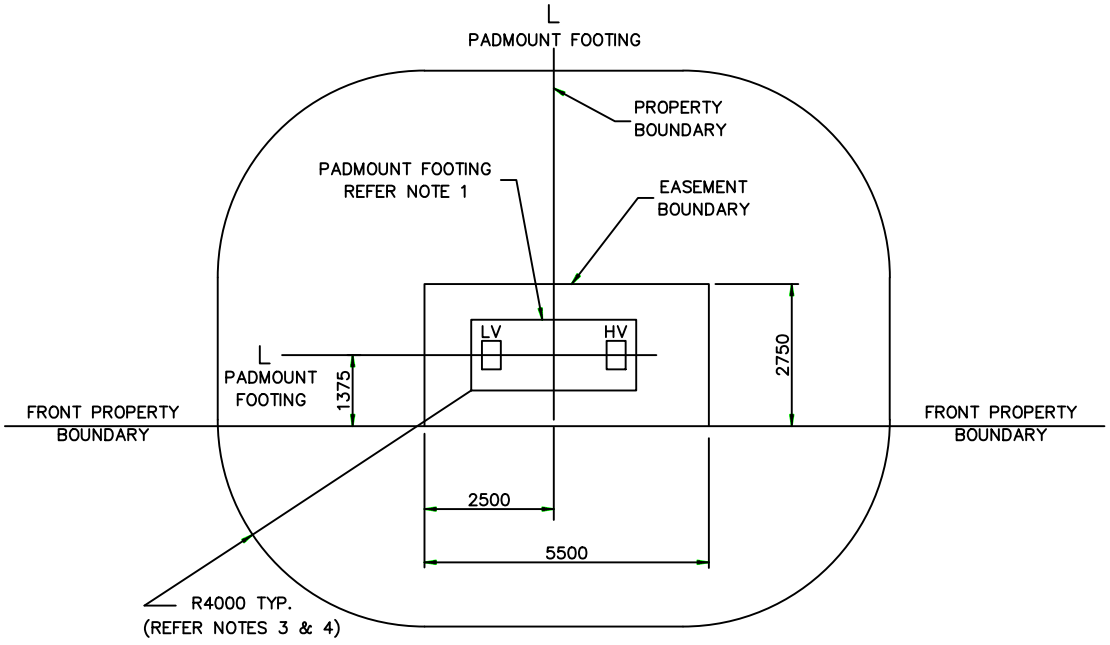
4. EXCEPT AS NOTED IN MCI0006,
   ANY METAL CLAD BU1LDING SHOULD NOT ENCROACH W1THIN THE AREA DEFINED BY A L1NE 4000mm FROM THE FOOTING EXTREMITIES.



UNDERGROUND RESIDENTIAL DEVELOPMENT
WHERE BUILDING SETBACKS ARE LESS THAN 7.5 METRES

– SUBSTATION TO BE POSITIONED WHEREVER POSSIBLE ON LOW SIDE OF
@U STREET. IF SUBSTATION MUST BE POSITIONED ON HIGH SIDE, DIM 2750
@U MUST BE INCREASED TO 4000 AND DIM 1375 MUST BE INCREASED TO 2625
@U TO CLEAR WATER BOARD SEWERS.

– FOOTING MAY BE ROTATED THROUGH 180 DEGREES.
@U
– MULTIPLE PADMOUNTS NOT APPLICABLE IN THIS CASE.

Endeavour Energy

ORIGINAL SCALE	1:75
APPROVED	C.Howat
DRAWN	R.M.M
DATE	18-5-92
CH'D	D.J.Z

FENCE ISOLATED PANEL INST DET — 061674
REFERENCE DRAWINGS — DRG. NO. — THIS ISSUE PAGE NO

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

D.B.Britten/C.H
ASSIST. G.M. ENG. 18-5-92

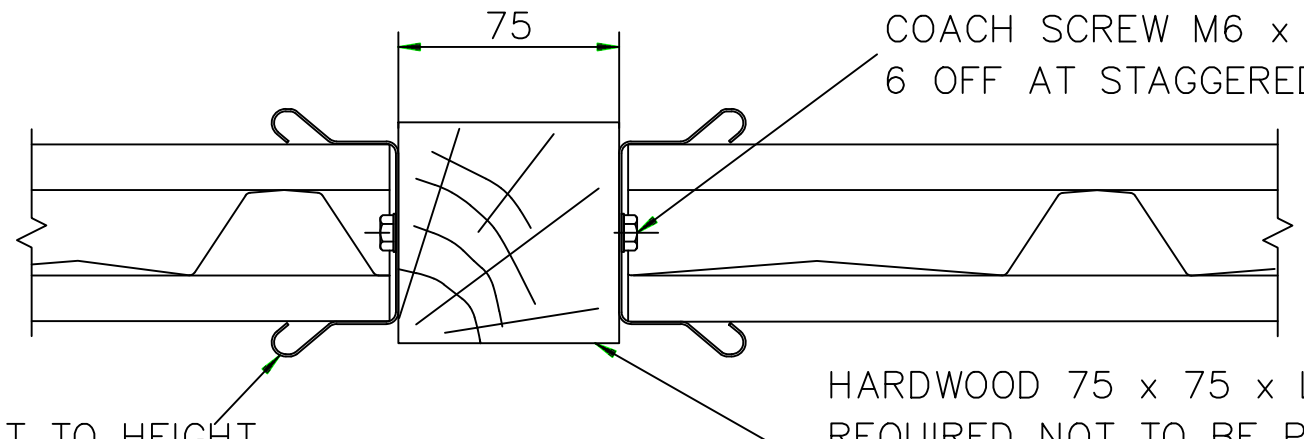
ISSUE IDENTIFICATION

11kV & 22kV PADMOUNT SUBSTATION
EASEMENT LAYOUT

SUB 016665 L
SHEET No 2 OF 2 SHEETS
INDEX REF S001E

THIS ISSUE

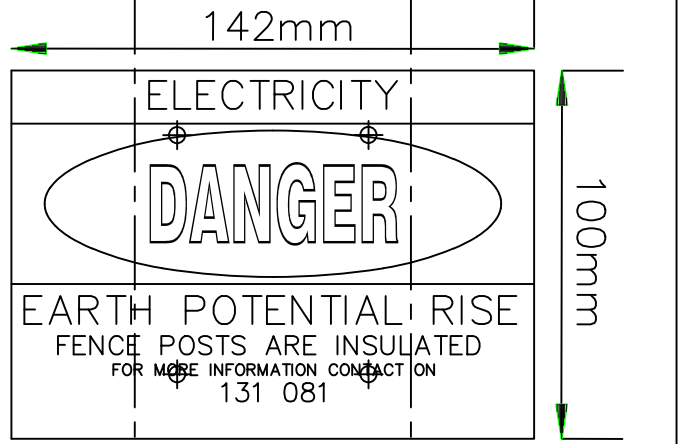
PAGE NO.



SECTION X–X
SCALE 1:2.5

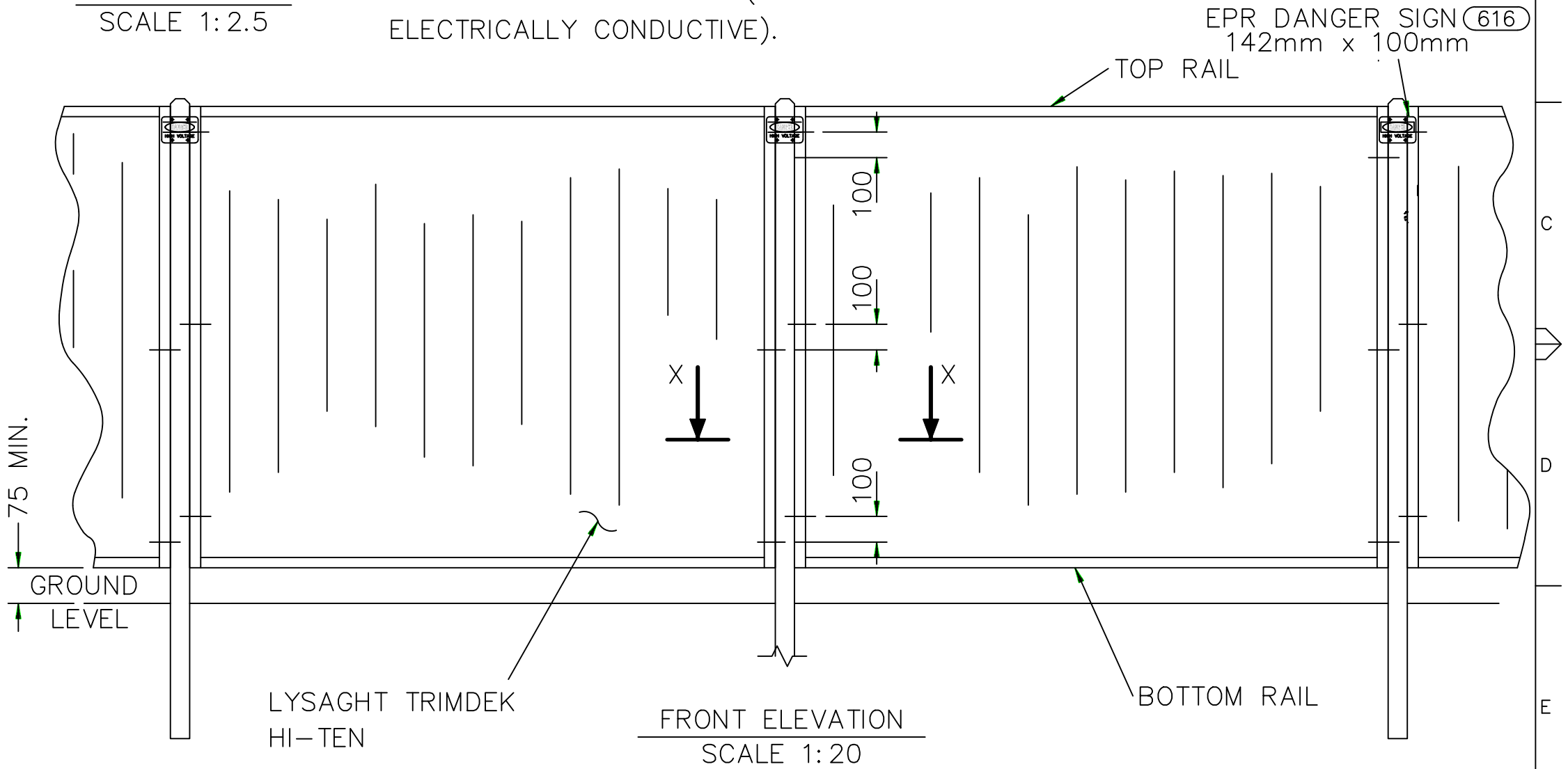
NOTES

1. ARRANGEMENT AS SHOWN IS DESIGNED FOR "LYSAGHT NEETASCREEN FENCING". WHEN OTHER TYPES OF METALLIC FENCING ARE ENCOUNTERED THE SAME PRINCIPLE IS TO BE APPLIED.
2. FENCE TO BE ERECTED IN ACCORDANCE WITH MCI0006.



EPR DANGER SIGN SPECIFICATION
SCALE 1:2

NOTES
1). 1.5MM WHITE RAVEK OR APPROVED EQUIVALENT
2). DANGER SIGN SYMBOL A/W AS1319–1994 (WHITE LETTERING ON RED OVAL ON BLACK BACKGROUND)
3). BLACK LETTERING ON WHITE BACKGROUND UNLESS STATED



FRONT ELEVATION
SCALE 1:20

AMENDMENTS

A ORIGINAL ISSUE — J R No. 900201 — DR'N RJH — CH'D RJH — DATE 18-6-99 — JR No WX911159

C 'CLAUSE 4.3' DELETED FROM NOTE 2. — MNAT JK — DR'N B.P.R — CH'D G.A — DATE 18.11.10 — JR No .

D DANGER SIGNS ADDED — . — DR'N G.S.F — CH'D G.S.F — DATE 26-11-15 — JR No N/A

E NOTE 2 REVISED MCI0006 WAS SDI 104. — NSM C.Crisafulli

ORIGINAL SCALE AS SHOWN

DRAWN	B.G.H
DATE	01–3–91
CH'D	B.G.H

APPROVED
C.Howat

Endeavour Energy

PARTS AND ACCESSORY LIST

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
D.B.Britten/CH

ASSIST. G.M. ENG. 01–3–91

INSULATED FENCE POST AND EPR DANGER SIGN

A3 061674 E

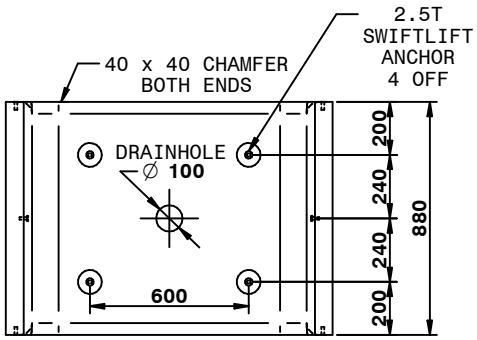
SHEET No 1 OF 1 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N D.J.Z. / CH'D D.J.Z. / DATE 16-03-93 / JR No 920294 — DRAINHOLE WAS Ø90. DIM 1234 WAS 1240. DIM 100 WAS 250. DIM 400 WAS 250. DIM 1092 ADDED. LIFT LUGS DELETED. S.D.E. D.T.G.
C	DR'N D.J.Z. / CH'D D.J.Z. / DATE 13-07-93 / JR No 930125 — TITLE REVISED, END SHEET DETAILS ADDED. ISSUE ID SDI104 ADDED. S.D.E. D.T.G.
D	DR'N T.A.B. / CH'D T.A.B. / DATE 27-05-94 / JR No 940063 — DIM 2800 WAS 2464, DIM 1160 WAS 1163, DIM 800 WAS 750, DIM 600 WAS 515, DIM 70 WAS 80, DIM 350 WAS 400, DIM 30 WAS 28, DIM 1235 WAS 1234, DIM 110 WAS 1092, DIM 1165 WAS 1015, DIM 560 WAS 490, ANCHORS WERE 820 APART, INTERNAL FERRULES ADDED, MASS WAS 1800KG, VOCAB ADDED, 22KV ADDED TO TITLE, HOLES WERE Ø14, CHAMFER ADDED, SDI114 ADDED. S.D.M. D.T.G.
E	DR'N D.J.Z. / CH'D D.J.Z. / DATE 16-11-94 / JR No 940162 — SDI117 WAS TP9. S.D.M. JK
F	DR'N J.W / CH'D R.J.H / DATE 18-04-95 / JR No 950077 — CHANGE END SHEET DETAIL WAS LV END SHEET DETAIL QUANTITY: 2 OFF WAS 1 OFF. DELETED: HV END SHEET DETAIL. S.D.M. JK
G	DR'N D.J.Z / CH'D D.J.Z. / DATE 20-12-96 / JR No 960097 — NOTE 1 ADDED. ISSUE ID'S DELETED. END SHEET COVER AND CUTOUT END SHEET DETAILS ADDED. END SHEET DETAIL DIM 1080 WAS 800. M.N.S.A. JK
H	DR'N G.Ford / CH'D G.Ford / DATE 09-12-04 / JR No --- — SWITCHING STATION CULVERT DETAILS ADDED. M.N.S.A. G.Ford
J	DR'N G.Ford / CH'D G.Ford / DATE 03-12-13 / JR No --- — SWIFTLIFT RATING 2.5T WAS 1.3T. END SHEET FIBREGLASS WAS PLASTIC. END SHEET RIBS ADDED. CUT OUT END SHEET AND NOTE 1 DELETED. M.P.S. G.Ford

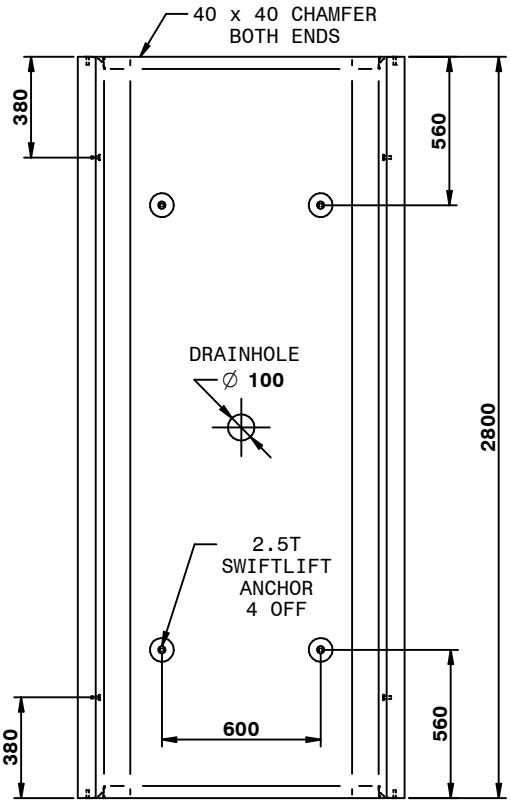
NOTES

1) -

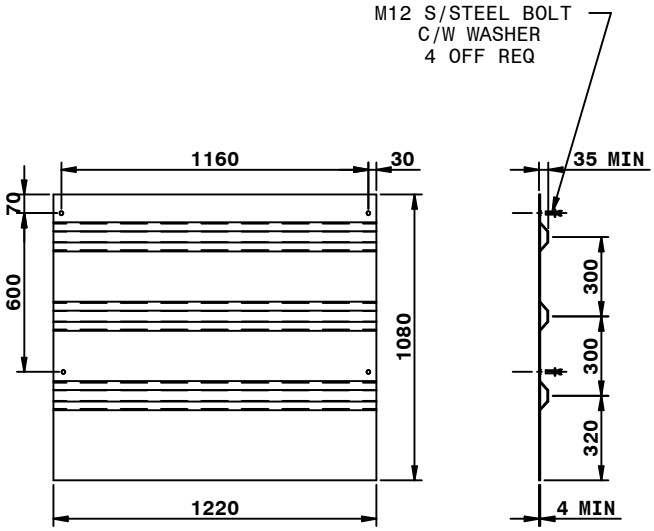
ITEM	QTY	DESCRIPTION	REMARKS



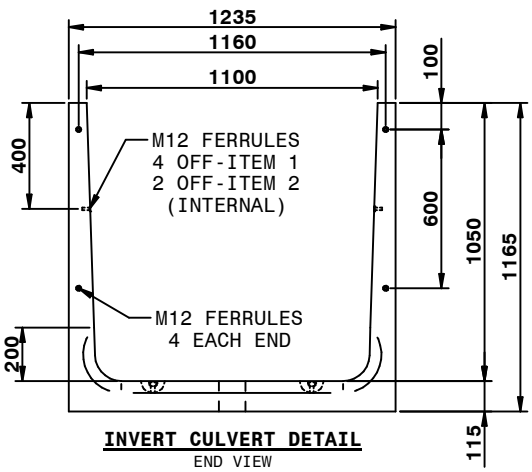
ITEM 2
INVERT CULVERT DETAIL
SWITCHING STATION PLAN VIEW



ITEM 1
INVERT CULVERT DETAIL
PADMOUNT PLAN VIEW



END SHEET DETAIL
MATERIAL: RIGID FIBREGLASS - MIN 4mm
THICK WITH STRENGTHENING RIBS
QUANTITY: 2 OFF PER CULVERT



INVERT CULVERT DETAIL
END VIEW

	PADMOUNT	SWITCHING STATION
APPROX. MASS:	2280kg	720kg
STOCK CODE:	YT10165	1554336

Endeavour Energy

ORIGINAL SCALE — APPROVED C.Howat

DRAWN T.A.B. — DATE 28/10/92 — CH'D D.J.Z — INDEX REF S002A

PM SUB INVERT CULVERT FTG INST 076665

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED D.B.Britten/CH
ASSIST. G.G. ENG. 28/10/92

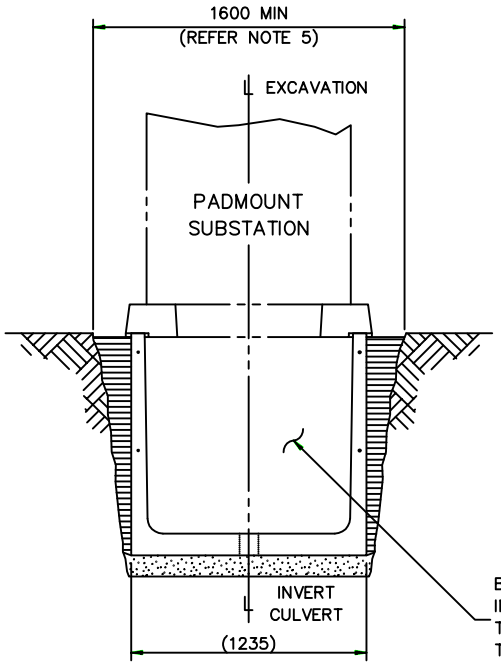
11 & 22kV PADMOUNT & SWITCHING STATION
INVERT CULVERT
CONSTRUCTION DETAILS

A4 075027 J
SHEET No. 1 OF 1

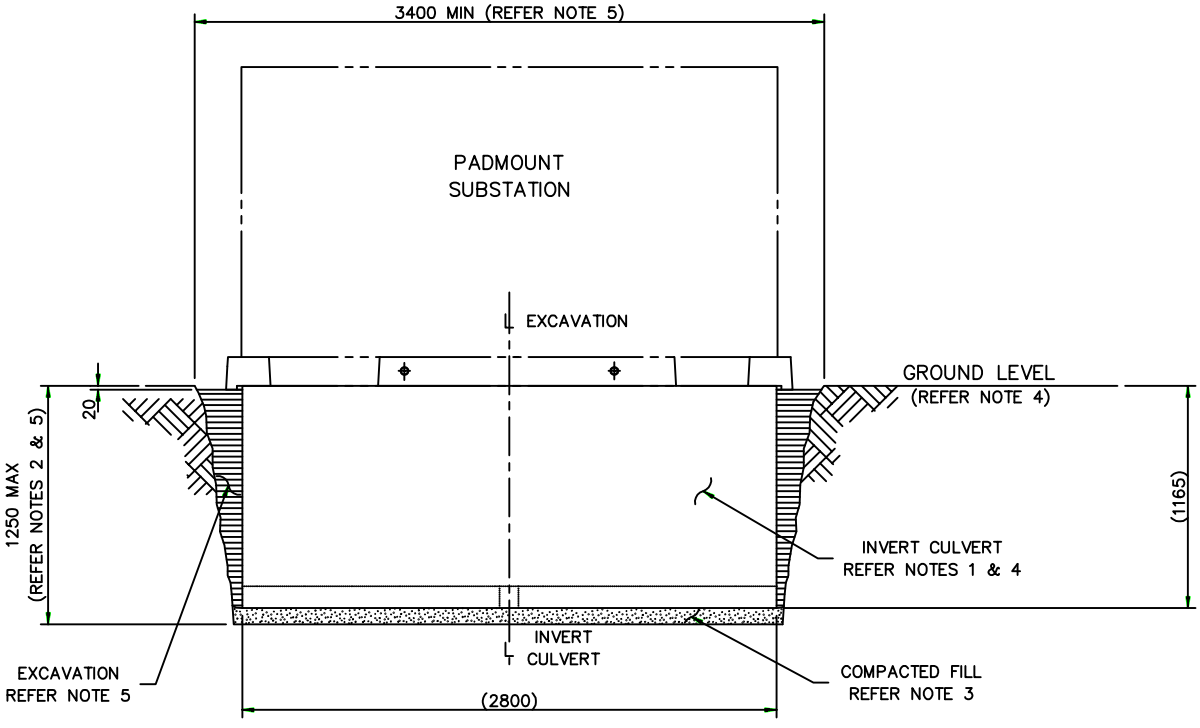
AMENDMENTS	
A	ORIGINAL ISSUE
J R No.	920294
B	DR'N C.B.T. CH'D D.J.Z. DATE 22-7-93 JR No 930117 22kV REMOVED FROM TITLE. CULVERT WAS 75mm BELOW GROUND LEVEL.
S.D.M.	D.T.G.
C	DR'N T.A.B. CH'D T.A.B. DATE 27-5-94 JR No 940063 DIM 2800 WAS 2464 DIM 1250 WAS 1100 DIM 3300 WAS 3100 22KV ADDED SDI 114 ADDED NOTE 5 REVISED
S.D.M.	D.T.G.
D	DR'N D.J.Z. CH'D D.J.Z. DATE 16-11-94 JR No 940162 SDI 117 WAS IP9. DIM 1600 WAS 1400. DIM 3400 WAS 3300. REF DIM 1165 ADDED. NOTE 5 REVISED.
S.D.M.	J.K.
E	DR'N G.F.S. CH'D G.F.S. DATE 23-10-97 JR No 970067 NOTE 4 WAS FLUSH WITH EXISTING GRND
M.N.S.A	J.K.

NOTES

1. THE INVERT CULVERT FOOTING IS SUITABLE FOR INSTALLATION ON GROUND WITH A MINIMUM BEARING CAPACITY OF 75 kPa. SOFT CLAYS, SILTS & LOOSE FINE SAND ARE EQUIVALENT TO 110 kPa.
2. FOR SOIL BEARING CAPACITIES LESS THAN 75 kPa AN EXTRA 500mm OF EXCAVATION IS REQUIRED THEN BACKFILLED IN ACCORDANCE WITH NOTE 3 TO ACHIEVE A MINIMUM OF 75 kPa SOIL BEARING CAPACITY.
3. FILLING REQUIRED FOR LEVELLING MUST BE ROAD BASE AND PLACED IN LAYERS NOT EXCEEDING 200mm THICKNESS. THIS FILLING MUST BE COMPACTED TO A DENSITY OF 98% STANDARD.
4. TOP OF CULVERT TO BE POSITIONED 50mm BELOW FINISHED GROUND LEVEL.
5. EXCAVATION TO BE 3400mm X 1600mm MINIMUM X 1250mm MAXIMUM DEPTH AND BACKFILLED WITH SAND AROUND INVERT CULVERT TO A LEVEL NOT GREATER THAN 20mm BELOW FINISHED HEIGHT OF INVERT CULVERT. ENSURE THAT NO BACKFILL IS INSIDE INVERT CULVERT.



END VIEW



ELEVATION

Endeavour Energy

REFERENCE DRAWINGS	DRG. NO.	THIS ISSUE PAGE NO
INVERT CULVERT DETAIL	075027	
PADMOUNT SUB EASEMENT LAYOUT	016665	

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

J.Allen/JC
ASSIST. G.M. ENG. 24-3-93

ISSUE IDENTIFICATION	SDI 104	SDI 114	SDI 117
THIS ISSUE			
PAGE NO.			

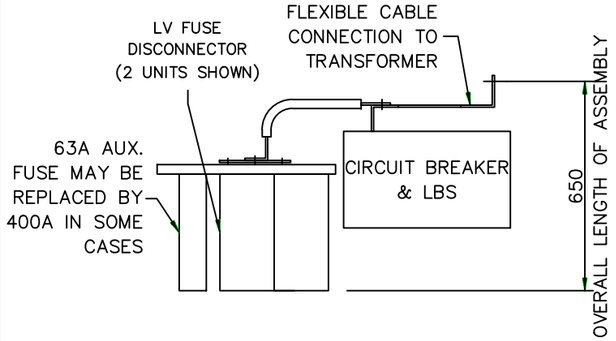
ORIGINAL SCALE 1:20

APPROVED J.Cook

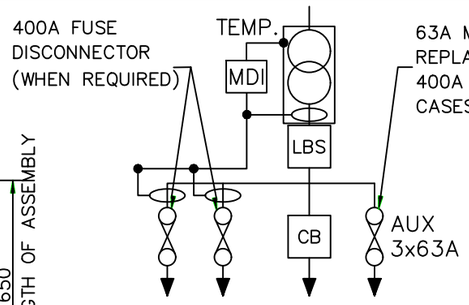
DRAWN D.J.Z.
DATE 24-3-93
CH'D D.J.Z.

11/22kV PADMOUNT SUBSTATION
INVERT CULVERT FOOTING INSTALLATION

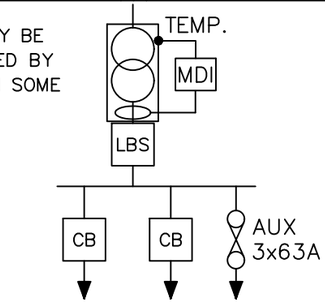
SUB 076665 E
SHEET No 1 OF 1 SHEETS
INDEX REF S002A



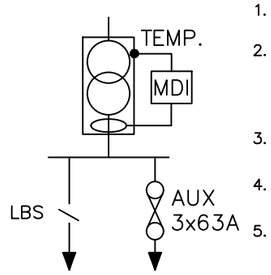
PLAN VIEW – CB FRAME OMMITTED



TYP. SCHEMATIC DIAGRAM
TYPE 1,2,3, SWITCHBOARDS



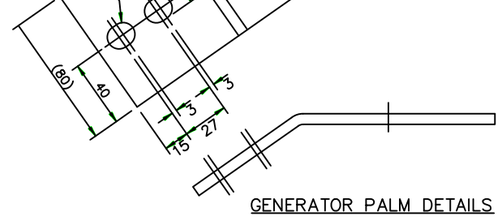
TYP. SCHEMATIC DIAGRAM
TYPE 4 SWITCHBOARDS



TYP. SCHEMATIC DIAGRAM
LBS SWITCHBOARDS

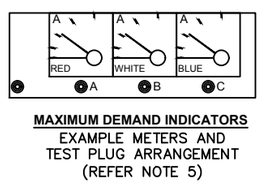
NOTES

1. DRAWING TO BE READ IN CONJUNCTION WITH PADMOUNT SUBSTATION STANDARDS.
2. FRAME TO BE FULLY WELDED CONSTRUCTION IN ACCORDANCE WITH AS1554.
   FRAME FINISH: HOT DIP GALVANISED TO AS1650.
   REMOVE ALL SHARP EDGES, MILL SCALE, WELDING SLAG & SPLATTER.
3. FRAME TO BE SUITABLY BRACED TO MAINTAIN STABILITY UNDER OPERATIONAL CONDITIONS.
4. SWITCHGEAR FOOTING SHALL BE DESIGNED TO MATCH PADMOUNT SUBSTATION DRAWING NUMBER 245886
5. THE MDI IS ABLE TO BE REPLACED WITHOUT AN OUTAGE ON LV. MDI TO FACE SAME SIDE AS WHERE SWITCHING OPERATIONS ARE PERFORMED BUT LOCATION IS NEGOTIABLE



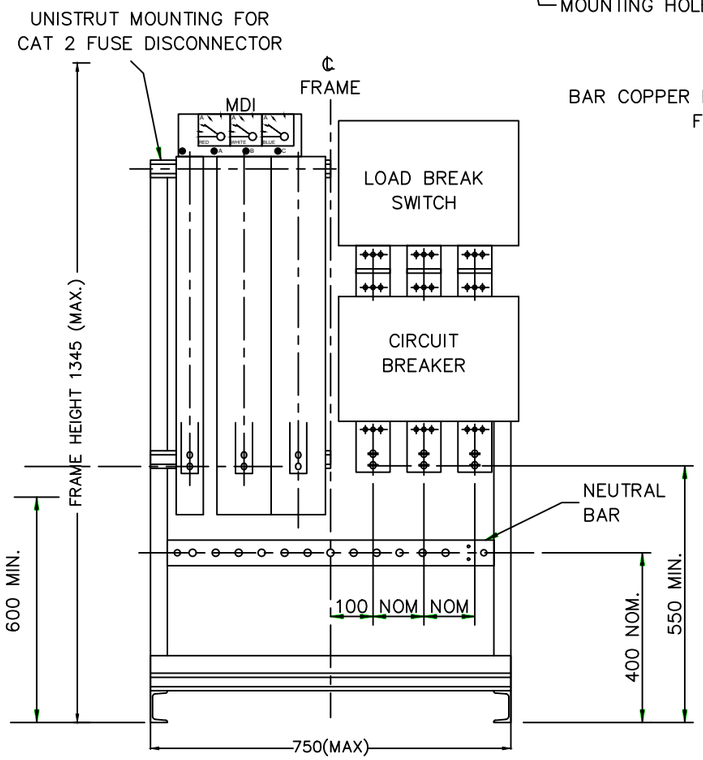
NEUTRAL EARTH BAR

BAR COPPER FLAT HDHC 80 x 6 x xLENGTH TO SUIT FRAME
FINISH: TINNED AFTER FABRICATION

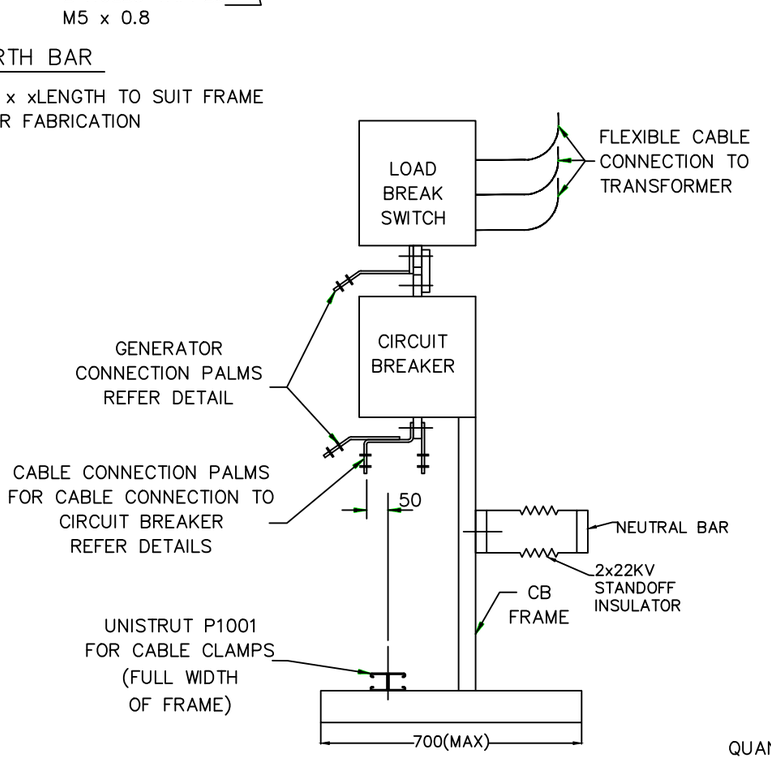


MAXIMUM DEMAND INDICATORS
EXAMPLE METERS AND TEST PLUG ARRANGEMENT
(REFER NOTE 5)

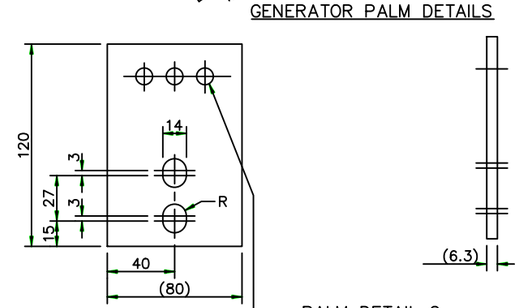
GENERATOR PALM DETAILS



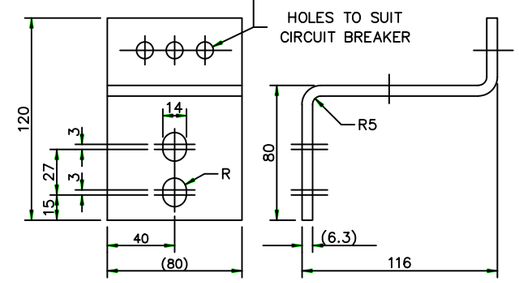
FRONT VIEW



SIDE VIEW



PALM DETAIL 2



PALM DETAIL 1

CABLE CONNECTION PALMS

MATERIAL: BAR COPPER FLAT HDHC ROUND EDGE 80 X 6.3
FINISH: TINNED.
QUANTITY–GEN. PALM: 1 OFF EACH SIDE OF EACH CB FOR GEN. INPUT
QUANTITY– PALM 1 & 2: 1 OFF EACH CB OR LBS FOR OUTGOING CABLE CONN.

AMENDMENTS

A	ORIGINAL ISSUE	Job No.	930209	DR'N	G.P.S.
		CH'D	G.P.S.	DATE	23–10–97
		JR No	970067	NOTE 3 WAS "LUGS TO BE FITTED TO" & 20	
		M.N.S.A	J.K		
D		DR'N	B.G.H		
		CH'D	J.K	DATE	24–12–97
		JR No	GZ851126	4 OFF DOUBLE 14 HOLES ADDED.	
E		DR'N	J.K		
		CH'D	R.J.H	DATE	01–11–99
		JR No	WX011240	MDI DIMS DELETED	
		M'NAS	J.K	PLAN & FRONT VIEW. DIMS 550, 600 WERE 600, 650 FRONT VIEW. NOTES RE MAX DEMAND INDIC., LIFT HOLES & FRAME MTG HOLES DELETED. NOTE NUMBERING REVISED TO SUIT.	
F		DR'N	R.J.H		
		CH'D	R.J.H	DATE	6–9–10
		JR No	N/A	SWITCH BETWEEN CB & TRF. ADDED TO ALL CB FRAMES. MDI DETAIL MODIFIED. AUX. FUSE CAN BE UPGRADED TO 400A FUSE STRIP ON TYPE 1, 2 & 4 FRAMES. GENERATOR CONN. PALM ADDED.	
		M'NAT	J.K		
G		DR'N	I.K.T		
		CH'D	V.M	DATE	24.4.06
		JOB No		STAND OF INSULATORS ADDED DRWWING ALTERED TO SHOW TYPES OF SWITCHBOARDS	
		DSM	V.M		
H		DR'N	G.S.F.		
		CH'D	G.S.F.	DATE	26–11–15
		JR No	N/A	NOTE 4 DRG No WAS 945 886 NOW 245886	
		MDEB	G.S.F.		
J		DR'N	G.S.F.		
		CH'D	G.S.F.	DATE	26–11–15
		JR No	N/A		
		NSM	C. Crisafulli		

ORIGINAL SCALE	APPROVED
	J.Cook

DRAWN	CRT		
DATE	3.11.93		
CH'D	DJZ		

Endeavour Energy

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
J.Cook

PADMOUNT SUBSTATION
TYPICAL LV CIRCUIT BREAKER AND LOAD BREAK SWITCH FRAME ARRANGEMENT DETAILS

MGR TRANSMISSION CAPITAL PROJECTS 24.11.93

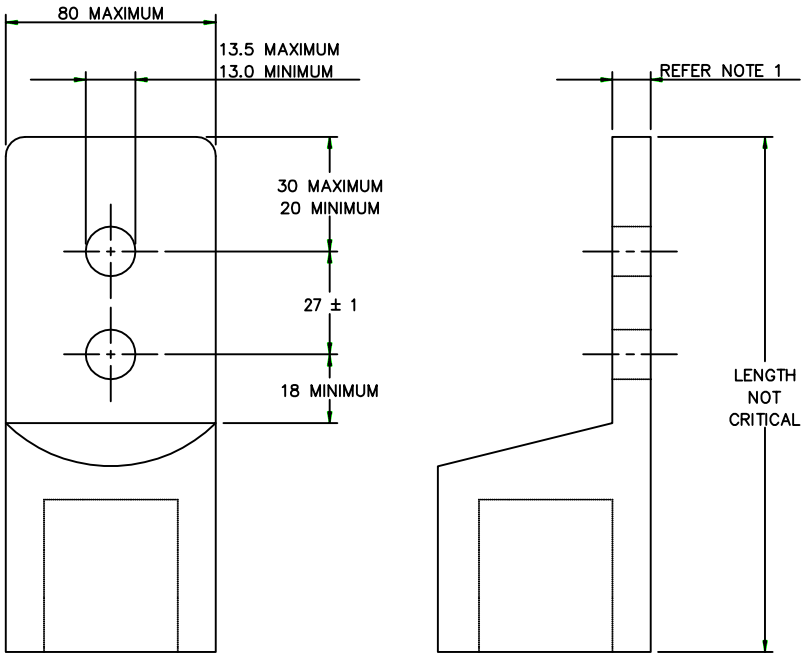
A2 077555 J

SHEET No 1 OF 1 SHEETS

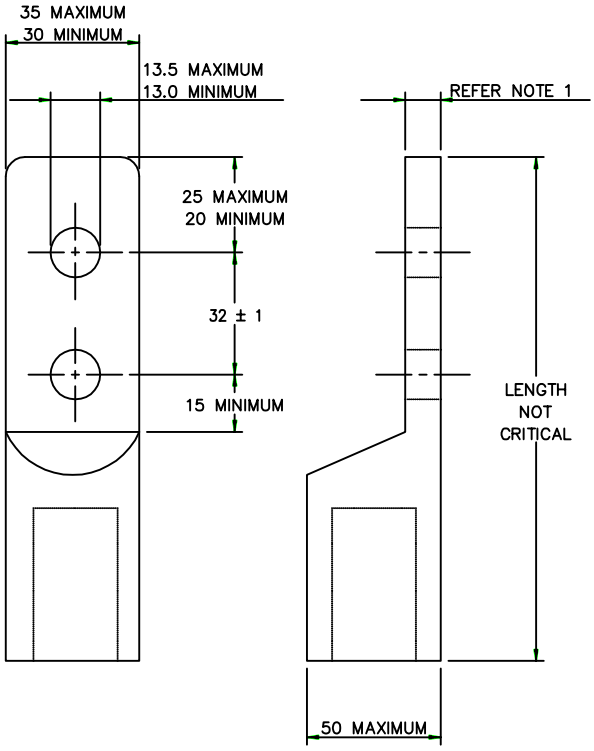
AMENDMENTS		
A	ORIGINAL ISSUE	
	J R No.	940145
B	DR'N	D.J.Z.
	CH'D	J.K.
	DATE	09-1-96
	JR No	960001
NOTE 1 ADDED.		
M.S.S.		J.K.

NOTES

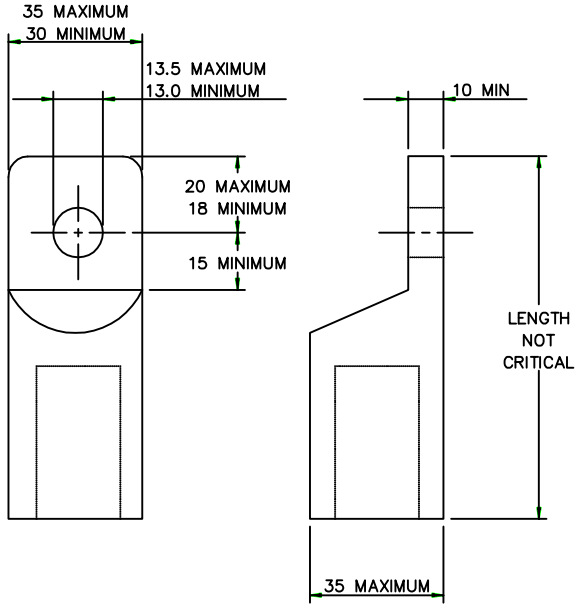
1. THE CURRENT RATING OF THE LUG SHALL BE EQUIVALENT TO THE CURRENT RATING OF THE CABLE/S TO A MAXIMUM 1400 AMPS.
   ALL DISTRIBUTION SWITCHGEAR WILL ACCEPT BOTH ALUMINIUM OR COPPER CABLES.



CIRCUIT BREAKER CABLE LUG
MAXIMUM SIZE CABLE – 630mm²
MAXIMUM No PER PHASE – 4 OFF



FEEDER FUSED DISCONNECTOR
CATEGORY 2 CABLE LUG
MAXIMUM SIZE CABLE – 240mm²
MAXIMUM No PER PHASE – 2 OFF



FEEDER FUSED DISCONNECTOR
CATEGORY 1 CABLE LUG
MAXIMUM SIZE CABLE – 240mm²
MAXIMUM No PER PHASE – 2 OFF

Endeavour Energy

ORIGINAL SCALE	APPROVED
NONE	C.Howat

DRAWN	D.J.Z.
DATE	27-9-94
CH'D	D.J.Z.

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

REFERENCE DRAWINGS	DRG. NO.	THIS ISSUE PAGE NO

C.Howat
SUBSTATION DEVELOPMENT MGR 12-10-94

LOW VOLTAGE EQUIPMENT
CABLE LUG
CRITICAL DIMENSIONS

SUB 078239 B
SHEET No 1 OF 1 SHEETS
INDEX REF S008A

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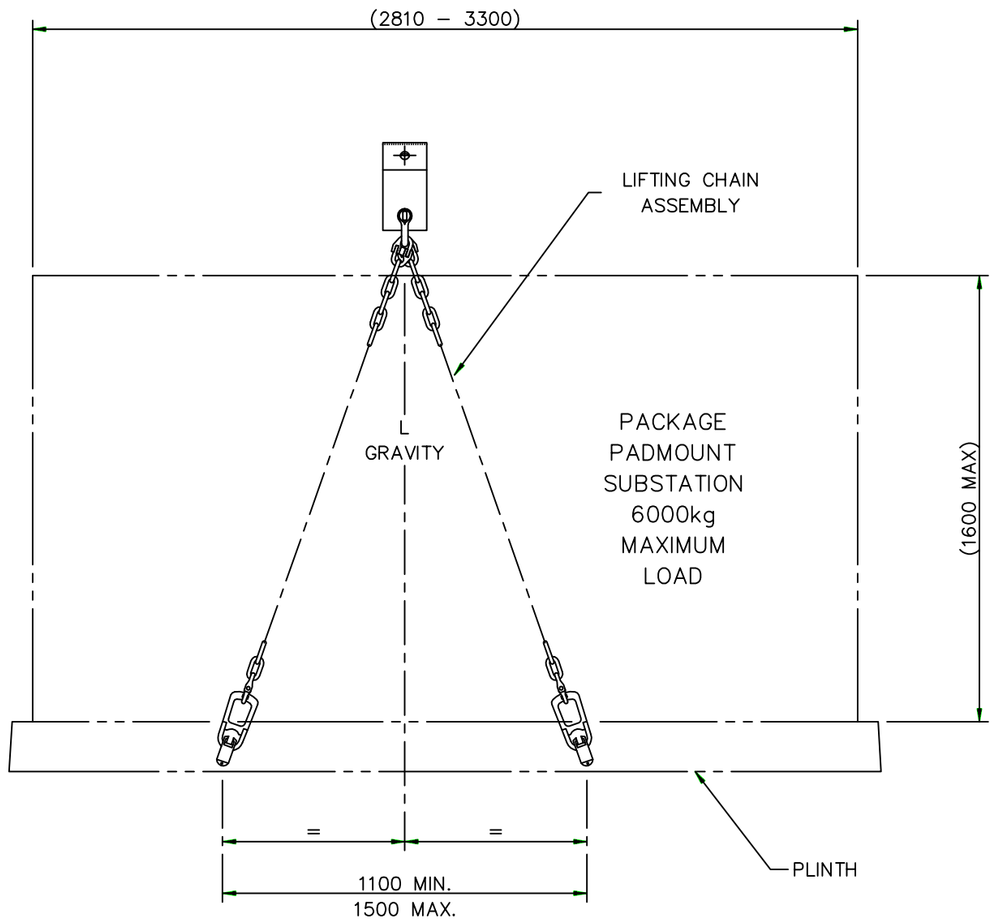
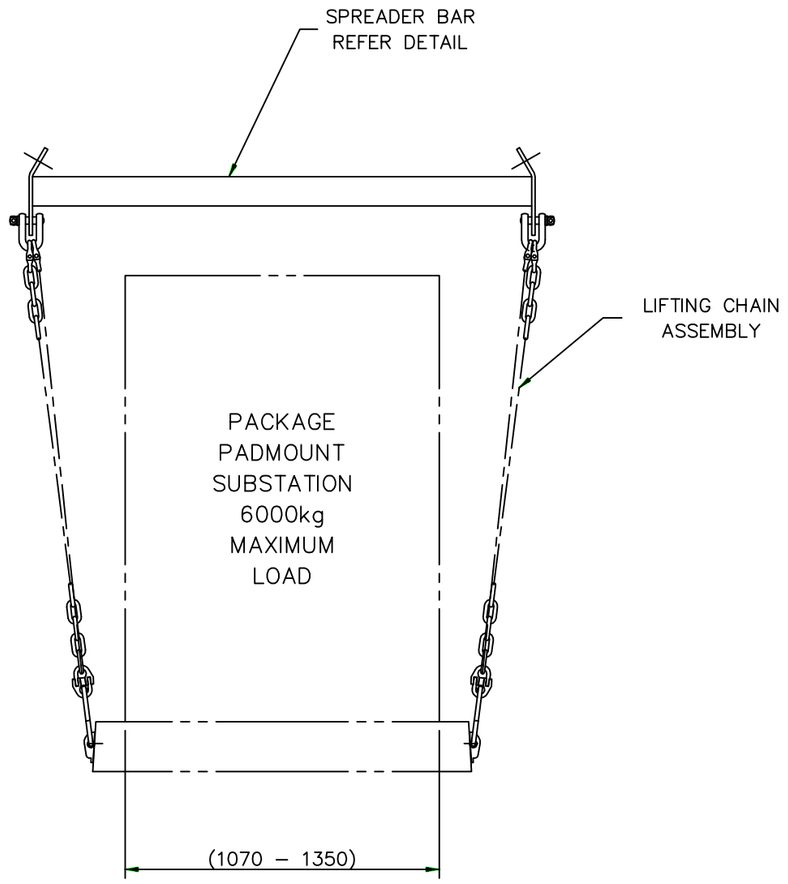
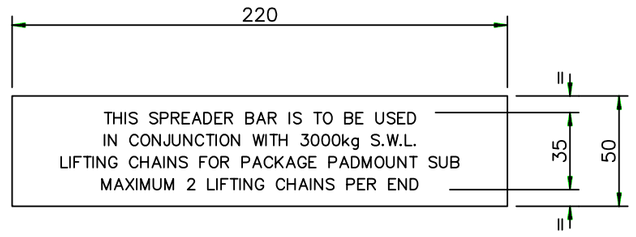
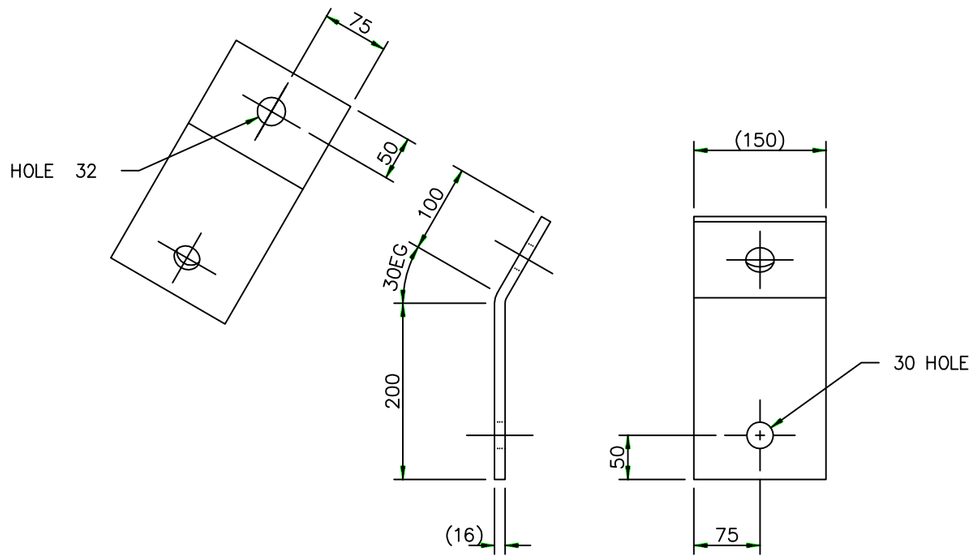


ARRANGEMENT
SCALE 1:15





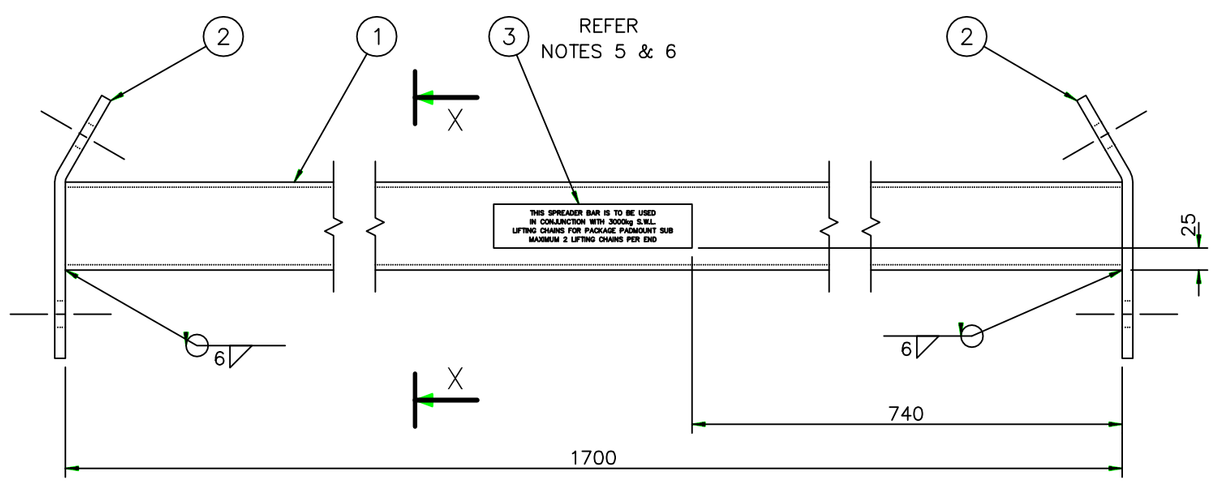
ITEM 3 DETAIL
SCALE 1:2
REFER NOTES 5 & 6



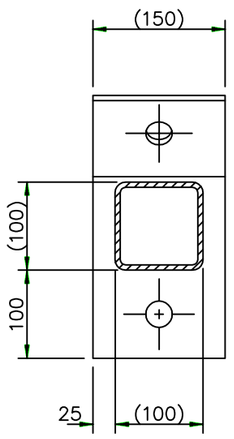
ITEM 2 DETAIL
SCALE 1:5
(2 OFF REQUIRED)

NOTES

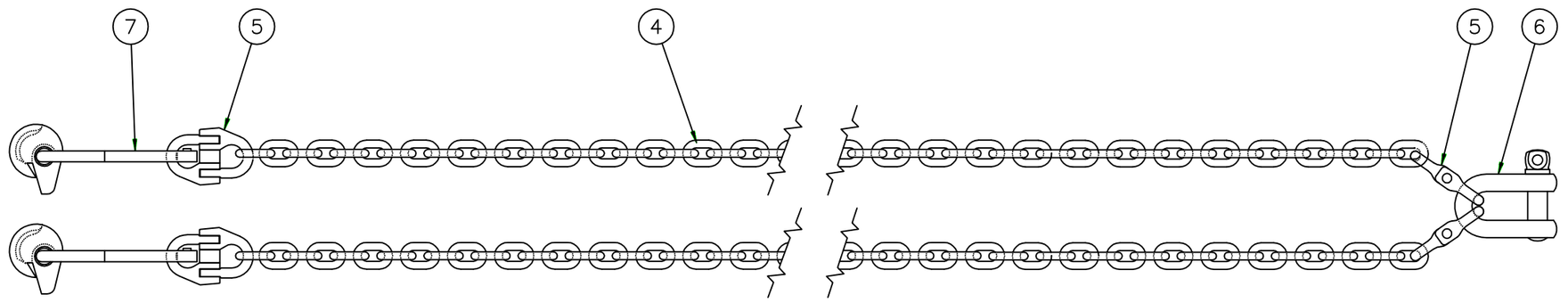
1. WELDING TO BE DONE IN ACCORDANCE WITH AS1554.1.
2. SYMBOLS COMPLY WITH AS1101.3.
3. LIFTING CHAINS TO HAVE "S.W.L. 3000kg" CAPACITY.
4. FINISH:
   2 COATS PRIMER/SURFACER
   (DULUX 2K "PRIMECOTE" OR EQUIV)
   2 COATS SAFETY YELLOW ACRYLIC/ENAMEL
   (DULUX 2K "ACRAN" OR EQUIV).
5. LABEL (ITEM 3) TO BE "POP" RIVETTED TO SPREADER BAR IN POSITION SHOWN AFTER PAINTING.
6. LABEL (ITEM 3) TO BE ENGRAVED AS SHOWN CHARACTERS TO BE 5mm HIGH AND PAINT FILLED (BLACK).



SPREADER BAR DETAIL
SCALE 1:5



SECTION "X–X"



LIFTING CHAIN ASSEMBLY
SCALE 1:5
REFER NOTE 3
(2 OFF REQUIRED)

ITEM	PART	DRG	DESCRIPTION	QTY	REMARK
1	–	–	TUBE STEEL RHS 100 x 100 x 6 x 1700 LG	1	–
2	–	–	BAR STEEL FLAT 150 x 16 x 305 LG	2	DETAIL
3	–	–	SHEET ALUMINIUM 3 x 50 x 220 LG	1	DETAIL
4	–	–	CHAIN (GUNNEBO) SIZE 10 DIA. GRADE 80 CODE KL–10–8 (MAX. LOAD 3.2t.) 54 LINKS (1620 LG.)	4	–
5	–	–	COUPLING LINK (GUNNEBO) TYPE G CODE G–10–8 (MAX. LOAD 3.2 t.)	8	–
6	–	–	SHACKLE DEE ALLOY GRADE S NOM. SIZE 22 DIA. GALV. (WLL 6.5t.)	2	–
7	–	–	LIFTING EYE UNIVERSAL GALV. (REID SWIFTLIFT) (SWL 2.5t.)	4	–

AMENDMENTS

A ORIGINAL ISSUE
J.R No. 950032
DR'N JK
CH'D dd/s
DATE 15–1–96
J.R No. 960004
TENDER SPECIFICATION FROM TITLE BLOCK DELETED
M.S.S. dd/s

B DR'N dd/s
CH'D dd/s
DATE 23–10–97
J.R No. 970067
DIMS 1700, 740 WERE 1400 & 590 (F3).
ITEM 4 WAS 50 LINKS. PACKAGE WAS 4250kg MAXIMUM LOAD.
1100 MIN, 1500 MAX DIMS ADDED (D2).
TITLE WAS "11kV PADMOUNT"
M.S.S. dd/s

C DR'N D.J.Z.
CH'D D.J.Z.
DATE 24–11–97
J.R No. 970067
ITEM 1 WAS 100x100x6 TUBE
ITEM 2 WAS 12 THK
M.N.S.A. JK

D DR'N D.J.Z.
CH'D D.J.Z.
DATE 04–7–95
J.R No. 950032
ITEM 1 WAS 100x100x6 TUBE
ITEM 2 WAS 12 THK
M.N.S.A. JK

ORIGINAL SCALE AS SHOWN
APPROVED C.Howat
DRAWN D.J.Z.
DATE 04–7–95
CH'D D.J.Z.

Endeavour Energy

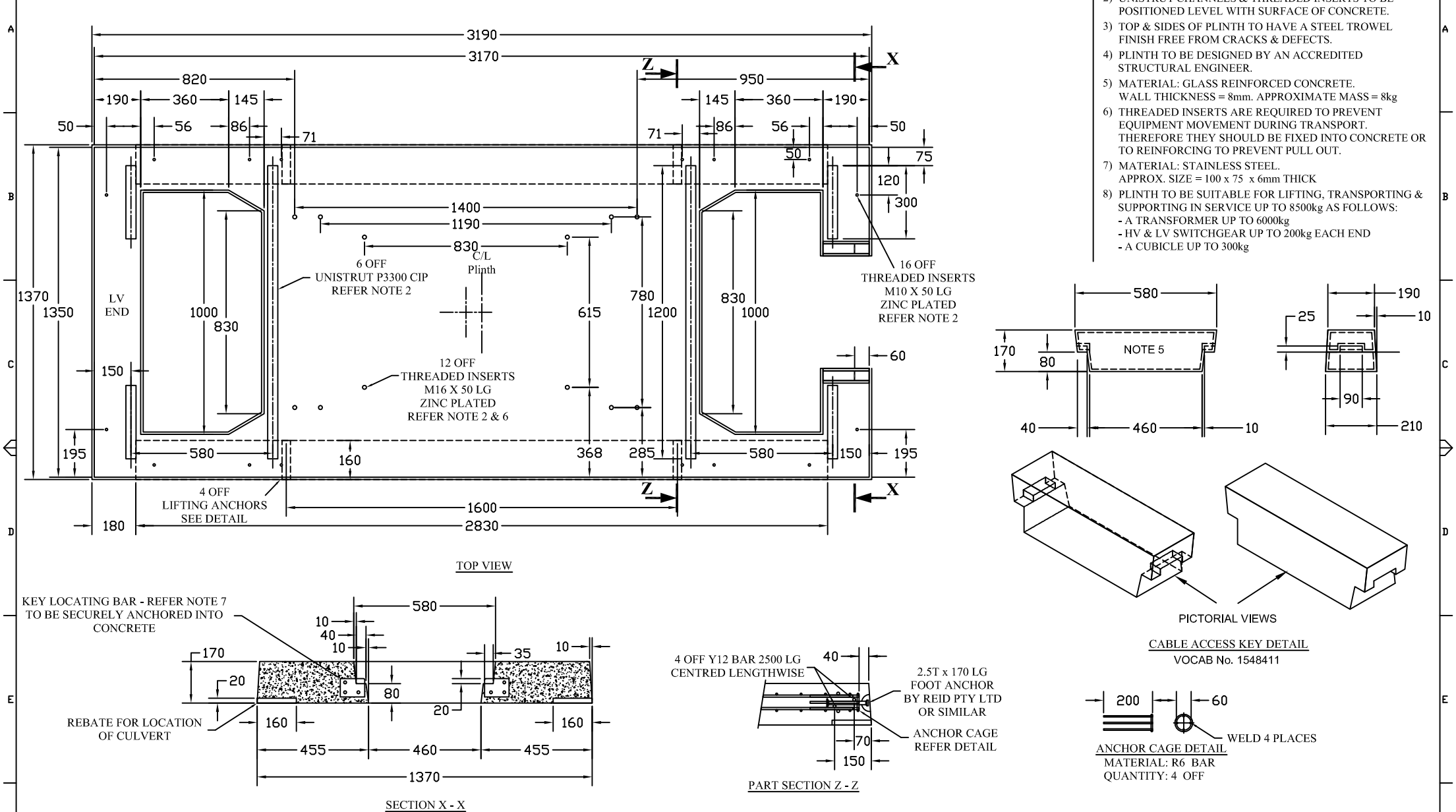
REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED C.Howat
SUBSTATION DEVELOPMENT MGR 12–07–95

PACKAGE PADMOUNT SUBSTATION
LIFTING ARRANGEMENT & DETAILS

A1 078481 D
SHEET No 1 OF 1 SHEETS



NOTES

1) CONCRETE TO HAVE MINIMUM COMPRESSIVE STRENGTH OF 32MPa AFTER 28 DAYS. MAXIMUM SLUMP 80mm.
2) UNISTRUT CHANNELS & THREADED INSERTS TO BE POSITIONED LEVEL WITH SURFACE OF CONCRETE.
3) TOP & SIDES OF PLINTH TO HAVE A STEEL TROWEL FINISH FREE FROM CRACKS & DEFECTS.
4) PLINTH TO BE DESIGNED BY AN ACCREDITED STRUCTURAL ENGINEER.
5) MATERIAL: GLASS REINFORCED CONCRETE. WALL THICKNESS = 8mm. APPROXIMATE MASS = 8kg
6) THREADED INSERTS ARE REQUIRED TO PREVENT EQUIPMENT MOVEMENT DURING TRANSPORT. THEREFORE THEY SHOULD BE FIXED INTO CONCRETE OR TO REINFORCING TO PREVENT PULL OUT.
7) MATERIAL: STAINLESS STEEL. APPROX. SIZE = 100 x 75 x 6mm THICK
8) PLINTH TO BE SUITABLE FOR LIFTING, TRANSPORTING & SUPPORTING IN SERVICE UP TO 8500kg AS FOLLOWS:
   - A TRANSFORMER UP TO 6000kg
   - HV & LV SWITCHGEAR UP TO 200kg EACH END
   - A CUBICLE UP TO 300kg

AMENDMENTS				
A	ORIGINAL ISSUE			
B	DRN	G. FORD	S.E.D.	HV & LV PENETRATIONS & CUBICLE HOLD DOWN MODIFIED
	CH'D	G. FORD		
	DATE	21/06/01		
	JR No			
C	DRN	G. FORD	D.E.S.	CABLE ACCESS KEY SHAPE MODIFIED TO TAPPER SAME AS PLINTH
	CH'D	G. FORD		
	DATE	04/01/05		
	JR No			

ORIGINAL SCALE	
APPROVED	G. Ford
DRAWN	G. Ford
DATE	22/08/2001
CH'D	G. Ford

Endeavour Energy

REFERENCE DRAWINGS

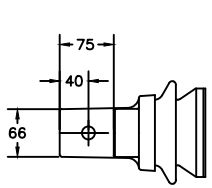
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET SERVICES 22/08/2001

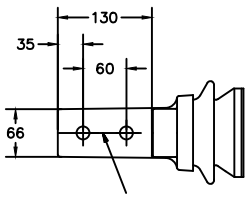
SIZE 14 & 16 PADMOUNT SUBSTATION
PRECAST CONCRETE PLINTH
FOR CULVERT FOOTING
CONSTRUCTION DETAILS

A3 | 245886 | C

SHEET No 1 OF 1 SHEETS

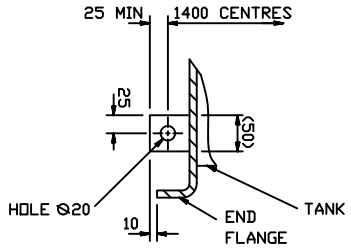


315KVA & 500KVA
PHASE ONLY
1 HOLE Ø18 LV PALM

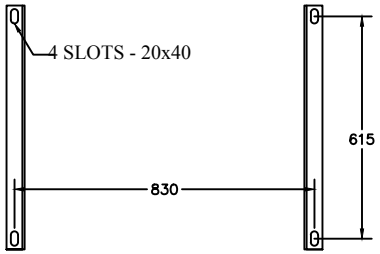


1000KVA, 1500KVA PHASE
& ALL TRF NEUTRALS
2 HOLES Ø18 LV PALM

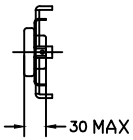
LV PALM DETAILS



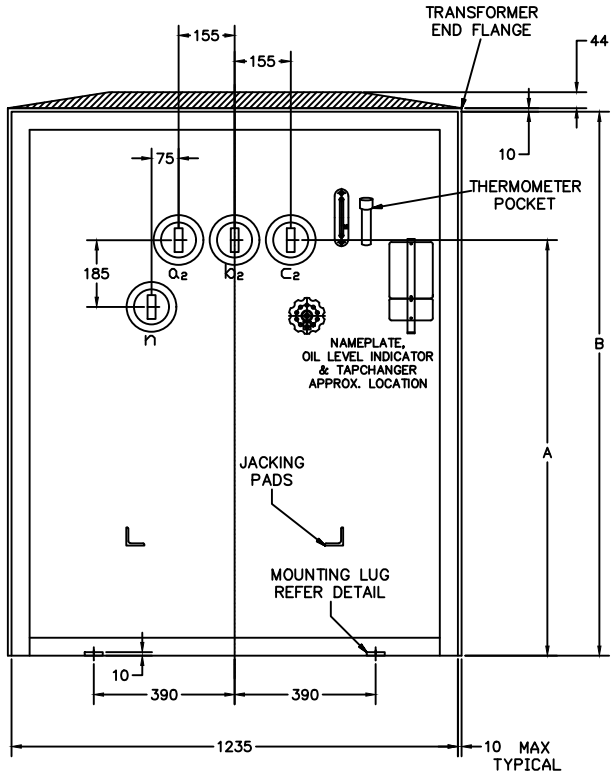
MOUNTING LUG DETAIL
PLAN VIEW



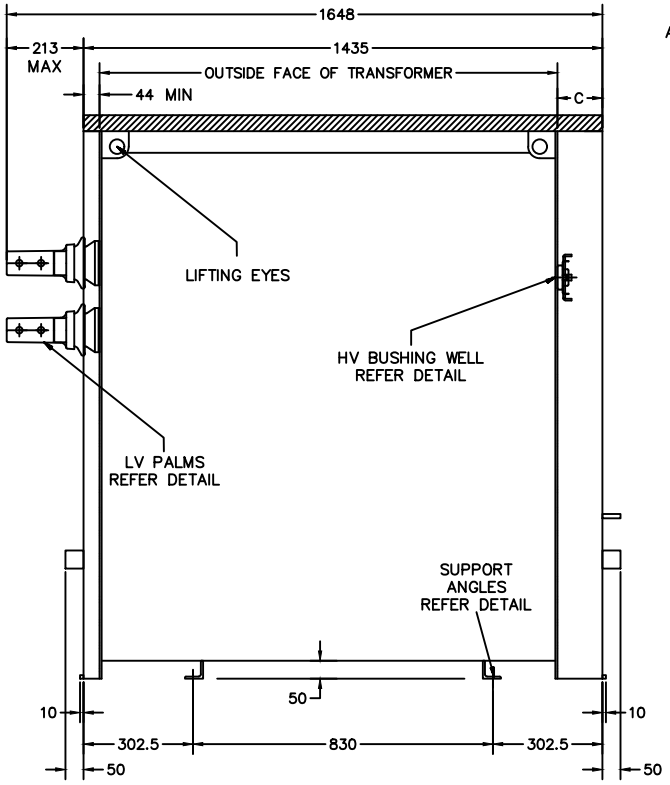
SUPPORT/MOUNTING ANGLES DETAIL
PLAN VIEW



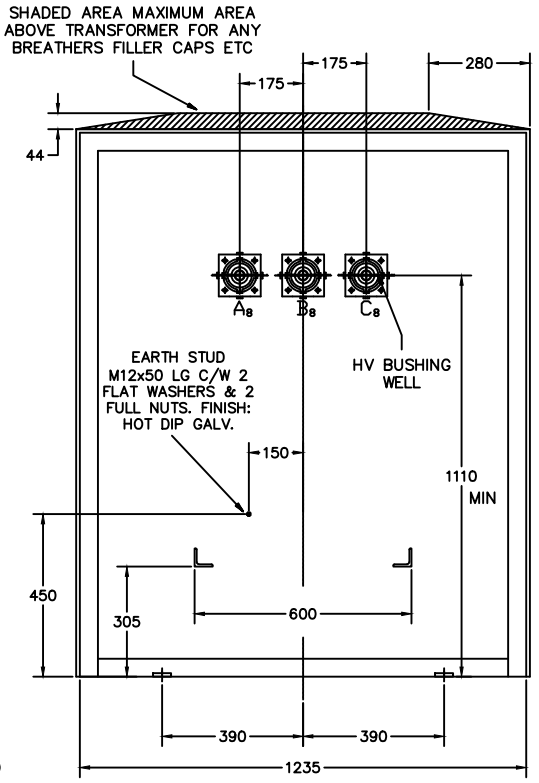
HV BUSHING WELL DETAIL



L.V. END



SIDE VIEW



H.V. END

RATING OF TRANSFORMER			
	315 & 500kVA	1000kVA	1500kVA
DIM A	1150	1345	1345
DIM B	1275	1505	1505
DIM C	130	75	44

AMENDMENTS

A	ORIGINAL ISSUE	G.P.S	
B	DRN G.P.S; CH'D G.P.S; DATE 23-10-97; JR No 970067; TITLE WAS "300," K.M.S.A		
C	DRN B.C.H; CH'D B.C.H; DATE 02-10-98; JR No GD11100; 600 WAS 1700 & 1250; WAS 1450, (GR A4), 1465 & 1750 WAS 1550 MAX. (GR B3). NOTE 2 WAS HEIGHT: 1560 - 1600mm.		
D	DRN R.H; CH'D R.H; DATE 23-8-99; JR No W2011223; LAYOUT OF LV & HV ENDS REVISED. TABLE ADDED.	MNAT	
E	DRN G. Ford; CH'D G. Ford; DATE 25-6-2008; JR No; REDRAWN, TABLES AMENDED, HV BUSHING DETAILS ADDED	MDAS	G. Ford
F	DRN CSA; CH'D VM; DATE 26/11/04; JOB No; LV PALM HOLE DIAMETER CHANGED FROM 22 TO 18.	DSEP	VM
G	DRN G. Ford; CH'D G. Ford; DATE 26-11-15; JR No; LV NEUTRAL BUSHING NOW AT LEFT. LIFTING EYES SHOWN. THERMOPOCKET SHOWN.	NSW	C. Crisp. Fulli

ORIGINAL SCALE		APPROVED	G. Ford
DRAWN	B.G.H		
DATE	03/10/1997	INDEX REF.	S008A
CH'D	G.P.S		

Endeavour Energy

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

REFERENCE DRAWINGS

AUTHORISED
Glen Ford

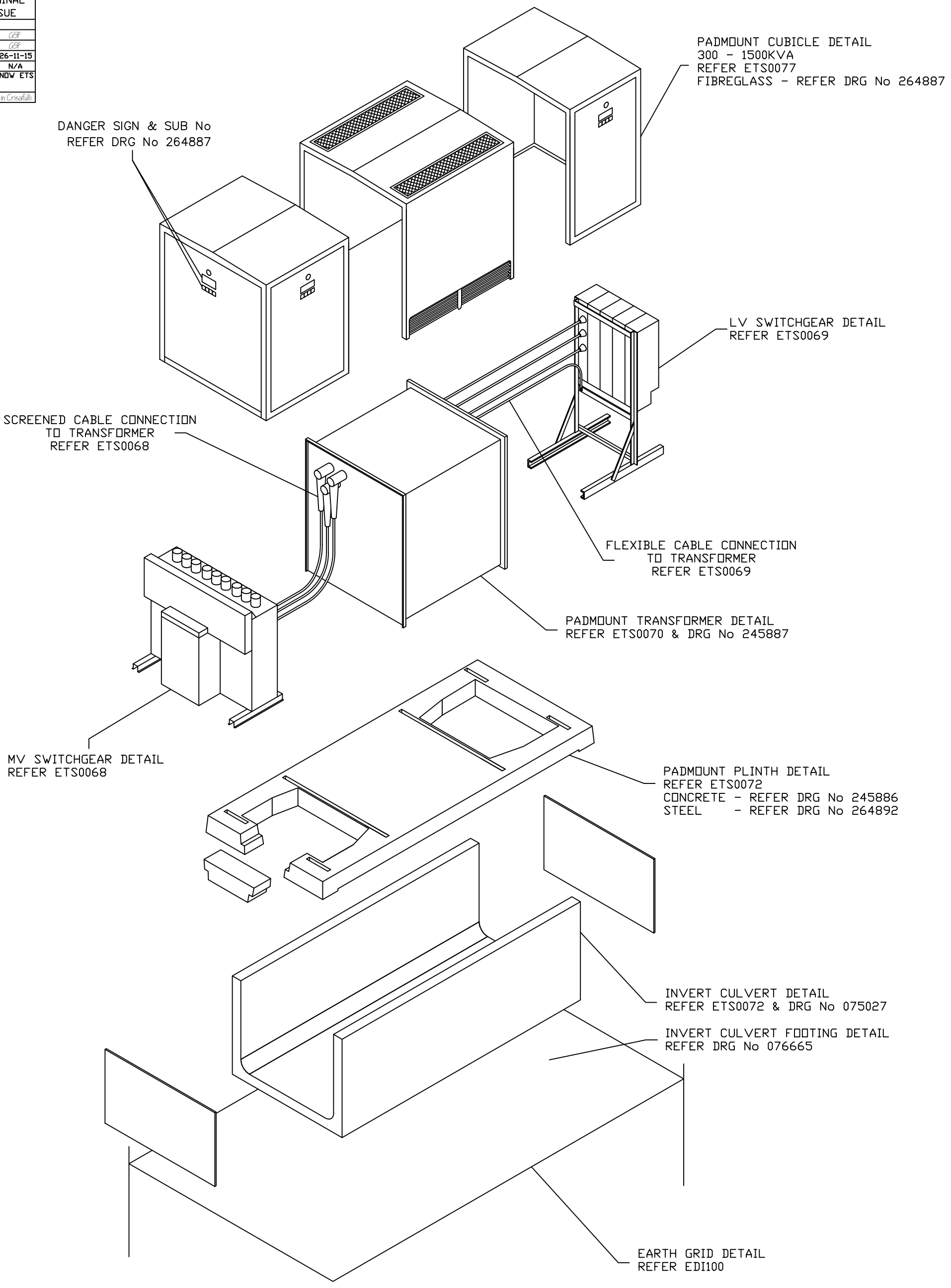
MANAGER SUBSTATION STANDARDS 03/10/1997

SIZE 14-315,500KVA & SIZE 16-1000,1500KVA
PADMOUNT & INDOOR TRANSFORMER
TYPICAL REQUIREMENTS

A3 | 245887 | G

SHEET No 1 OF 1 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N GSF CH'D GSF DATE 26-11-15 JR No N/A ALL SDI REF. NOW ETS REFERENCES NSM Colin Crisafulli



Endeavour Energy

ORIGINAL SCALE		APPROVED	G. Ford
DRAWN	G. Ford		
DATE	01/08/2001	INDEX REF.	S003A
CH'D	G. Ford		

REFERENCE DRAWINGS

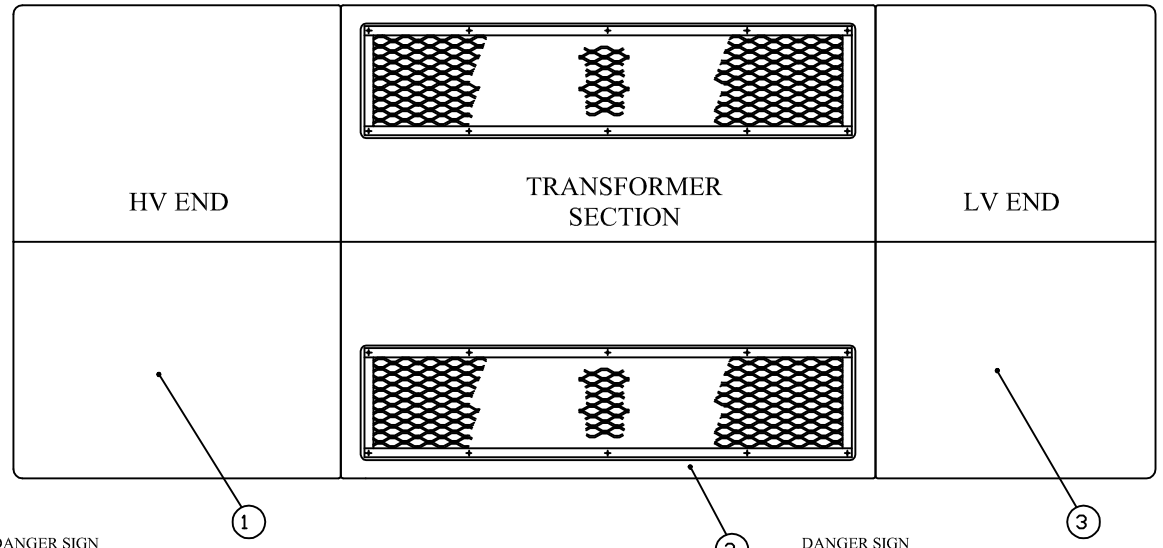
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET SERVICES 01/08/2001

SIZE 14 AND 16
11/22KV PADMOUNT SUBSTATION
EXPLODED VIEW

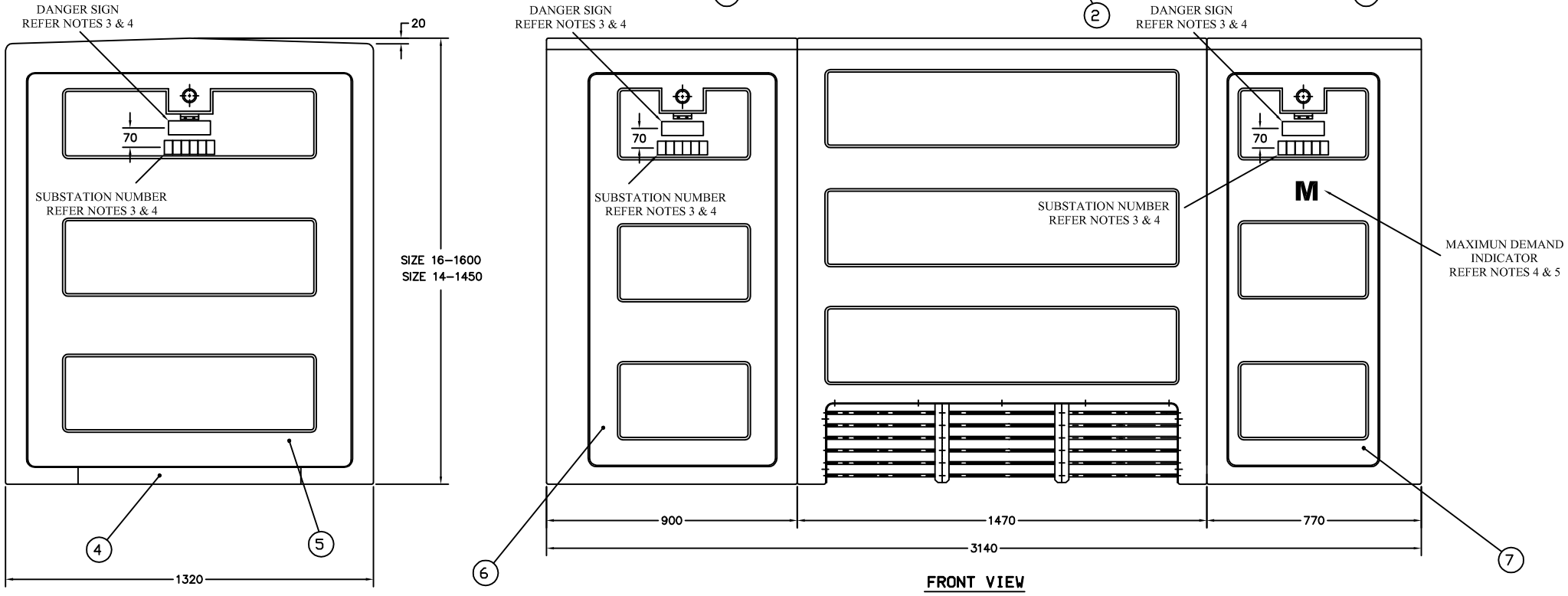
A3 | 264786 | B

SHEET No 1 OF 1 SHEETS

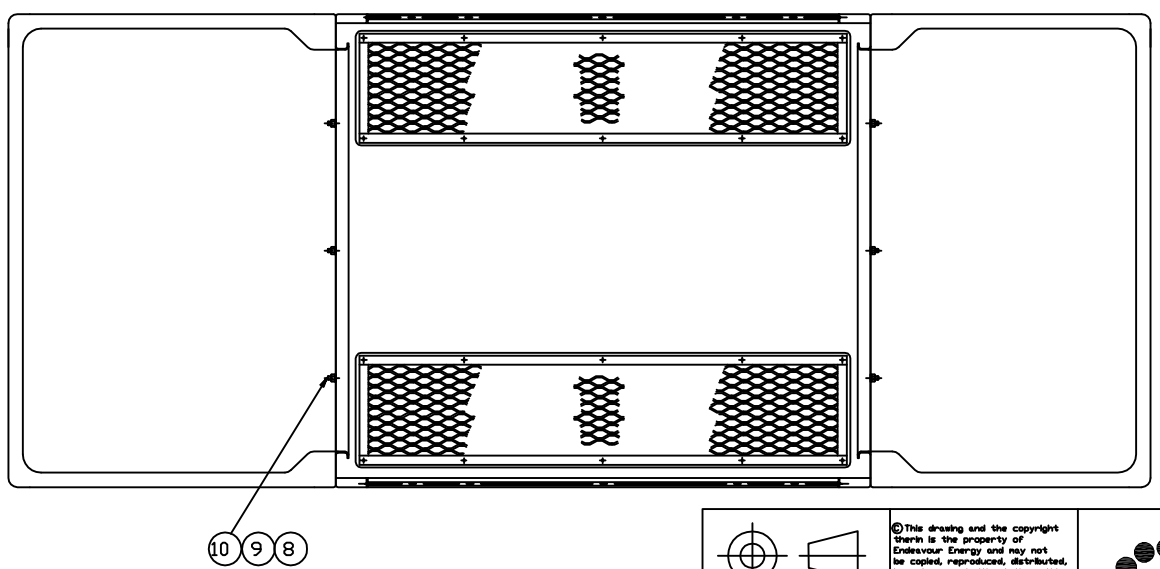


NOTES

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH THE RELEVENT Endeavour Energy PADMOUNT SUBSTATION CUBICLE SPECIFICATION
2. THE REAR VIEW NOT DRAWN IS A MIRROR IMAGE OF FRONT VIEW SHOWN.
3. "DANGER HIGH VOLTAGE" SIGNS AND SUBSTATION NUMBERS TO BE FITTED ON ALL DOORS AS SHOWN.
4. SIGNS & NUMBERS TO BE FITTED BY WORKSHOP STAFF PRIOR TO ISSUE.
5. LETTER "M" TO BE AFFIXED TO LOW VOLTAGE DOOR WHICH ALLOWS ACCESS FOR THE READING OF MAXIMUM DEMAND INDICATORS.



FRONT VIEW



ITEM NO	VOCAB / DRG	DESCRIPTION	QTY	REFER
1	NA	HIGH VOLTAGE COMPARTMENT	1	DRG 264891
2	NA	TRANSFORMER COMPARTMENT	1	DRG 264888
3	NA	LOW VOLTAGE COMPARTMENT	1	DRG 264891
4	NA	REMOVABLE BOTTOM MULLION	2	DRG 264891
5	NA	DOOR CUBICLE END HV & LV	2	DRG 264890
6	NA	DOOR CUBICLE SIDE HIGH VOLTAGE	2	DRG 264890
7	NA	DOOR CUBICLE SIDE LOW VOLTAGE	2	DRG 264890
8	NA	WASHER ROUND FLAT GALV M10	18	–
9	NA	WASHER SPRING GALV M10	18	–
10	NA	NUT HEX HD GALV M10	18	–

AMENDMENTS

A	ORIGINAL ISSUE		
B	DR'N	GSF	
	CH'D	GSF	
	DATE	01-10-03	
	JR No	– –	
	SIZE 14 HEIGHT NOW 1450MM.		GSF
	MDEB		

ORIGINAL SCALE

APPROVED G. Ford

DRAWN	G. Ford		
DATE	10/08/2001		
CH'D	G. Ford		

Endeavour Energy

REFER MATERIAL LIST

STEELWORK DETAILS 264889

REFERENCE DRAWINGS

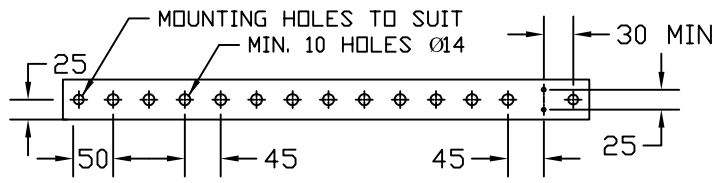
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET SERVICES 10/08/2001

SIZE 14 & 16 – PADMOUNT SUBSTATION
FIBREGLASS CUBICLE
GENERAL ARRANGEMENT

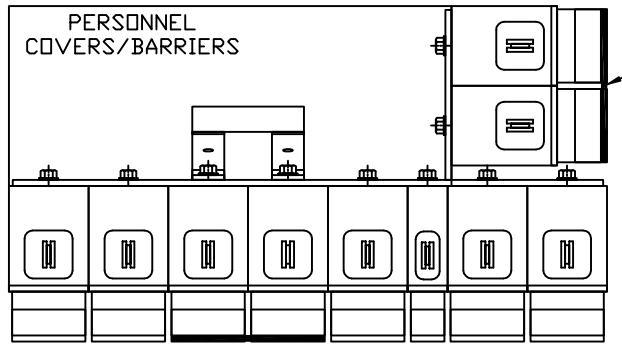
A3 264887 B

SHEET No 1 OF 1 SHEETS



NEUTRAL EARTH BAR

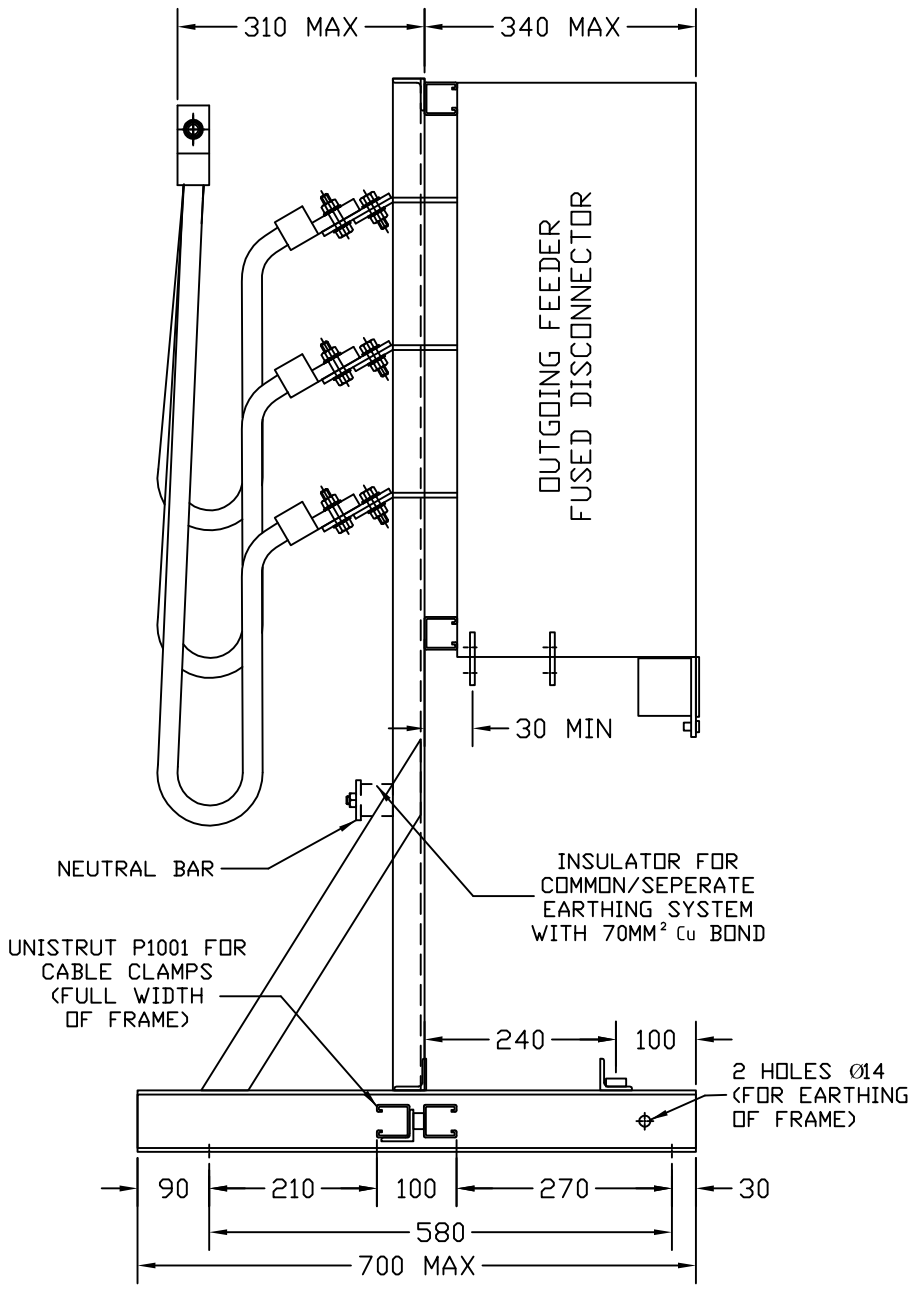
BAR COPPER FLAT HDHC 50 x 6
FINISH: TINNED AFTER FABRICATION

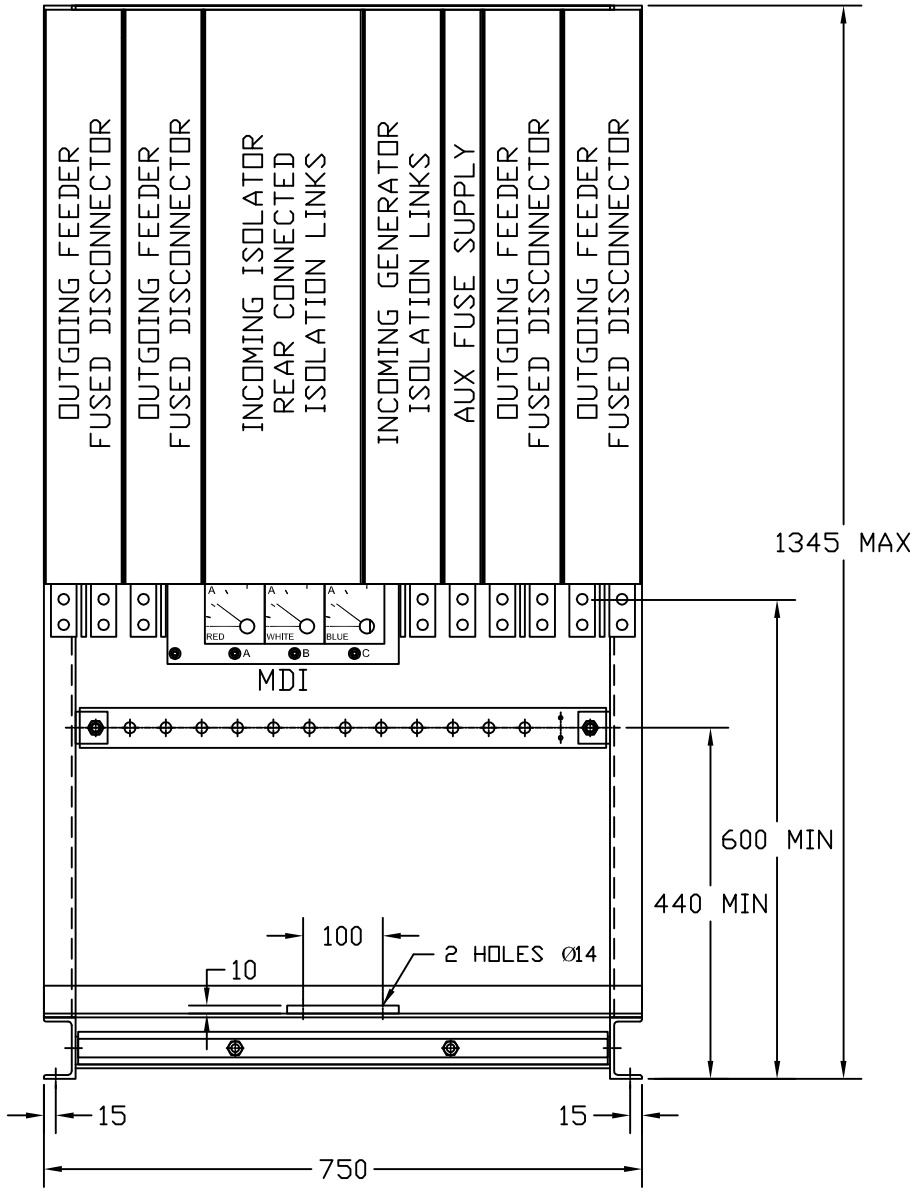


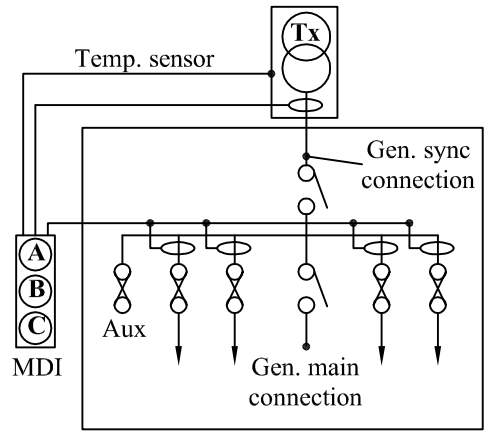
TOP VIEW OF LV WITH GENERATOR
CONNECTION LOCATION OPTIONS

NOTES

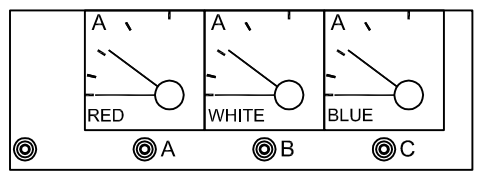
1) DRAWING TO BE READ IN CONJUNCTION WITH THE PADMOUNT SUBSTATION STANDARDS.
2) FRAME TO BE FULLY SEAL WELDED IN ACCORDANCE WITH AS1554. REMOVE ALL SHARP EDGES, MILL SCALE, WELDING SLAG AND SPLATTER. FRAME FINISH: HOT DIP GALVANISED TO AS1650.
3) FRAME TO BE SUITABLY BRACED TO MAINTAIN STABILITY UNDER OPERATING CONDITIONS. ANY BRACING USED MUST NOT EXTEND ABOVE THE NEUTRAL EARTH BAR.
4) SWITCHGEAR FOOTING SHALL BE DESIGNED TO MATCH PADMOUNT SUBSTATION DRAWING NUMBER 245886.
5) THE MDI IS TO BE ABLE TO BE REPLACED WITHOUT AN OUTAGE ON LV. MDI TO FACE SAME SIDE AS WHERE SWITCHING OPERARTIONS ARE PERFORMED BUT LOCATION IS NEGOTIABLE.







SCHEMATIC DIAGRAM



MAXIMUM DEMAND INDICATORS

EXAMPLE METERS AND
TEST PLUG ARRANGEMENT
(REFER NOTE 5)

AMENDMENTS			
A	ORIGINAL ISSUE		
	DR'N	KT	
	CH'D	VM	
	DATE	26-4-06	
	JR No	--	
B	STAND OFF INSUL. & Cu LINK ADDED TO NEUTRAL EARTH BAR NOTE 4 ADDED. TITLE REVISED		
	DSM	VM	
	DR'N	GSF	
	CH'D	GSF	
	DATE	06-9-10	
	JR No	--	
C	WIDTH REDUCED FROM 965 TO 750. MDI TYPE AND LOCATION MODIFIED. ALT. GEN. LOCATION ADDED.		
	MDEB	GSF	

ORIGINAL SCALE

APPROVED G. Ford

DRAWN	G. Ford		
DATE	23/10/2001		
CH'D	G. Ford		

Endeavour Energy

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER DISTRIBUTION SERVICES 23/10/2001

PADMOUNT SUBSTATION LV DISTRIBUTION BOARD FRAME TO SUIT SIZE 14 & 16 SUBSTATION ARRANGEMENT DETAILS

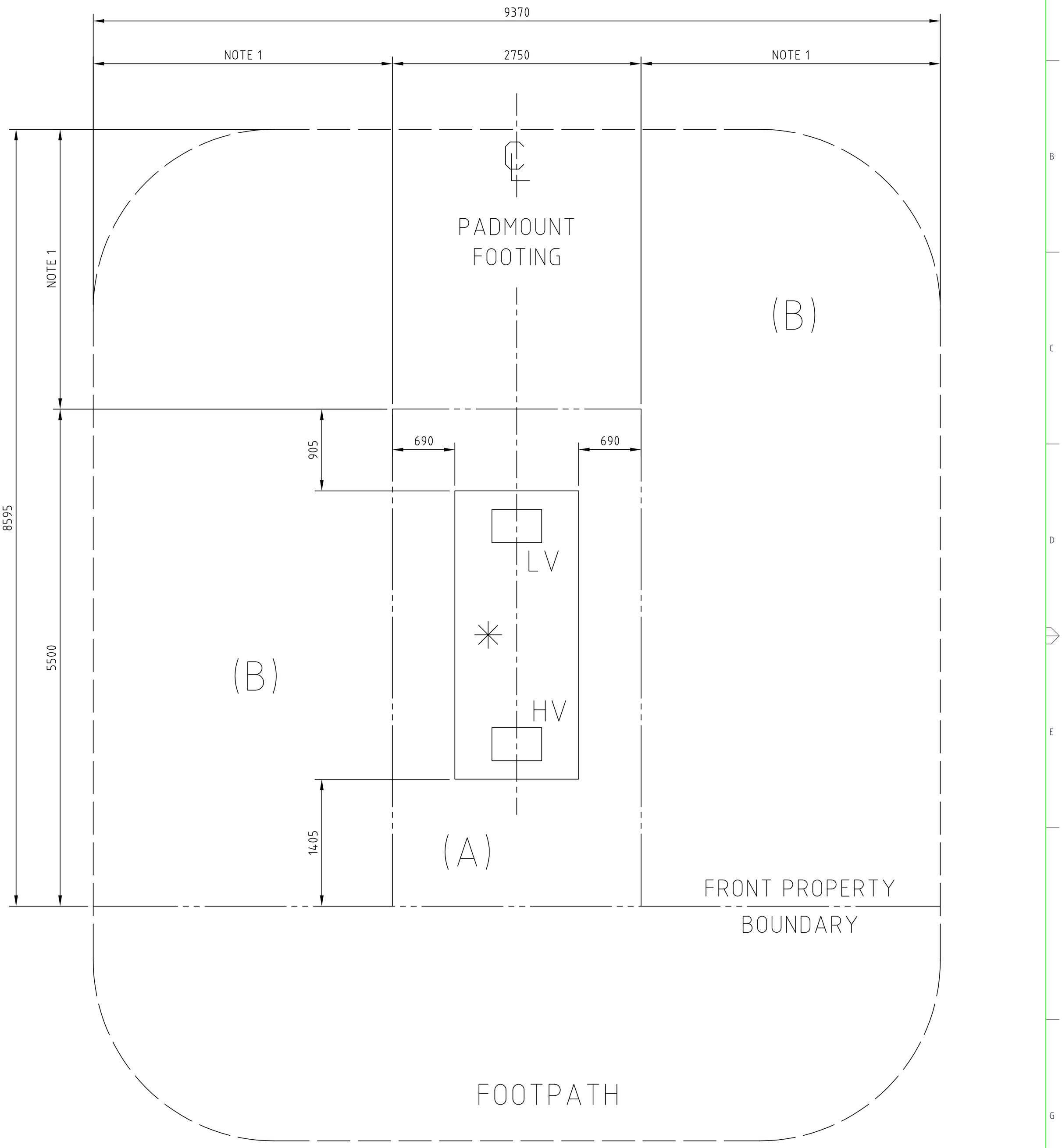
A3 | 266515 | C

SHEET No 1 OF 1 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

EASEMENT PROPOSALS FOR PADMOUNT SUBSTATION

GENERAL ARRANGEMENT



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.
2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES.
3. EASEMENT TO BE UNENCUMBERED BY FENCING. WHERE FENCING ENCROACHES ON THE EASEMENT THE EASEMENT MUST BE MOVED.

www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

✳ PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m^2

(B) COVENANT

Endeavour Energy

ORIGINAL SCALE 1:30		APPROVED D.Marshall	
DRAWN	J.H.		
DATE	24-08-05		
CH'D	DM		

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W.Isley
MANAGER ASSET ENGINEERING 26.10.05

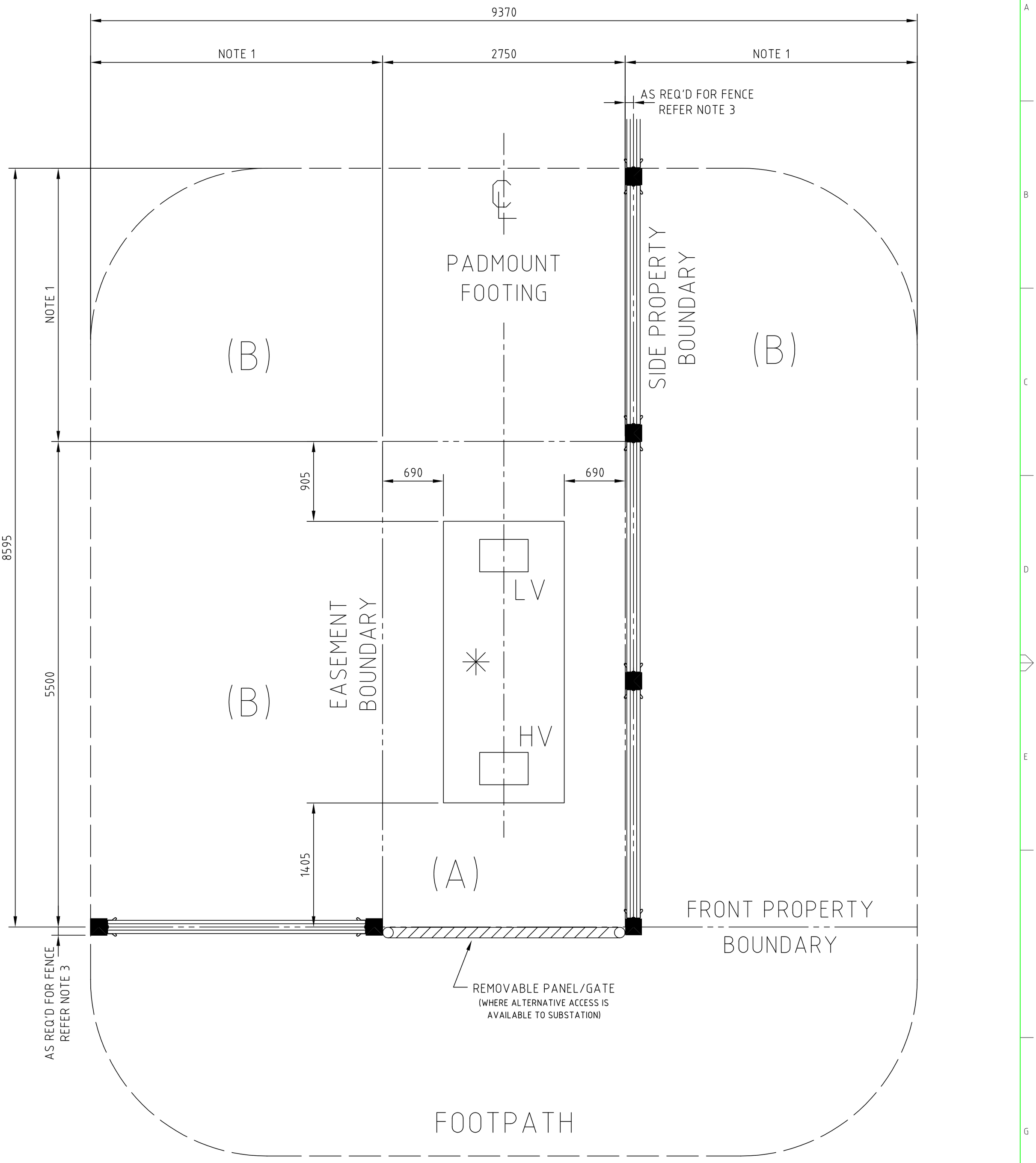
FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION (EASEMENT DETAILS)

A2P 289702 A

SHEET No 1 OF 7 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

SCENARIO No.1



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.

2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES. IF LOCKED THEN PANEL/GATE IS TO BE FITTED WITH "IE" SERIES LOCK.

3. EASEMENT TO BE UNENCUMBERED BY FENCING. WHERE FENCING ENCROACHES ON THE EASEMENT THE EASEMENT MUST BE MOVED.

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DIAL 1100 BEFORE YOU DIG

■ FOR SEPARATELY EARTHED SUBSTATIONS, INSULATED POSTS ARE REQUIRED ON ALL PANELS UP TO & INCLUDING 4m FROM SUBSTATION.

✳ PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m²

(B) COVENANT

▭ FENCE

▨ GATE/REMOVABLE FENCE PANEL

Endeavour Energy

REFERENCE DRAWINGS

ORIGINAL SCALE 1:30	APPROVED D.Marshall	DO NOT SCALE DIMENSIONS IN MILLIMETRES	AUTHORISED W.Isley

DRAWN	J.H.		
DATE	24-08-05		
CH'D	DM		

FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION SCENARIO No.1

MANAGER ASSET ENGINEERING 26.10.05

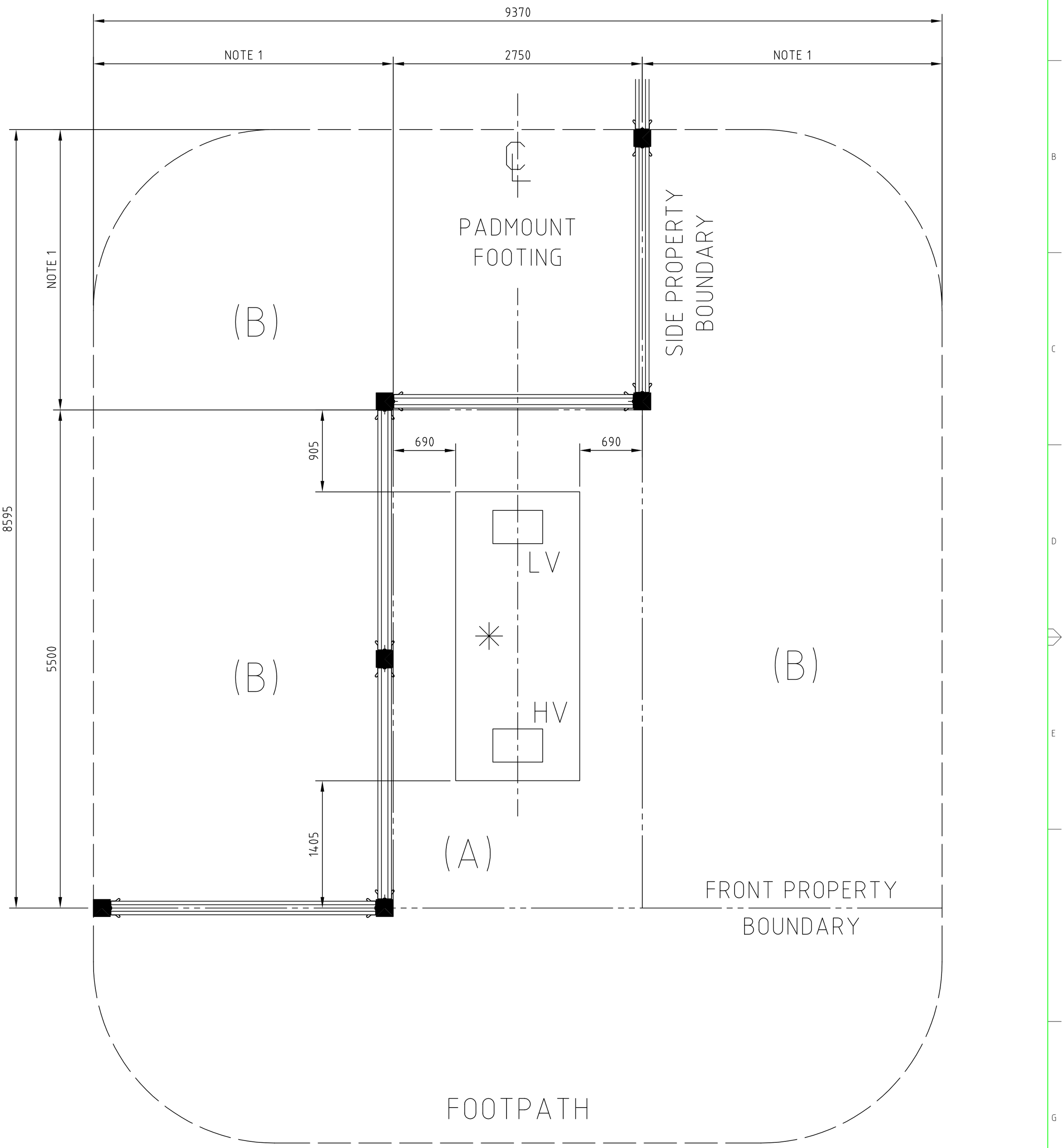
A2P 289702 A

SHEET No 2 OF 7 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

SCENARIO No.2

PARTIALLY FENCED



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.
2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES.
3. EASEMENT TO BE UNENCUMBERED BY FENCING. WHERE FENCING ENCROACHES ON THE EASEMENT THE EASEMENT MUST BE MOVED.

www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

■ FOR SEPARATELY EARTHED SUBSTATIONS, INSULATED POSTS ARE REQUIRED ON ALL PANELS UP TO & INCLUDING 4m FROM SUBSTATION.

✳ PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m²

(B) COVENANT

FENCE

Endeavour Energy

ORIGINAL SCALE 1:30	APPROVED D.Marshall
DRAWN J.H.	
DATE 24-08-05	
CH'D DM	

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSION IN MILLIMETRES

AUTHORISED W.Isley

MANAGER ASSET ENGINEERING 26.10.05

FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION SCENARIO No.2

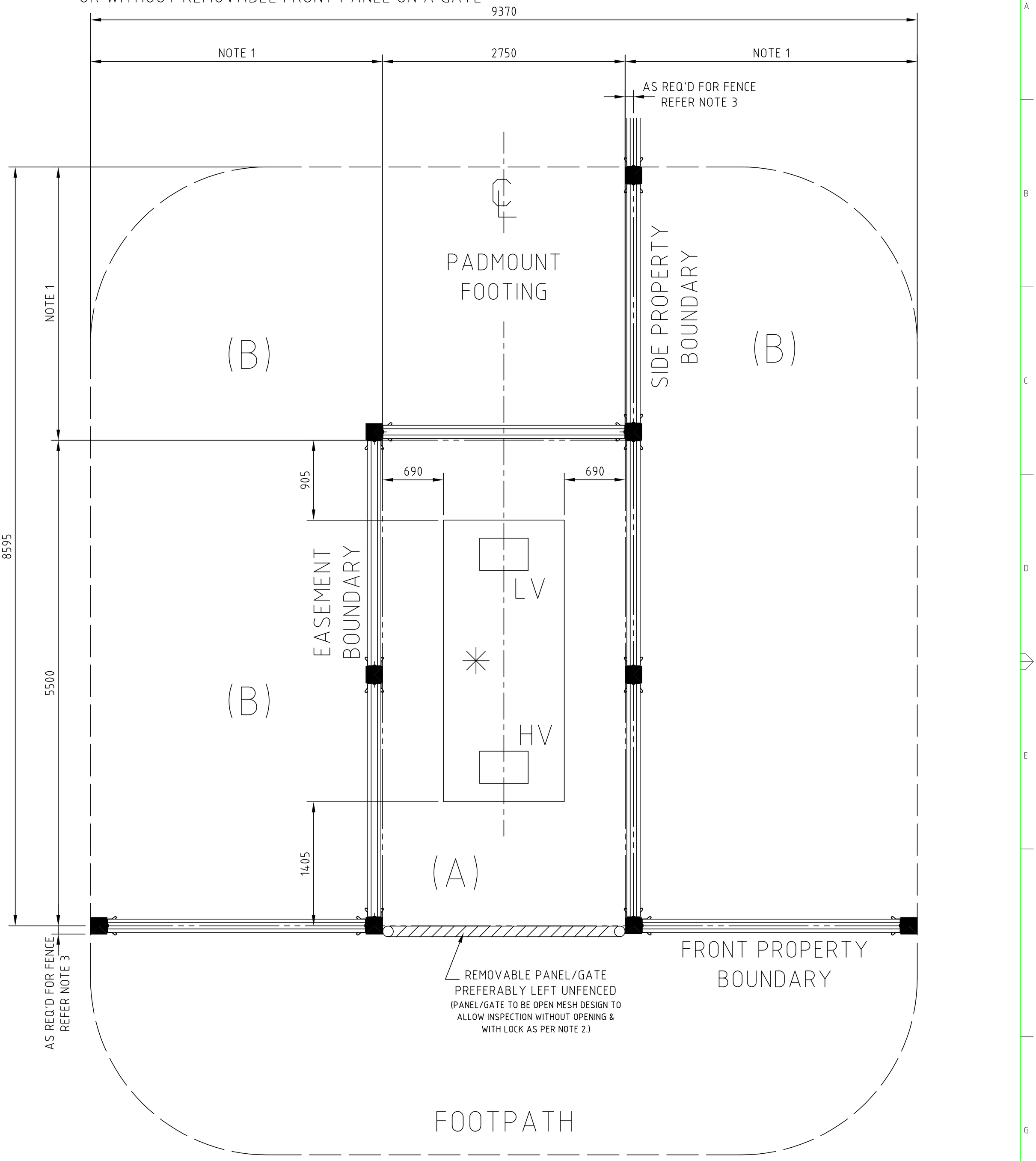
A2P 289702 A

SHEET No 3 OF 7 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

SCENARIO No.3

FULLY FENCED OUT PADMOUNT SUBSTATION WITH OR WITHOUT REMOVABLE FRONT PANEL ON A GATE



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.
2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES. IF LOCKED THEN PANEL/GATE IS TO BE FITTED WITH "IE" SERIES LOCK.
3. EASEMENT TO BE UNENCUMBERED BY FENCING. WHERE FENCING ENCROACHES ON THE EASEMENT THE EASEMENT MUST BE MOVED.

www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

■ FOR SEPARATELY EARTHED SUBSTATIONS, INSULATED POSTS ARE REQUIRED ON ALL PANELS UP TO & INCLUDING 4m FROM SUBSTATION.

✳ PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m²

(B) COVENANT

FENCE

GATE/REMOVABLE FENCE PANEL

Endeavour Energy

ORIGINAL SCALE 1:30		APPROVED D.Marshall	
DRAWN	J.H.		
DATE	25-08-05		
CH'D	DM		

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W.Isley
MANAGER ASSET ENGINEERING 26.10.05

FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION SCENARIO No.3

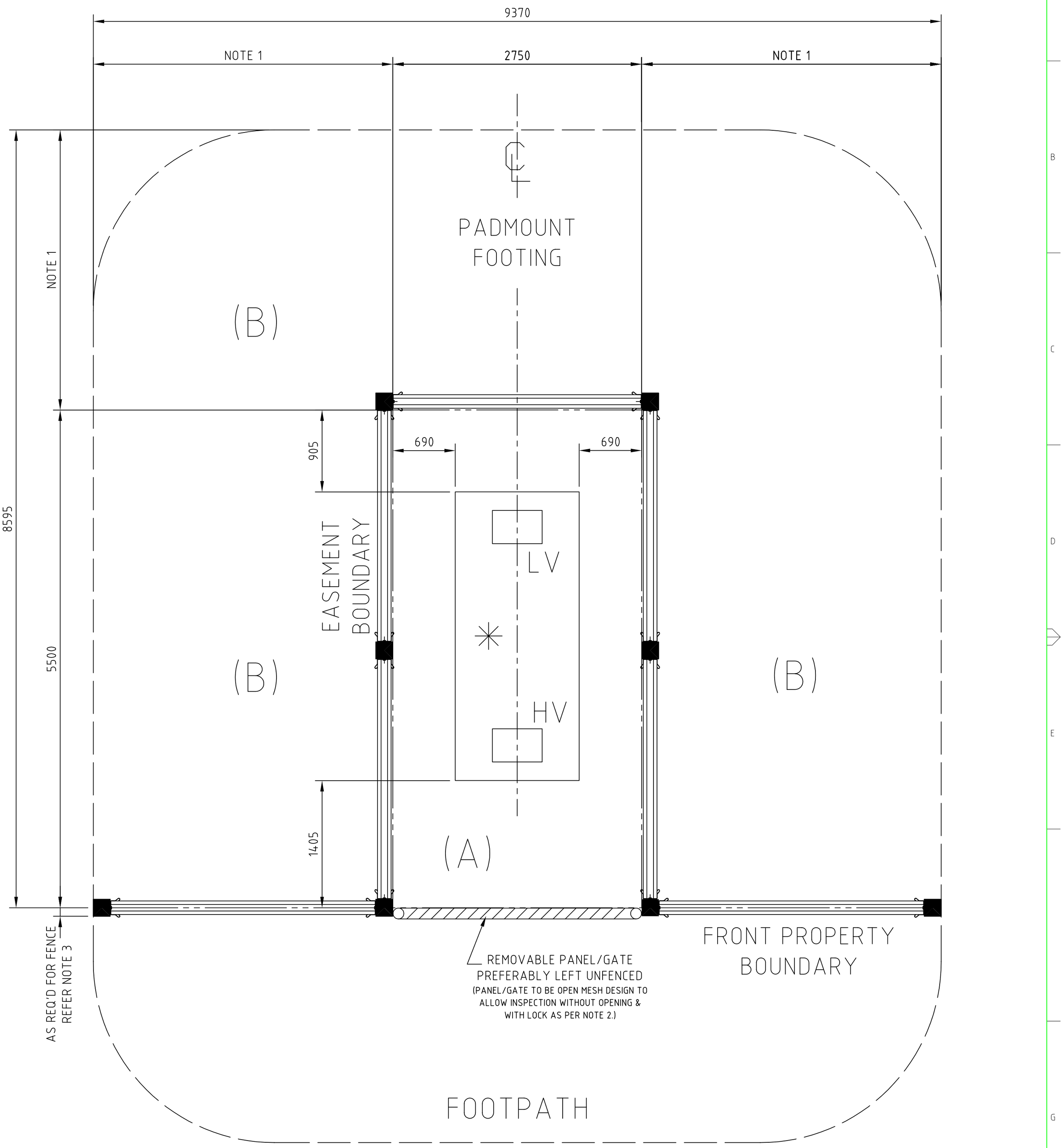
A2P 289702 A

SHEET No 4 OF 7 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

SCENARIO No.4

FULLY FENCED OUT PADMOUNT SUBSTATION WITH OR WITHOUT REMOVABLE FRONT PANEL ON A GATE



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.
2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES. IF LOCKED THEN PANEL/GATE IS TO BE FITTED WITH "IE" SERIES LOCK.
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www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

FOR SEPARATELY EARTHED SUBSTATIONS, INSULATED POSTS ARE REQUIRED ON ALL PANELS UP TO & INCLUDING 4m FROM SUBSTATION.

PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m^2

(B) COVENANT

FENCE

GATE/REMOVABLE FENCE PANEL

Endeavour Energy

ORIGINAL SCALE 1:30		APPROVED D.Marshall	
DRAWN	J.H.		
DATE	25-08-05		
CH'D	DM		

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W.Isley
MANAGER ASSET ENGINEERING 26.10.05

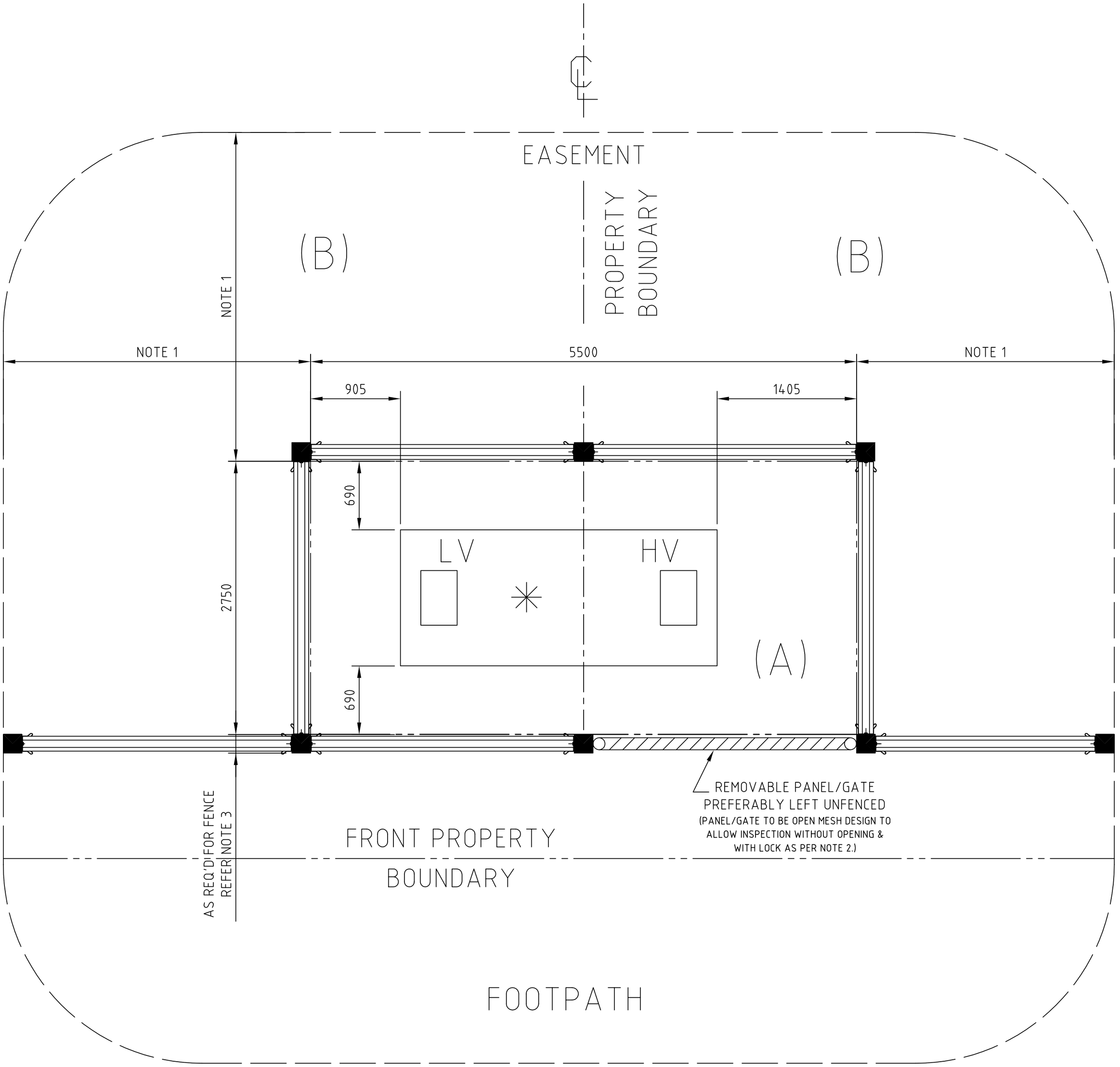
FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION SCENARIO No.4

A2P 289702 A

SHEET No 5 OF 7 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

SCENARIO No.5



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.

2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES. IF LOCKED THEN PANEL/GATE IS TO BE FITTED WITH "IE" SERIES LOCK.

3. EASEMENT TO BE UNENCUMBERED BY FENCING. WHERE FENCING ENCROACHES ON THE EASEMENT THE EASEMENT MUST BE MOVED.

www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

■ FOR SEPARATELY EARTHED SUBSTATIONS, INSULATED POSTS ARE REQUIRED ON ALL PANELS UP TO & INCLUDING 4m FROM SUBSTATION.

✳ PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m^2

(B) COVENANT

▭ FENCE

▨ GATE/REMOVABLE FENCE PANEL

ORIGINAL SCALE 1:30		APPROVED D.Marshall	
DRAWN	J.H.		
DATE	25-08-05		
CH'D	DM		

Endeavour Energy

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W.Isley
MANAGER ASSET ENGINEERING 26.10.05

FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION SCENARIO No.5

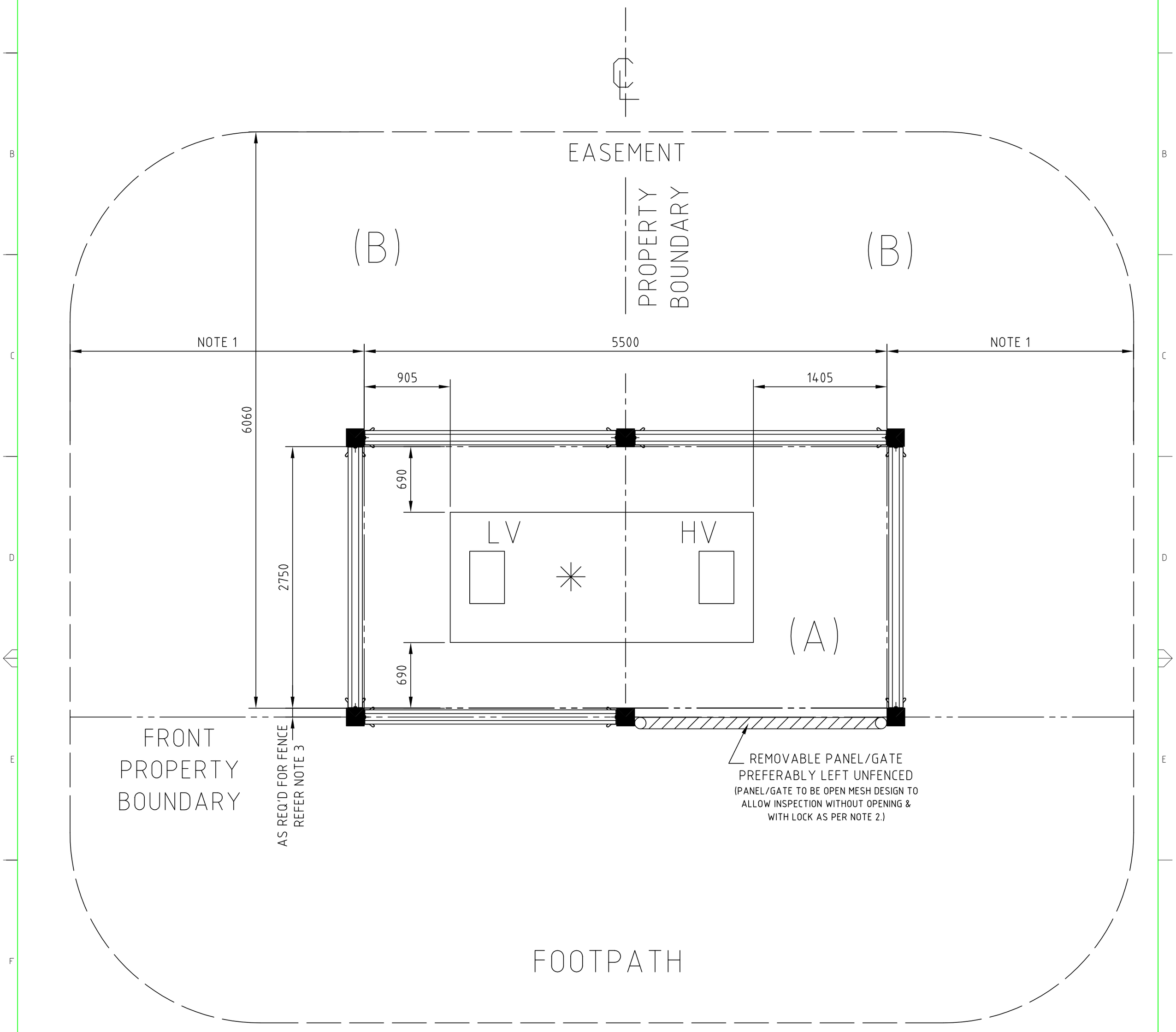
A2P 289702 A

SHEET No 6 OF 7 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	

SCENARIO No.6

LEFT UNFENCED OR REMOVABLE PANELS/GATES



NOTE

1. COVENANT DIMENSIONS SHOULD BE CHECKED TO ENSURE THEY COMPLY WITH SDI 100 AND SUBSTATION DESIGN STANDARDS.
2. UNRESTRICTED 24 HOUR ACCESS TO THE SUBSTATION IS REQUIRED, DIRECTLY FROM A PUBLIC STREET FOR PERSONNEL AND HEAVY VEHICLES. IF LOCKED THEN PANEL/GATE IS TO BE FITTED WITH "IE" SERIES LOCK.
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www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG

■ FOR SEPARATELY EARTHED SUBSTATIONS. INSULATED POSTS ARE REQUIRED ON ALL PANELS UP TO & INCLUDING 4m FROM SUBSTATION.

✳ PLINTH DIMENSIONS 3.19m x 1.37m

(A) EXISTING EASEMENT AREA IS 15.1m²

(B) COVENANT

FENCE

GATE/REMOVABLE FENCE PANEL

ORIGINAL SCALE 1:30		APPROVED D.Marshall	
DRAWN	J.H.		
DATE	25-08-05		
CH'D	DM		

Endeavour Energy

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W.Isley
MANAGER ASSET ENGINEERING 26.10.05

FENCING ARRANGEMENT FOR PADMOUNT SUBSTATION SCENARIO No.6

A2P 289702 A

SHEET No 7 OF 7 SHEETS

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7.7.2 Indoor substation – associated drawings

Drawing no.	Amendment no.	Subject
040877/1	D	Removable pulling ring and socket fabrication details
040877/2	C	Removable pulling ring and socket fabrication details
040879	E	Four tonne wall anchor fabrication and installation details
040881	F	Typical conduit details
040882	B	Suspended cable tray support details
040883/1	F	Ventilation control typical schematic (with supervisory control)
040883/2	G	Ventilation control typical schematic (without supervisory control)
053671	F	Manhole access ladder and cover detail 1200 high basement
053914	F	Std layout for HV switch room to suit single transformer chamber
054738	C	Typical cable alcove details
061736	B	ID sub cable stand 3 x 16mm″ XLPE
069526	A	Cover plate lifting handle detail
077696	F	ID sub high voltage switch room (to suit up to 4 trf) std layout
078239	B	Low voltage equipment cable lug critical dimensions
240118	C	ID sub bund wall fabrication detail
292712	A	Substation earth stake protection box
297547	A	Indoor dist. sub HV and LV floor penetration and trench detail
297555	C	Indoor dist. sub sw/gr trench cover plate detail
297556	C	Indoor dist. sub HV sw/gr trench mounting support brkt detail
297557	B	Standard layout single transformer indoor substation
297558	C	Standard layout two transformer indoor substation
317522	B	Standard layout single transformer indoor padmount style distribution substation

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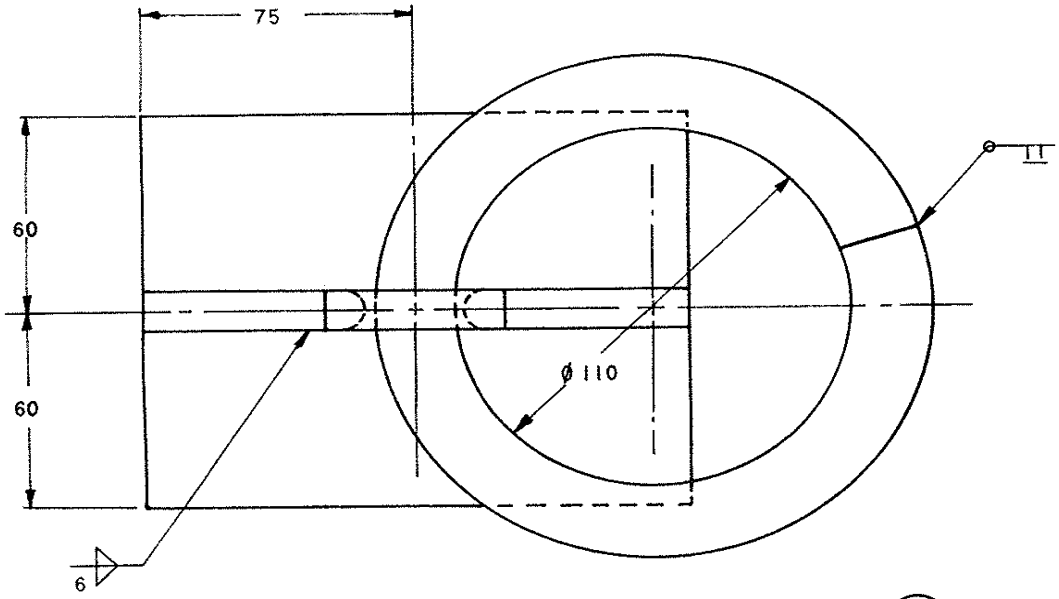
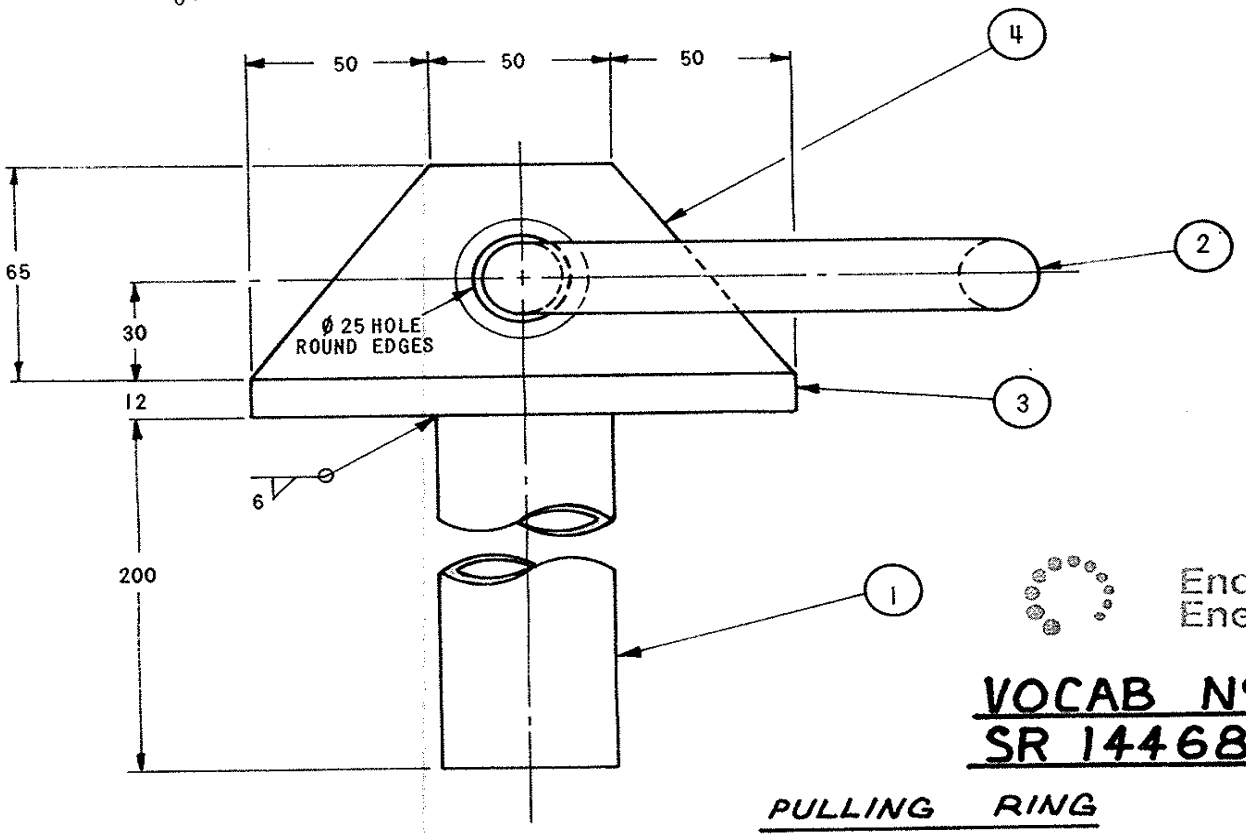




AMENDMENTS		
B	DRN	W.C.H.
	CHD	SGP.
	DATE	19.12.84
	CH.N°	242
VOCAB N° ADDED		
SUBS ENG.		
C	DR'N	J.H.
	CH'D	FM
	DATE	27-7-05
	JOB N.	
DSM	FM/GAP	
DRG. FRAME WAS PCC.		

Endeavour Energy

VOCAB N°
SR 14468

PULLING RING

NOTES:

1. FINISH: HOT DIPPED GALVANISED AFTER FABRICATION
2. ALL WELDING TO BE IN ACCORDANCE WITH AS 1554. SYMBOLS TO AS Z6
3. TWO PULLING RINGS REQUIRED IN EACH SUBSTATION

ITEM	DESCRIPTION	QTY
4	STEEL BAR FLAT 150 x 12 x 65 LG	1
3	STEEL BAR FLAT 150 x 12 x 120 LG	1
2	STEEL BAR ROUND Ø 22 x 420 LG	1
1	PIPE STEEL MED 40 NB x 200 LG (OD 48.3)	1

CONCRETE WALL ANCHOR — F 40879
REMOVABLE PULLING RING SOCKET — SHEET 2
REFERENCE DRAWINGS

SHEET 1 OF 2 SHEETS

ALL DIMENSIONS ARE IN MILLIMETRES

APPROVED	L Engel		
JOB N°		DR'N	A.P.A.
PLAN ENG	DIST ENG	CH'D	
CONS ENG	MAINS ENG	SUPV D'MAN	
	REF A4(h)		

DISTRIBUTION SUBSTATIONS

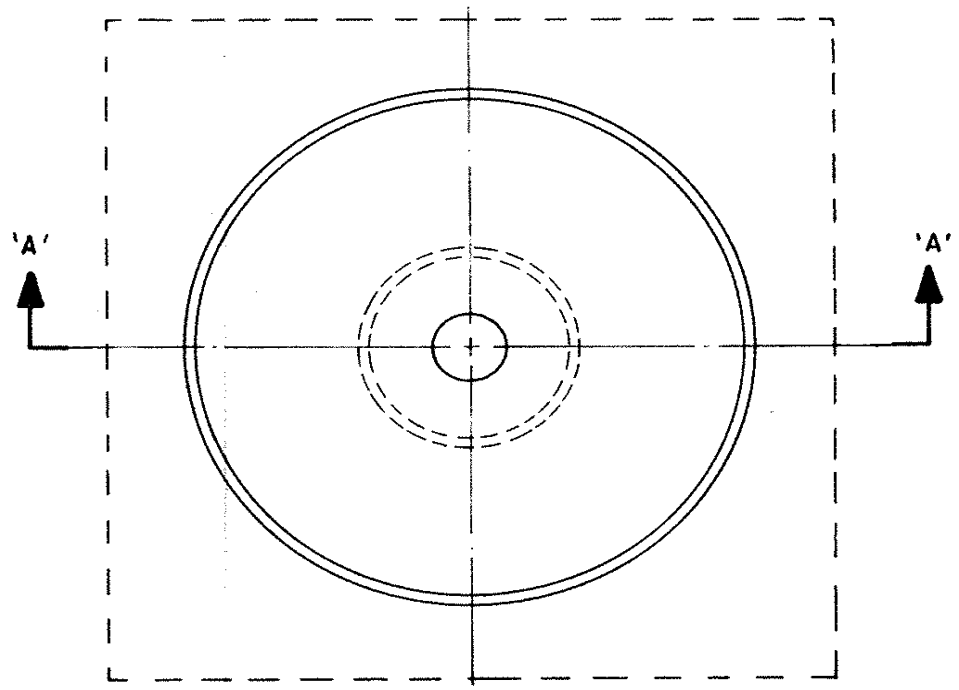
REMOVABLE PULLING RING & SOCKET FABRICATION DETAILS

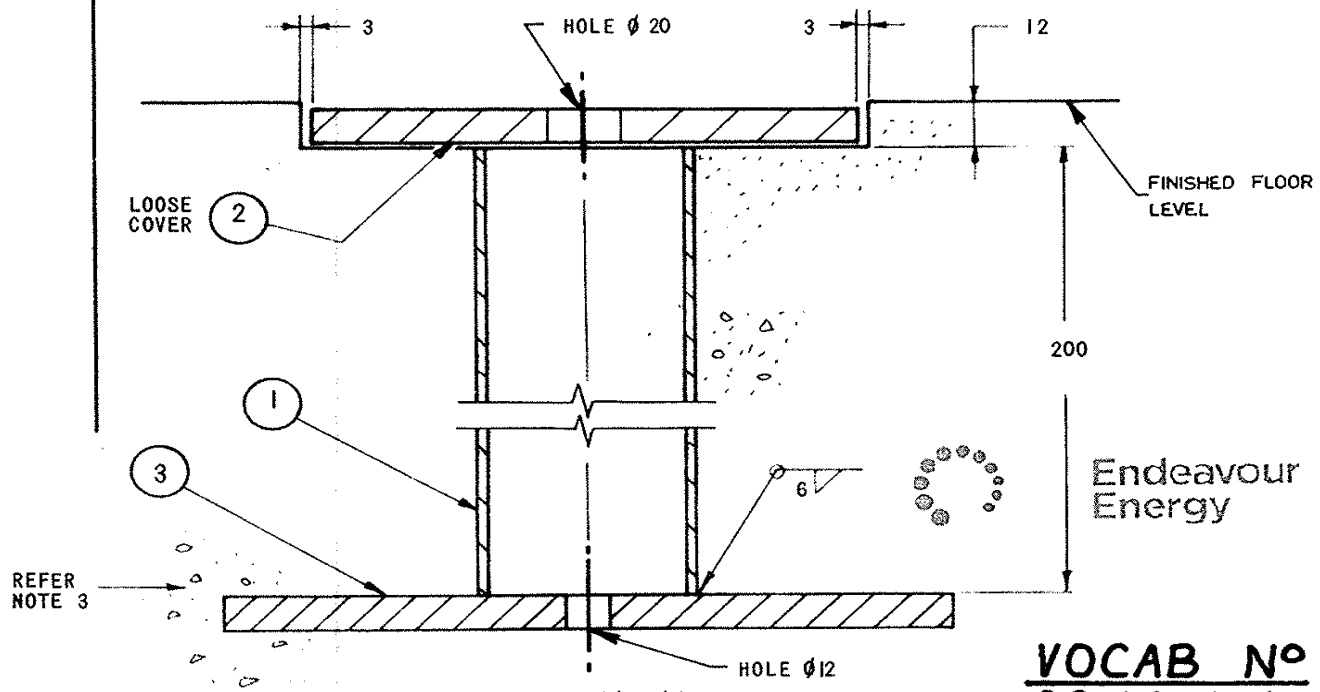
A. P. Moore
CHIEF ELEC ENG | DATE 30-7-15
SCALE 1:2

F 40877 A
B C

TECH 150

A	ORIGINAL ISSUE	
B	DR'N.	R.J.H.
	CH'D	D.J.2
	DATE	8-10-82
Ø12 HOLE IN ITEM 3 ADDED. AUST. STANDARD N°'S UPDATED.		
SUB. ENG. C.G.		
C	DR'N	W.C.H.
	CH'D	SGP
	DATE	19.12.84
	CH N°	242.
VOCAB N° ADDED.		
SUBS ENG.		
D	DR'N	J.H.
	CH'D	FM
	DATE	27-7-05
	JOB N°	
DSM	FM/GAP	
DRG. FRAME WAS PPC		





SECTION 'A - A'

SOCKET

VOCAB N° SS 14474.

NOTES:-

1. FINISH: AFTER FABRICATION HOT DIP GALV. TO AS1650.
2. ALL WELDING TO BE IN ACCORDANCE WITH AS 1554. SYMBOLS TO AS1101 PT. 3.
3. MINIMUM OF 75 mm OF CONCRETE AROUND ITEM 3

ITEM	DESCRIPTION	QTY
3	STEEL PLATE 10 x 200 x 200	1
2	STEEL PLATE 10 x 150 DIA	1
1	PIPE STEEL MED 50 NB x 200 LG (ID 53.1)	1

DO NOT SCALE

SHEET 2 OF 2 SHEETS

ALL DIMENSIONS ARE IN MILLIMETRES

REFERENCE DRAWINGS	
CONCRETE WALL ANCHOR	F40879
REMOVABLE PULLING RING	SHEET 1

APPROVED	L Engel		
JOB N°		DR'N	A.P.A.
PLAN ENG	DIST ENG	CH'D	
CONS ENG	MAINS ENG	SUPV D'MAN	
	REF 44(h)		

A. C. Moore
CHIEF ELEC ENG DATE 30-7-75

ORIGINAL SCALE 1:2

DISTRIBUTION SUBSTATIONS

REMOVABLE PULLING RING & SOCKET FABRICATION DETAILS

F 40877 A

B C D

NOTES

1. ANCHOR ASSEMBLY

MATERIAL: DEFORMED BAR Y28 TO AS 1302
FINISH: HOT DIP GALVANISED
CAPACITY: 4 TONNES.

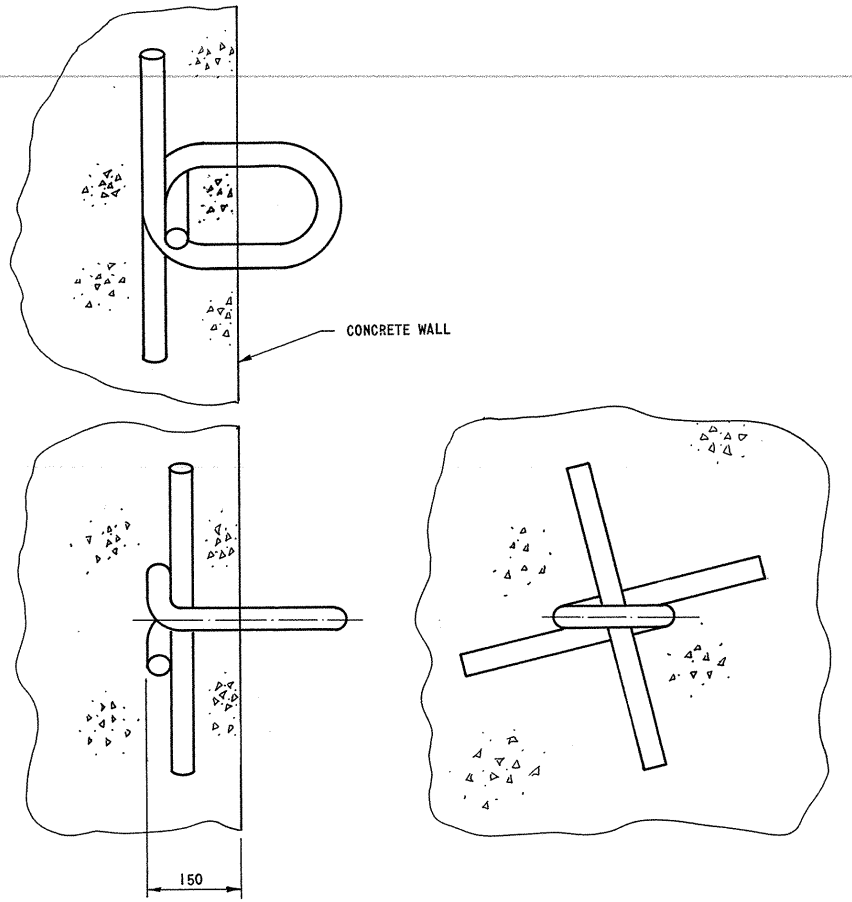
2. CONCRETE WALL DETAIL

THE WALL IN WHICH THE ANCHOR IS SET SHALL COMPLY WITH THE FOLLOWING:

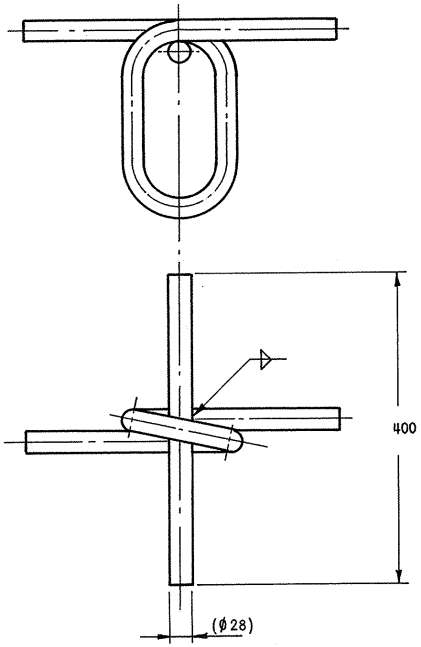
THICKNESS: 200 mm (MINIMUM)
HEIGHT: NO RESTRICTION
WIDTH: NO RESTRICTION
REINFORCING: Y12 AT 200 mm CENTRES OR Y16 AT 300 mm CENTRES. PLACED EACH WAY WITH 40 mm COVER FROM FACE THROUGH WHICH THE ANCHOR PROJECTS (THIS IS MINIMUM REINFORCING).
CONCRETE: 20 MPa (MINIMUM)
RESTRAINT: WALL SHALL BE RESTRAINED AT TOP & BOTTOM TO PREVENT MOVEMENT IN DIRECTION OF FORCE APPLIED TO ANCHOR.

3. POSITION OF ANCHOR:

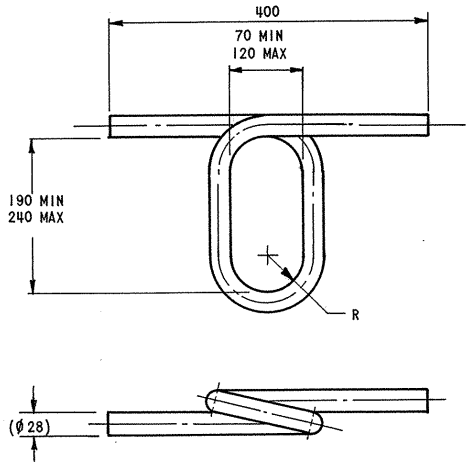
500 mm (MAXIMUM) 300 mm (PREFERRED) ABOVE FLOOR LEVEL.



MOUNTING DETAILS



ASSEMBLY



DETAIL

Endeavour Energy

~~VOCAB No SA 11616~~

(DRAWING PREPARED FROM W.H. ROSIER P.L. DRG No 84031-2.)

AMENDMENTS: ORIGINAL ISSUE	DR'N DMcD	CH'D D.J.T.	DATE 22-4-85	CH No 2435	REDRAWN M.S.D.
DR'N J.H.	CH'D FMKF	DATE 21-7-05	JOB No	DSM PMY CAP	DRG. FRAME WAS PCC 21 VOCAB. Nos DELETED AS A STORES ITEM

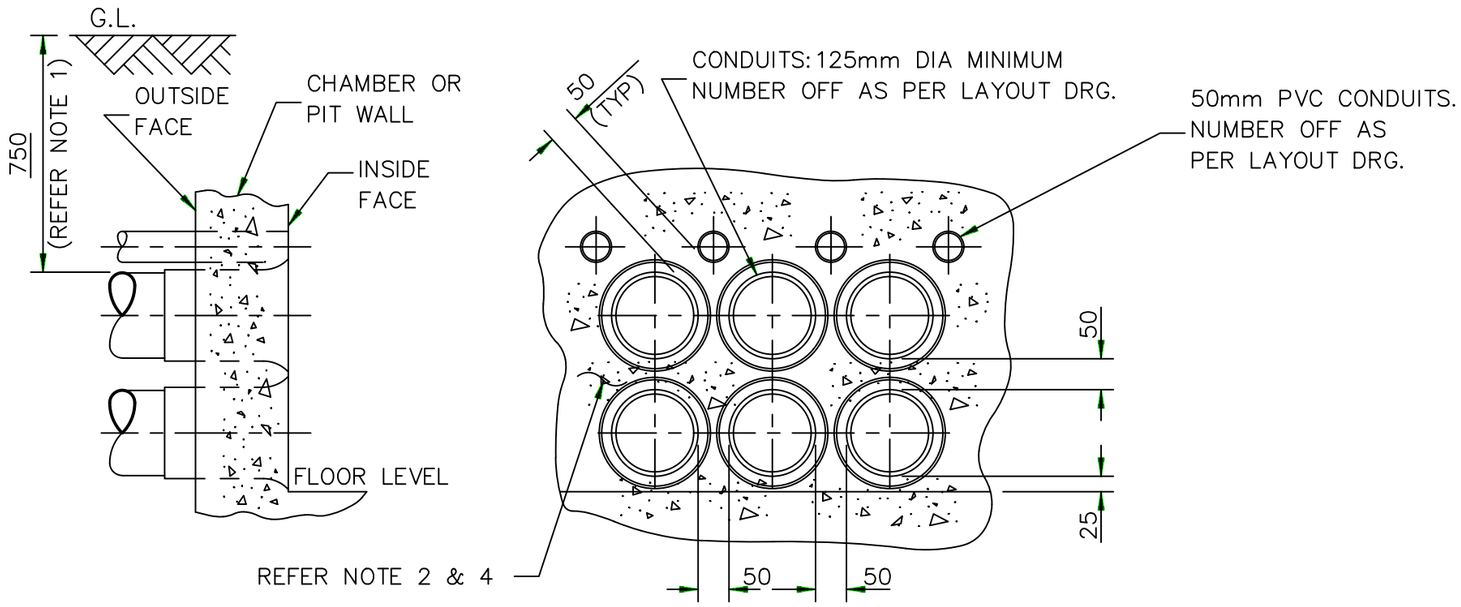
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

REFERENCE DRAWINGS

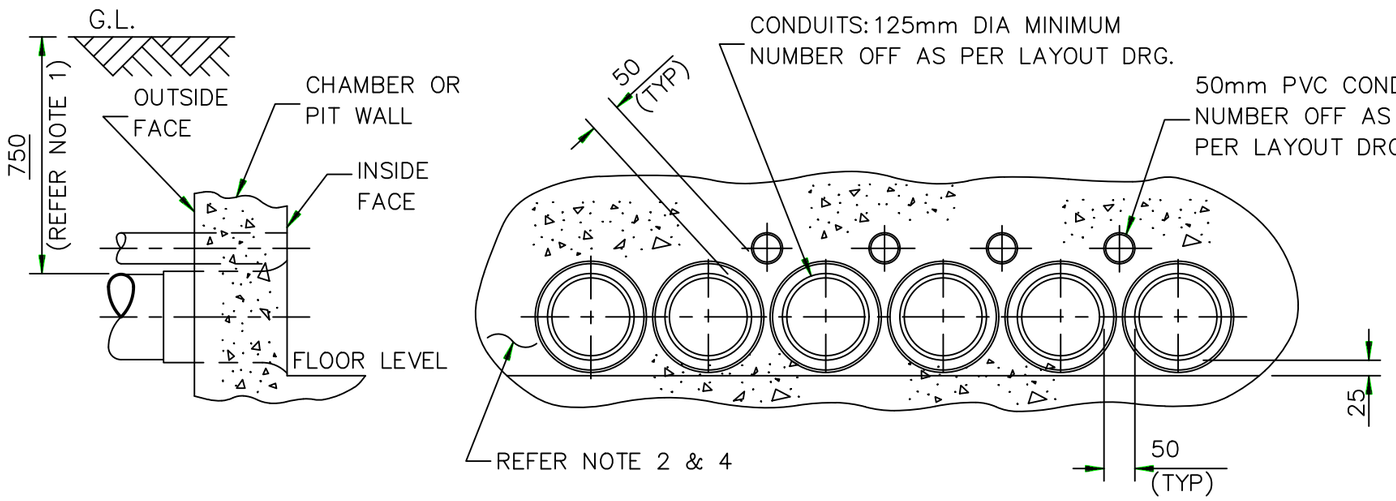
ORIGINAL SCALE 1:5	APPROVED L Engel		P.T. Lomson 1/5 DIRECTOR ENG. DATE 22-4-85
DRAWN DMcD			C 40879 A
CH'KD D.J.T.		CONCRETE WALL MOUNTED ANCHOR 4 TONNE CAPACITY FABRICATION & MOUNTING DETAILS	SHEET No OF SHEETS
CO-ORD D'SERV			D E INDEX REF A4 H

NOTES

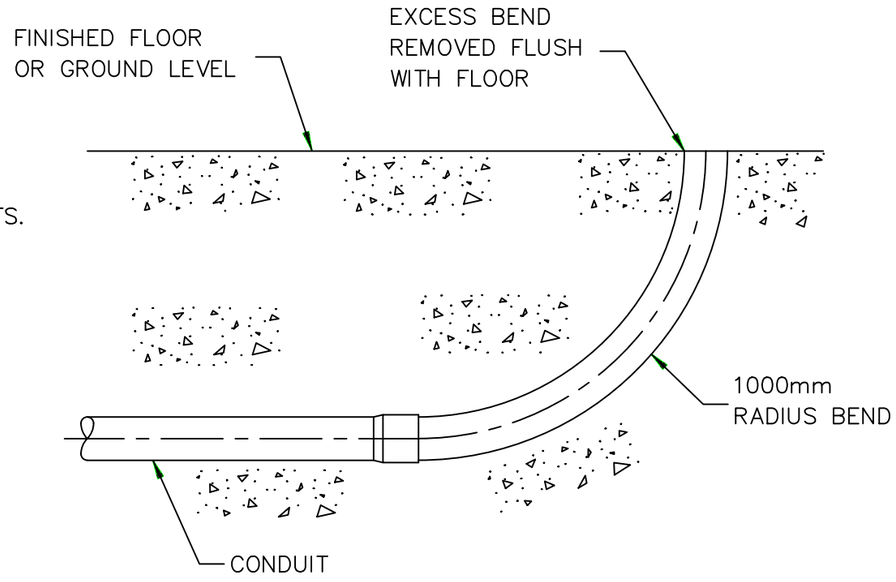
1. MINIMUM COVER TO TOP OF CONDUITS TO BE 750mm, OTHERWISE CONCRETE ENCASE 75mm THICK.
2. CONDUITS TO BE GROUTED INTO WALL OPENING WITH WATERPROOF CEMENT RENDER TO PREVENT INGRESS OF WATER.
3. THIS DRG TO BE READ IN CONJUNCTION WITH MCI0006 & MDI0028
4. 125mm DIA CONDUIT ENDS TO BE BELLMOUTHED.



PREFERRED CONDUIT ENTRY DETAIL
SCALE 1:10



ALTERNATIVE CONDUIT ENTRY DETAIL
SCALE 1:10



CONDUIT BEND DETAIL
SCALE 1:20

AMENDMENTS									
A	ORIGINAL ISSUE	J R No.	N/A	S.E.O.	J.K.	NOTE 3 MCI0006 & MDI0028 WAS SDI 105	DR'N	GSF	
		DR'N	JW				CH'D	GSF	
E	DRAWING REDRAWN NOTE 3 SDI 105 WAS 118.	CH'D	D.J.Z	F			DATE	26-11-15	
		DATE	16-5-96				JR No	N/A	
		JR No	960035				NSM	C. Crisafulli	

ORIGINAL SCALE AS SHOWN

APPROVED M.Tamp

DRAWN	J.W		
DATE	16-5-96		
CH'D	J.K.		

Endeavour Energy

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

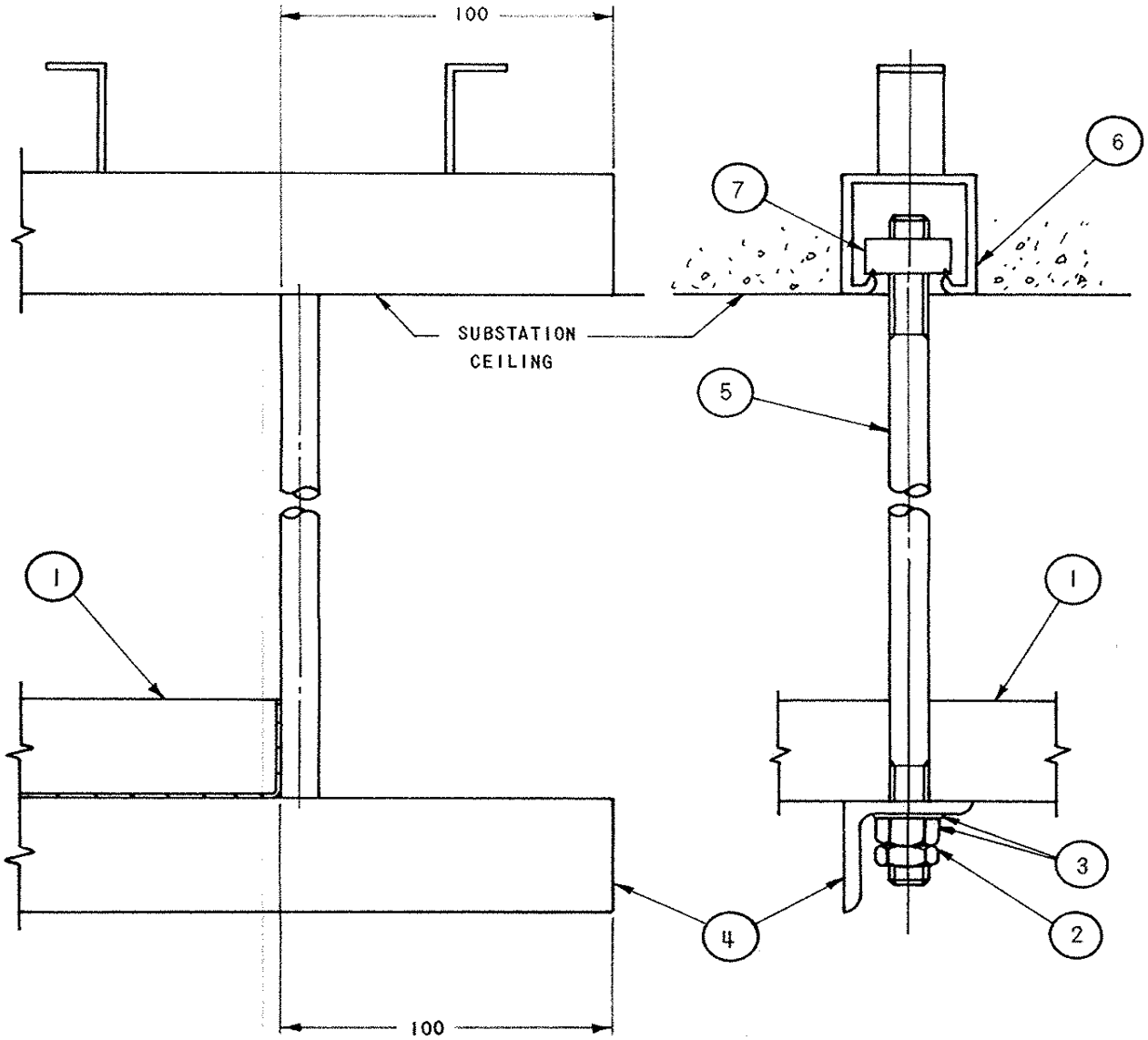
AUTHORISED M.Tamp

M.N.S.A. 17-05-96

INDOOR DISTRIBUTION SUBSTATIONS TYPICAL CONDUIT DETAILS

A3 040881 F

SHEET No 1 OF 1 SHEETS



SHOWN FOR ONE SIDE ONLY

ALL DIMENSIONS ARE IN MILLIMETRES

ITEM	DESCRIPTION
7	UNISTRUT MI2 NUT AS REQ'D GALV
6	UNISTRUT TYPE M 1000 C1 (LENGTH TO SUIT) GALV
5	STEEL ROD MS ϕ12 LENGTH TO SUIT (40 mm OF THREAD BOTH ENDS)
4	STEEL ANGLE 38 x 38 x 5 (LENGTH TO SUIT)
3	NUT STEEL HEX GALV MI2 & WASHER
2	NUT STEEL LOCK HEX GALV MI2 AS REQ'D
1	CABLE TRAY (SIZE & LENGTH TO SUIT)

NOTE: ITEMS 1, 4 & 5 TO BE HOT DIPPED GALVANISED AFTER FABRICATION

DRAWING FRAME WAS PCC.

B	DR'N	J.H.	
	CH'D	F.M/G.F	
	DATE	27-7-05	
	DSM	FM/GAP	

Endeavour Energy

REFERENCE DRAWINGS

APPROVED L Engel

S O ENG		SUB ENG		DR'N	A.P.A.
PLAN ENG		DIST ENG		CH'D	
CONS ENG		MAINS ENG		SUPV D'MAN	
M & P ENG		REF A4(h)			

A.C. Mootz

CHIEF ELEC ENG | DATE 6.8.75

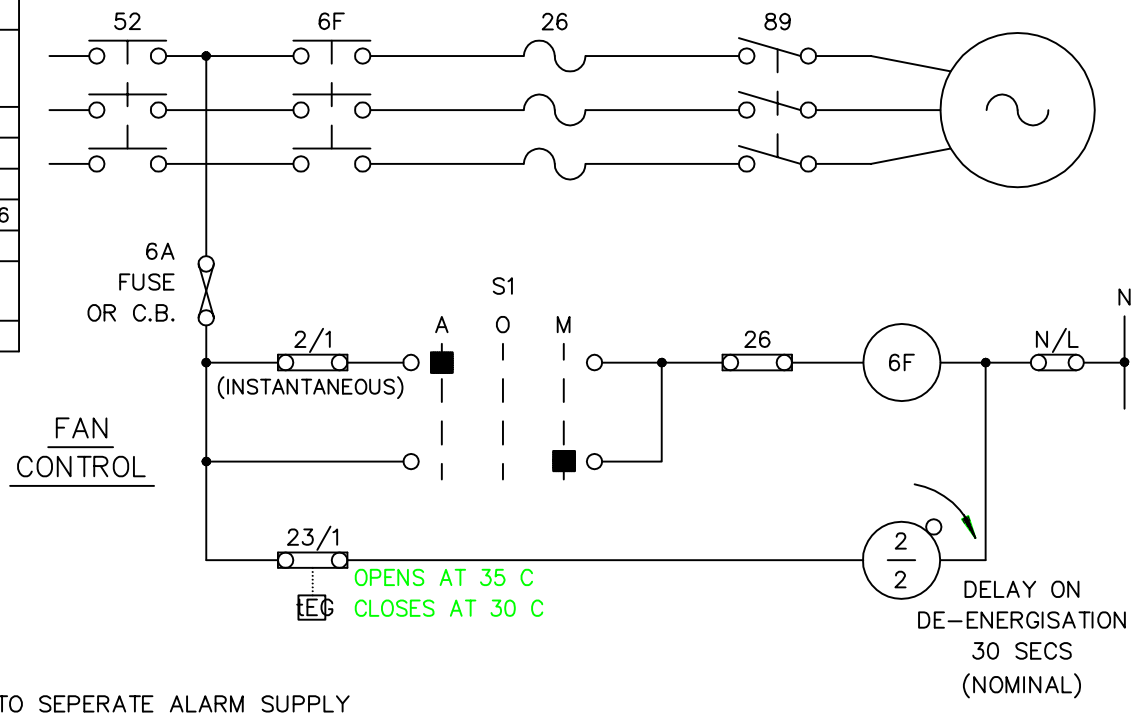
SCALE 1 : 2

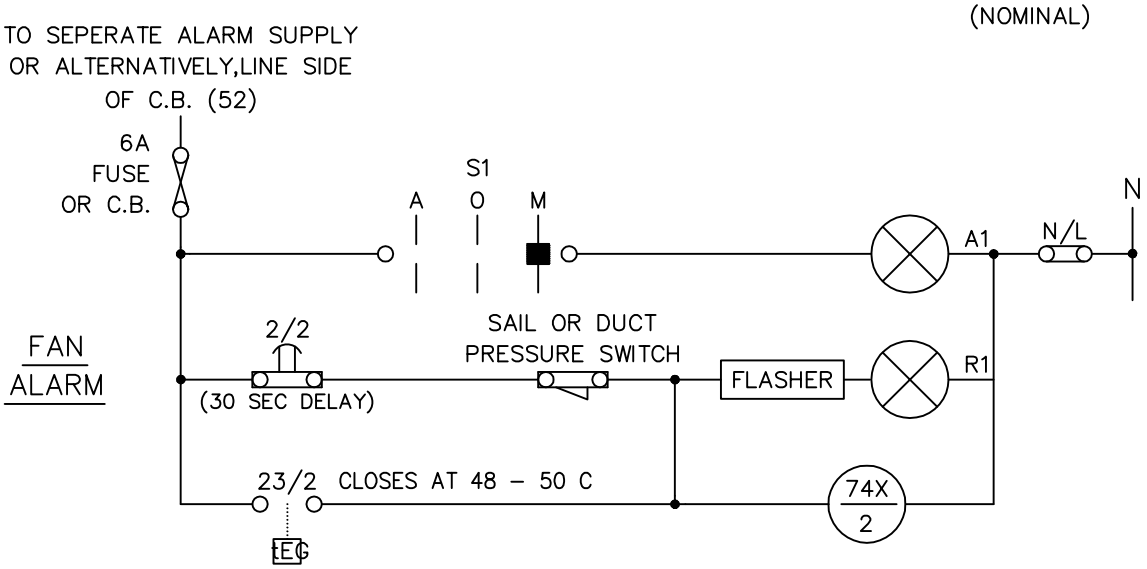
DISTRIBUTION SUBSTATIONS
SUSPENDED CABLE TRAY
SUPPORT DETAILS

F 40882 A

B

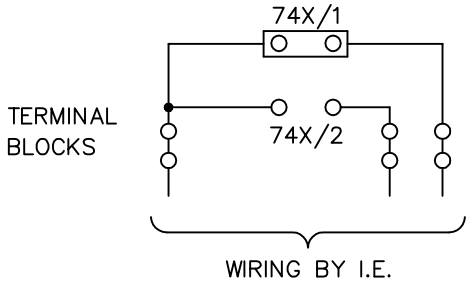
AMENDMENTS		
A	ORIGINAL ISSUE	
J R No.	N/A	
F	DR'N	J.W
	CH'D	D.J.Z
	DATE	16-5-96
	JR No	960035
DRAWING REDRAWN NOTE 5 REVISED.		
S.E.O.	J.K.	





LEGEND

A1 – MANUAL OPERATIONAL INDICATION LAMP (AMBER)
R1 – LOCAL VENTILATION FAILURE INDICATION LAMP (RED)
2 – AUTO CLOSE LOCKOUT TIMING RELAY
S1 – AUTO – OFF – MAN, SELECTOR SWITCH
23 – TEMPERATURE CONTROL DEVICE
26 – THERMAL OVERLOAD RELAY
52 – CIRCUIT BREAKER
89 – ISOLATOR
N/L – NEUTRAL LINK
6F – FAN CONTACTOR
74X – AUX. ALARM RELAY



NOTES

1. FAN MAY BE SINGLE PHASE.
2. ALL CONTROLS ARE TO BE LOCATED WITHIN THE SUBSTATION.
3. SAIL OR DUCT PRESSURE SWITCH TO BE LOCATED IN VENTILATION DUCT. CONTACTS OPEN WHEN VENTILATION WORKING.
4. CUSTOMER TO SUBMIT DETAILS OF PROPOSED VENTILATION SYSTEMS TO Endeavour Energy FOR APPROVAL PRIOR TO INSTALLATION.
5. CONTROL CIRCUIT FUSE/S TO BE SIEMENS TYPE 3NW 32NNSB OR SIMILAR TO SUIT 3NW NS6 FUSE CARTRIDGE.

DRAWN	J.W
DATE	16-5-96
CH'D	J.K.

Endeavour Energy

DISTRIBUTION SUBSTATIONS
WITH SUPERVISORY CONTROL –
VENTILATION CONTROL.
TYPICAL SCHEMATIC DIAGRAM

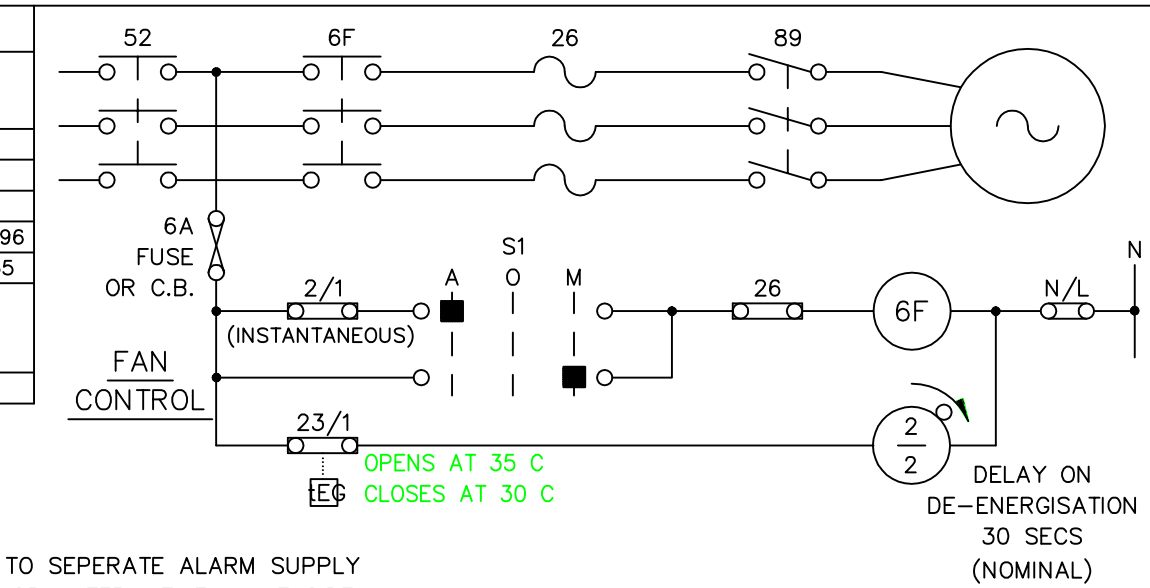
M.Tamp

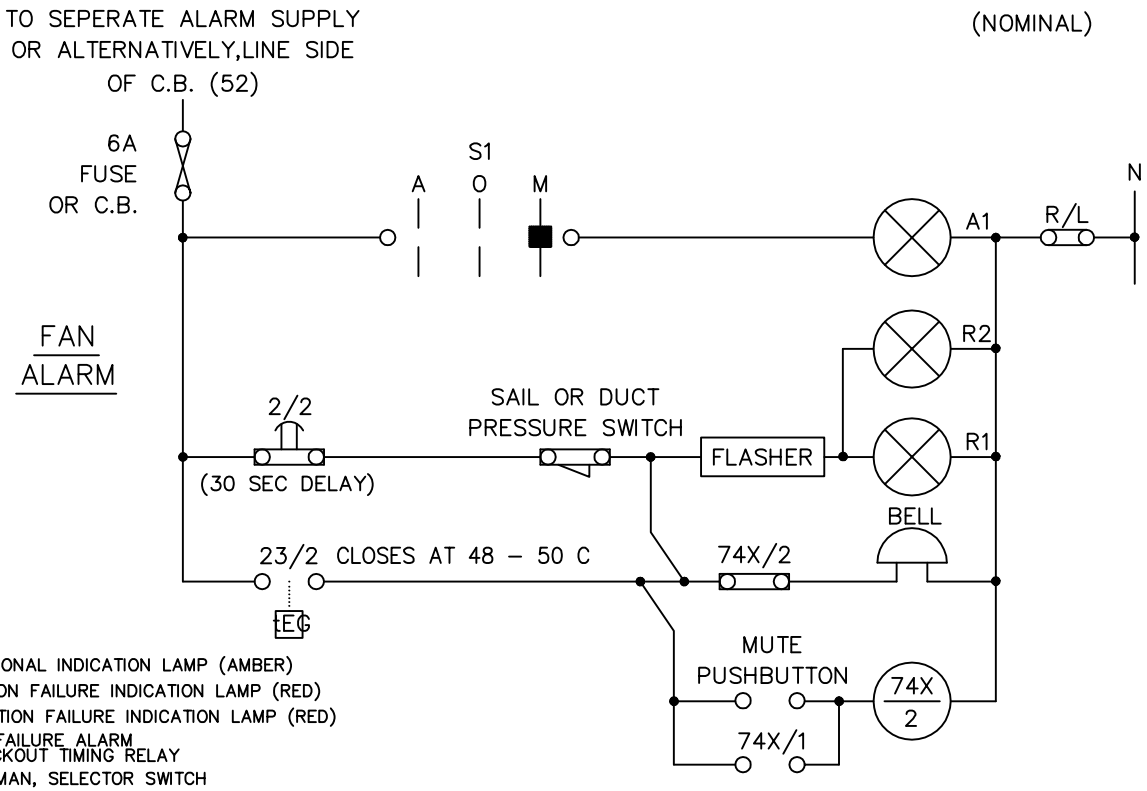
M.N.S.A.	17-05-96
ORIGINAL SCALE NONE	APPROVED M.Tamp

A4 | 040883 | F

SHEET No 1 OF 2 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
J R No.	N/A
G	DR'N J.W
	CH'D D.J.Z
	DATE 16-5-96
	JR No 960035
DRAWING REDRAWN NOTES 2,4 & 5 REVISED.	
S.E.O.	J.K.





LEGEND

A1 – MANUAL OPERATIONAL INDICATION LAMP (AMBER)
R1 – LOCAL VENTILATION FAILURE INDICATION LAMP (RED)
R2 – REMOTE VENTILATION FAILURE INDICATION LAMP (RED)
BELL – VENTILLATION FAILURE ALARM
2 – AUTO CLOSE LOCKOUT TIMING RELAY
S1 – AUTO – OFF – MAN, SELECTOR SWITCH
23 – TEMPERATURE CONTROL DEVICE
26 – THERMAL OVERLOAD RELAY
52 – CIRCUIT BREAKER
89 – ISOLATOR
N/L – NEUTRAL LINK
6F – FAN CONTACTOR
74X – AUX. ALARM RELAY

NOTES

1. FAN MAY BE SINGLE PHASE.
2. ALL CONTROLS TO BE LOCATED WITHIN THE SUBSTATION.
   ONLY THE BELL,MUTE PUSHBUTTON & R2 SHOULD BE MOUNTED EXTERNALLY IN A CONTROL ROOM OR ALARM PANEL, WITH NAME PLATE SAYING "NOTIFY Endeavour Energy'S NETWORK CONTROLLER ON INITIATION OF FAULT. TELEPHONE 131081".
3. SAIL OR DUCT PRESSURE SWITCH TO BE LOCATED IN VENTILATION DUCT.
   CONTACTS OPEN WHEN VENTILATION WORKING.
4. CUSTOMER TO SUBMIT DETAILS OF PROPOSED VENTILATION SYSTEMS TO Endeavour Energy FOR APPROVAL PRIOR TO INSTALLATION.
5. CONTROL CIRCUIT FUSE/S TO BE SIEMENS TYPE 3NW 32NNSB OR SIMILAR TO SUIT 3NW NS6 FUSE CARTRIDGE.

DRAWN	J.W
DATE	16-5-96
CH'D	J.K.

Endeavour Energy

DISTRIBUTION SUBSTATIONS
WITHOUT SUPERVISORY CONTROL
VENTILATION CONTROL
TYPICAL SCHEMATIC DIAGRAM

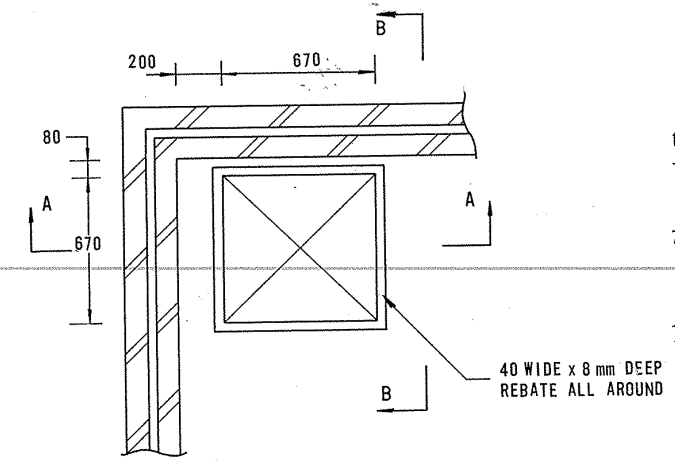
M.Tamp

M.N.S.A.	17-05-96
ORIGINAL SCALE NONE	APPROVED M.Tamp

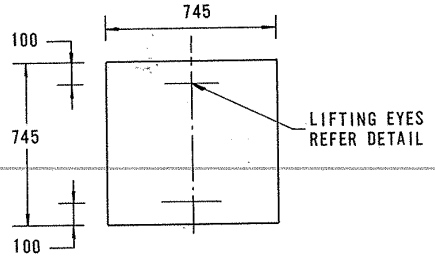
A4 | 040883 | G

SHEET No 2 OF 2 SHEETS

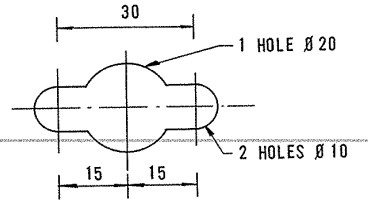
NOTES



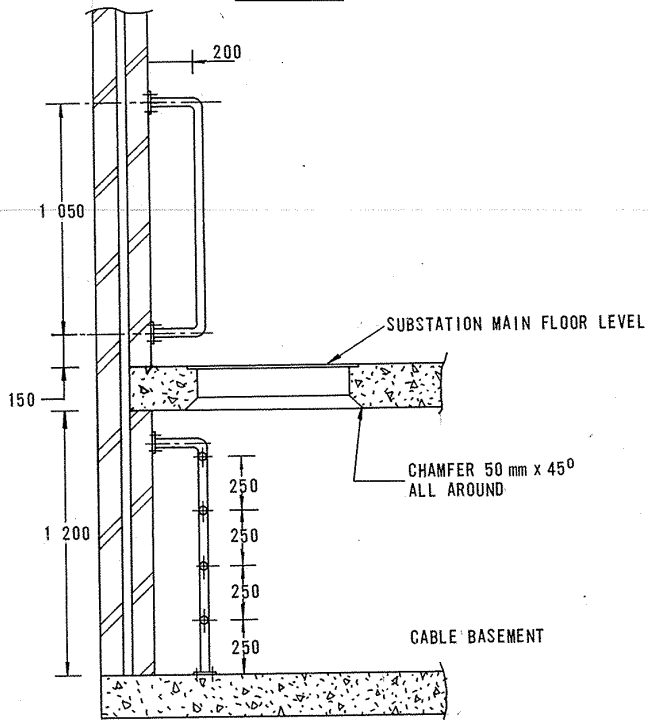
MAIN FLOOR LEVEL
SCALE 1:20



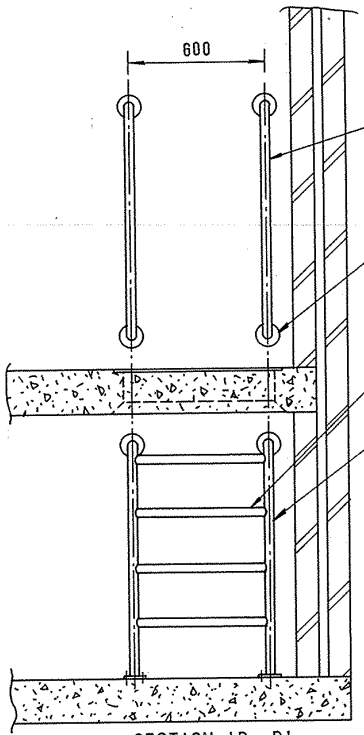
MANHOLE COVER
SCALE 1:20
MATERIAL: TREAD PLATE ALUMINIUM 6 THICK.



LIFTING EYE DETAIL
FULL SCALE



SECTION 'A - A'
SCALE 1:20



SECTION 'B - B'
SCALE 1:20

DO NOT SCALE

Endeavour Energy

DIMENSIONS IN MILLIMETRES

MANHOLE COVER LIFTING HANDLE DETAIL | 069526

REFERENCE DRAWINGS

AMENDMENTS

A ORIGINAL ISSUE — DR'N GLB — CH'D S.G.P. — DATE 5-7-85 — CH N° B32

B MANHOLE COVER MATERIAL ADDED — MSD — DR'N W.C.H. — CH'D S.G.P. — DATE 3-12-86 — CH N° 86/392

C LIFTING HANDLE DET. ADDED, HANDRAILS WERE GALV. IRON. — MSD — DR'N G.M. — CH'D D.J.S. — DATE 10/10/89 — CH N° 89/29

D MANHOLE COVER MATERIAL WAS STEEL FLOOR PLATE LIFTING HANDLE ALTERNATIVE MAT'L ADDED — M.S.D. F.M. — DR'N G.I.T. — CH'D D.J.Z. — DATE 13-11-90 — DR N° 90/135

E LIFTING HANDLE DETAIL DELETED — SUB ENG:

F — DR'N J.H. — CH'D F.M/G.F. — DATE 21-7-05 — JOB No. — DSM FM/GAP — DRG. FRAME WAS PCC

SCALE AS SHOWN — APPROVED W.P.

DRAWN P.N.B. — DESIGN K.M.

CH'KD

CO-ORD D'SERV

DISTRIBUTION SUBSTATIONS
MANHOLE, ACCESS LADDER &
COVER DETAIL
(1200mm HIGH BASEMENT)

P. Thomson
CHIEF ELECT. ENG. DATE 14-9-84

D 53671 F
SHEET No OF SHEETS

B C D E
INDEX REF A4H

AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N F.MAIO; CH'D J.Kirk; DATE 15-12-93; JR No 930250
	REDRAWN. SDI118 WAS TPS1100 WAS 1000. REF DRGS ADDED
	SDM J.Kirk
C	DR'N F.MAIO; CH'D S.QUINN; DATE 01-03-95; JR No 940203
	CONDUIT BELLMOUTH NOTE ADDED
	MNSS S.QUINN
D	DR'N F.MAIO; CH'D JK; DATE 16-6-97; JR No ...
	SDI105 WAS SDI118. INTEGRAL WAS PROSPECT. HOLEC MD4 SWGR REFERED
	MNSA JK
E	DR'N RJH; CH'D RJH; DATE 23-8-99; JR No WXD11101
	"NOT TO BE USED FOR CONSTRUCTION" REMOVED. REF DRG 250173 WAS 077697. NOTE 1 REVISED.
	MNAS G.Ford
F	DR'N GSF; CH'D GSF; DATE 26-11-15; JR No -
	REDRAWN. ROOM SIZE NOW TO SUIT MORE 4 FUNCTION SW-GR. TRENCH NOW TO DRG 297547
	NSM C.Grisafulli

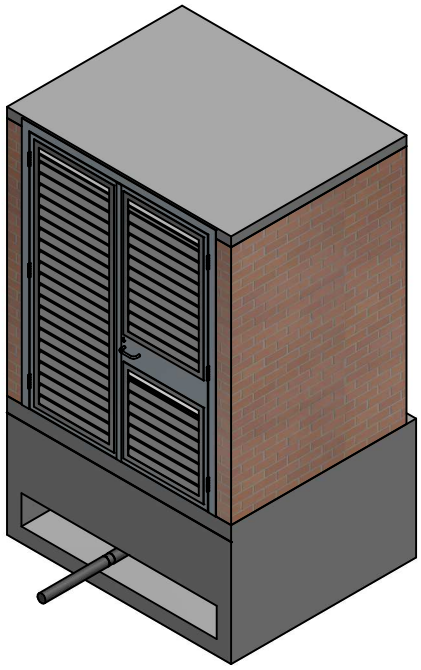
NOTES

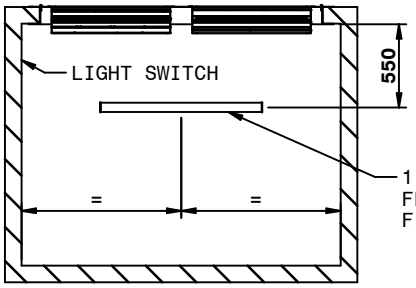
1) THIS DRAWING TO BE READ IN CONJUNCTION WITH MCI0006.

2) CABLE ALCOVE IS TO BE USED WHEN THE BUILDING ALIGNMENT (INCLUDING BELOW GROUND LEVEL FLOORS ETC) IS WITHIN 600 OF THE PROPERTY BOUNDARY. REFER DRG 54738.

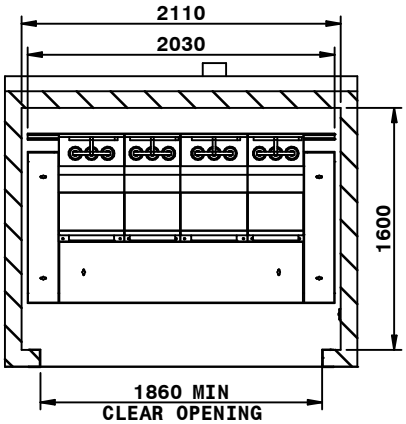
IF BUILDING ALIGNMENT IS FURTHER THAN 600 FROM THE PROPERTY BOUNDARY THEN CONDUITS ARE REQUIRED IN LIEU OF ALCOVE. SEE SECTION A-A-2.

ITEM	QTY	DESCRIPTION	REMARKS

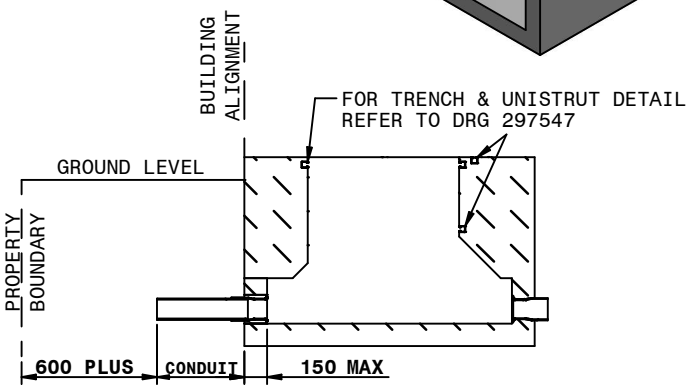




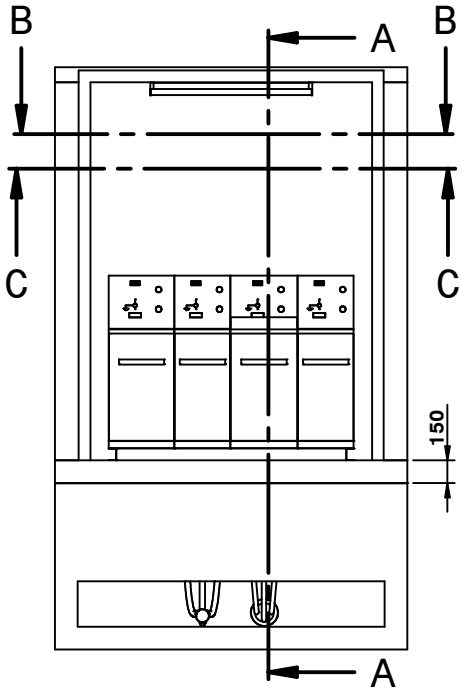
SECTION C-C
LIGHTING REQUIREMENTS



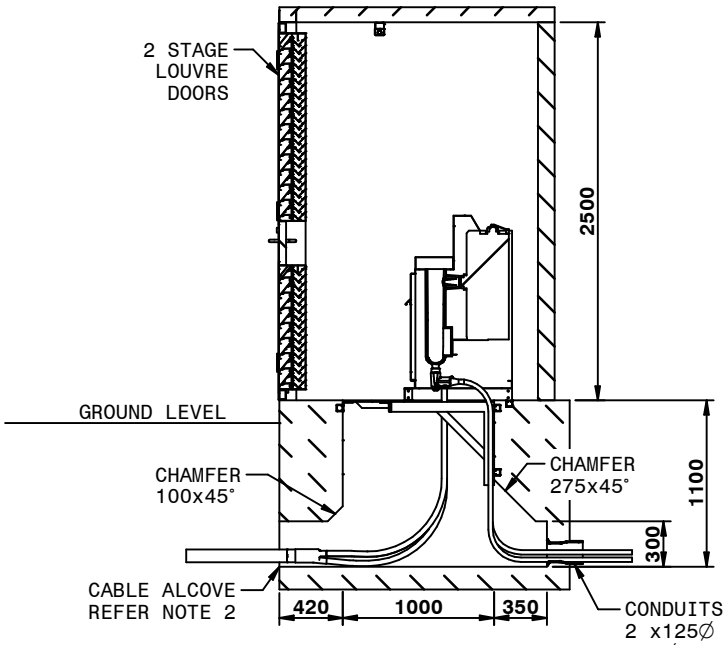
SECTION B-B



SECTION A-A-2
WHEN BUILDING ALIGNMENT IS GREATER THAN 600 FROM THE PROPERTY BOUNDARY AND CONDUITS TO BOUNDARY ARE REQUIRED



ELEVATION
(DOORS REMOVED FOR CLARITY)



SECTION A-A-1
WHEN BUILDING ALIGNMENT IS WITHIN 600 OF THE PROPERTY BOUNDARY

ID DIST SUB TRENCH COVER PLATE & SUPPORT ANGLE DETAIL	297555
ID DIST SUB FLOOR PENETRATION & TRENCH DETAILS FOR HV SW-GR	297547
DIST SUB TYPICAL CABLE ALCOVE	054738

REFERENCE DRAWINGS

Endeavour Energy

ORIGINAL SCALE — DO NOT SCALE
DIMENSIONS IN MILLIMETRES

APPROVED J. Cook

AUTHORISED J. N. Allen/JC

G.M. NETWORK 14-01-94

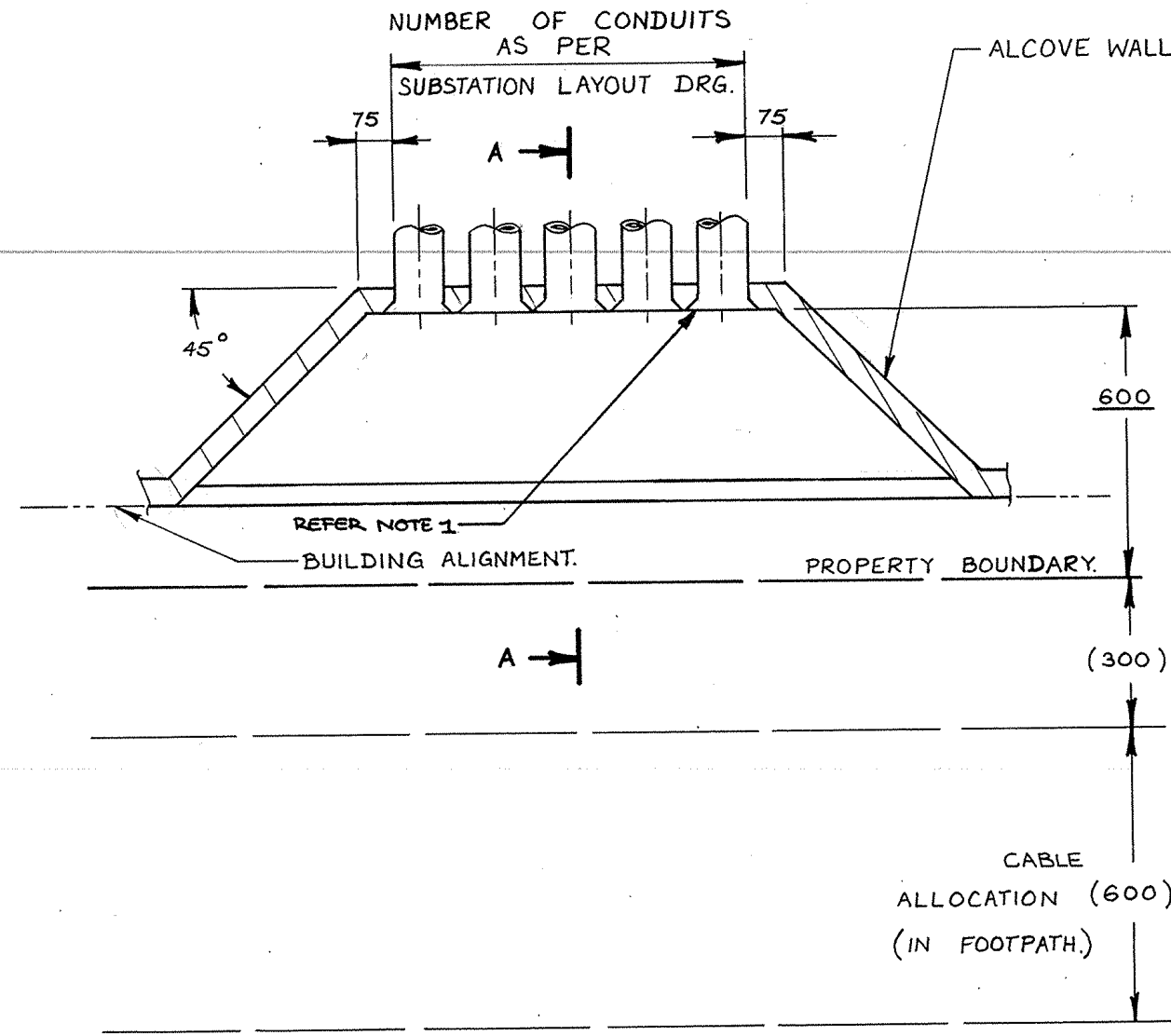
DRAWN	F. MAIO		
DATE	15-12-93		
CH'D	JK		

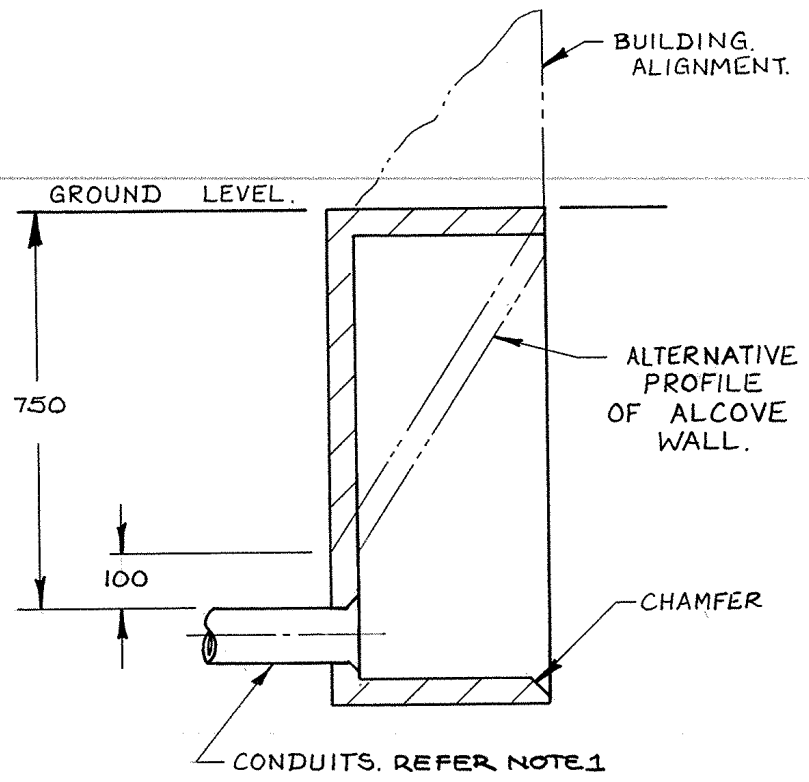
STANDARD LAYOUT FOR HV SWITCHROOM TO SUIT SWITCHING STATION OR SINGLE TRANSFORMER DISTRIBUTION SUBSTATION

A4 053914 F

SHEET No. 1 OF 1

NOTES
1. 125 mm DIA CONDUIT ENDS TO BE BELLMOUTHED.





SECTION 'A-A' (ROTATED 90°)

Endeavour Energy

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

REFERENCE DRAWINGS

AMENDMENTS								
ORIGINAL ISSUE	CH No 845.	DR'N P.M.	CH'D JK	DATE 16-2-95	JRN 940028			
B	NOTE 1 ADDED	SDM	JK.					
C		DR'N J.H.	CH'D F.M./G.F.	DATE 27-7-05	JOB No	DSM/FM/GAP	DRG. FRAME WAS PCC.	

ORIGINAL SCALE 1:10		APPROVED H Engel	
DRAWN	W.C.H.	SUBST'N DEVEL'T	
CH'KD	D.J.L.		
CO-ORD D'SERV	Final B		

P Thomson
DIRECTOR ENG | DATE 20-8-85.

DISTRIBUTION SUBSTATION TYPICAL CABLE ALCOVE DETAIL.

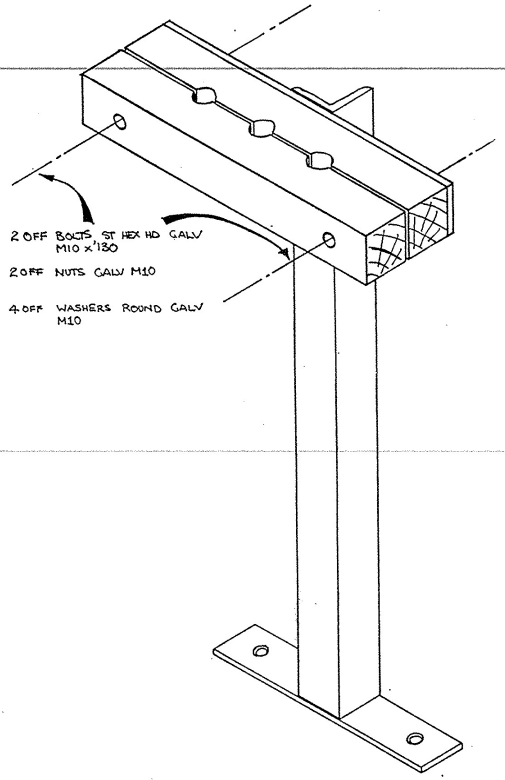
E 54738 A

SHEET No OF SHEETS

B C

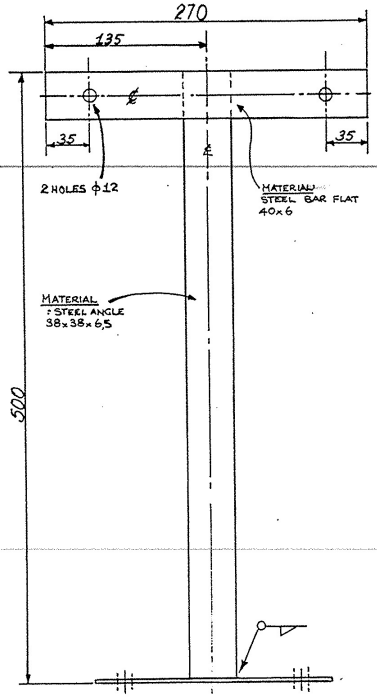
INDEX REF S008A

NOTES

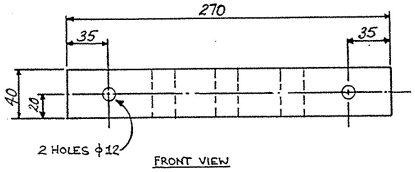


GENERAL VIEW

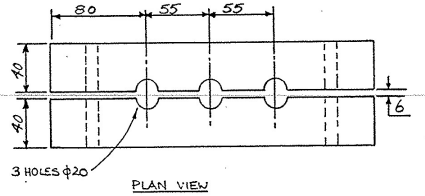
VOCAB Nº: SS17287



FRONT VIEW



FRONT VIEW



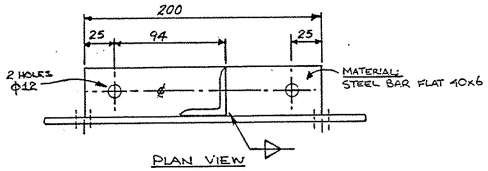
PLAN VIEW

CABLE CLEAT DETAIL

NOTES ① CABLE CLEAT TO BE MADE OF STRAIGHT GRAINED TALLOW WOOD OR APPROVED HARDWOOD FREE OF KNOTS, CRACKS OR DEFECTS OF ANY KIND.

② POSITION 6mm PACKERS IN SLOTS PRIOR TO DRILLING HOLES FOR CABLES.

③ FINISH: WOODWORK TO BE LEFT UNPAINTED



PLAN VIEW

CABLE SUPPORT STAND - ASSEMBLY

NOTE : ALL WELDING TO BE IN ACCORDANCE WITH AS.1554 USING STRUCTURAL GRADE ELECTRODES.
: ASSEMBLY IS TO BE GALVANISED IN ACCORDANCE WITH A.S.1650 AFTER FABRICATION.

Endeavour Energy

AMENDMENTS					
A	ORIGINAL ISSUE	J R No.	D'RN	J.H.	
			CH'D	E.M/GF	
			DATE	27-7-05	
		JR No			
B	DSM1 FM/GAP DRG. FRAME WAS PCC				

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

REFERENCE DRAWINGS

	ORIGINAL SCALE	APPROVED
DRAWN	F.M.	
CH'D		
SUP D'MAN		

N.T.S

C. Howat

Endeavour Energy

STANDARD DISTRIBUTION SUBSTATION
CABLE STAND 3 x 16 mm² X.L.P.E
CONSTRUCTION DETAIL.

D.B. Britten per cct
ASSIST. G M ENG. DATE 16-1-90

A2 61736 A
SHEET No 1 OF 1 SHEETS
B
INDEX REF 5008A

061736

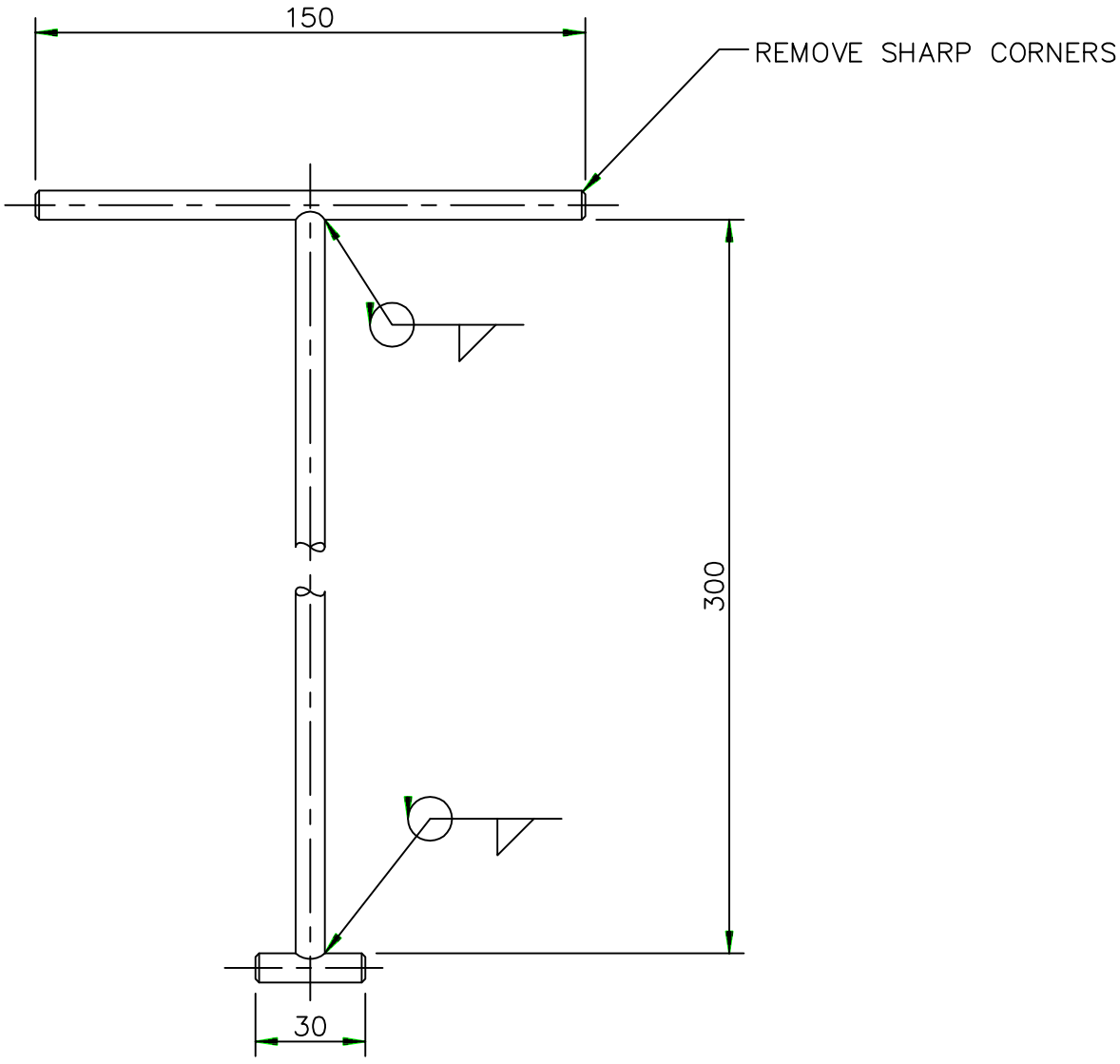
AMENDMENTS	
A	ORIGINAL ISSUE
J R No.	900035

NOTES

1. MATERIAL: BAR STEEL ROUND 8.
   FINISH: HOT DIP GALVANISED AFTER FABRICATION.
   OR
   MATERIAL: BAR ALUMINIUM ROUND 8.
   FINISH: NATURAL.

2. QUANTITY: 2 OFF REQUIRED PER INSTALLATION

3. A SUITABLE CONDUIT SADDLE 38mm (OR SIMILAR) TO BE FITTED TO WALL IN CLOSE PROXIMITY TO MANHOLE OR TRENCH COVER PLATES AT A HEIGHT 1350mm ABOVE FLOOR LEVEL FOR STORAGE OF LIFTING HANDLES.



Endeavour Energy

INDOOR DISTRIBUTION SUBSTATION
TRENCH & FLOOR COVER PLATE
LIFTING HANDLE
DETAIL

DRAWN	GIF
DATE	06–12–90
CH'D	D.J.Z

D.B.Britten/CH

ASSIST. G.M. ENG.		06–12–90
ORIGINAL SCALE	1: 2	APPROVED C.Howat
A4	069526	A
	SHEET No 1 OF 1 SHEETS	

AMENDMENTS		
A	ORIGINAL ISSUE	
B	DR'N	F.Maio
	CH'D	SQ
	DATE	24-1-96
	JR No	9402303
DIM.S A & B REV. TO SUIT SM6 HV SWGR. NOTE 2 ADDED. REF DRG'S REV. HV TRENCH DTLS REVISED. 1 GPO ADDED. ROOM WAS 3000 WIDE. EXIT LIGHT WAS CIN200NM		
MNSA	SQ	
C	DR'N	F.Maio
	CH'D	JK
	DATE	16-6-97
	JR No	...
SDI105 WAS SDI118. INTEGRAL WAS PROSPECT		
MNSA	JK	
D	DR'N	RJH
	CH'D	RJH
	DATE	23-8-99
	JR No	WX011223
NOTE 1 & REF DRG No's REVISED. NOTE 3 ADDED. REF DRG 078301 DELETED.		
T.A.M.	G.Ford	
E	DR'N	F.Maio
	CH'D	V.M.
	DATE	09/09/03
	JR No	WD4SUBS
DIMENSIONS A&B REVISED. HV SWGR MASS WAS 1500kG.		
DEP	G.F/V.M.	
F	DR'N	G.Ford
	CH'D	G.Ford
	DATE	26/11/15
	JR No	...
TRENCH DETAIL NOW TO DRG 297547. NOTE 1 WAS SDI105 NOW MCI0006. REF DRGS UPDATED. DIM 'A' & 'B' REVISED		
NSM	C.Crisafulli	

NOTES

1) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DISTRIBUTION STANDARDS MDI0028 & MCI0006.

2) BUILDER TO GIVE 14 DAYS NOTICE PRIOR TO POURING FLOOR OR BASEMENT SLAB TO ALLOW FOR INSTALLATION OF EARTH GRID.

3) REFER TO INDIVIDUAL HV SWITCHGEAR SUBSTATION DESIGN INSTRUCTION FOR DETAILS OF INSTALLING SWITCHGEAR MOUNTING STEELWORK.

4) ALL CONDUITS TO BE SEALED BY FIRE PROOF SEALANT AT ALL TIMES. CONDUITS TO RUN TO PROPERTY BOUNDARY.

5) SWITCHGEAR BASED ON MAX OF 4 INCOMING FEEDERS FOR 2,3 AND 4 TRF SUBS AND 3 FDRS FOR 1 TRF SUB. A 500mm GAP SHOULD BE MAINTAINED BETWEEN EACH HV SWITCHGEAR TO ALLOW FOR CABBLING AND INSTALLATION.

ITEM	QTY	DESCRIPTION	REMARKS

SWITCHED SOCKET

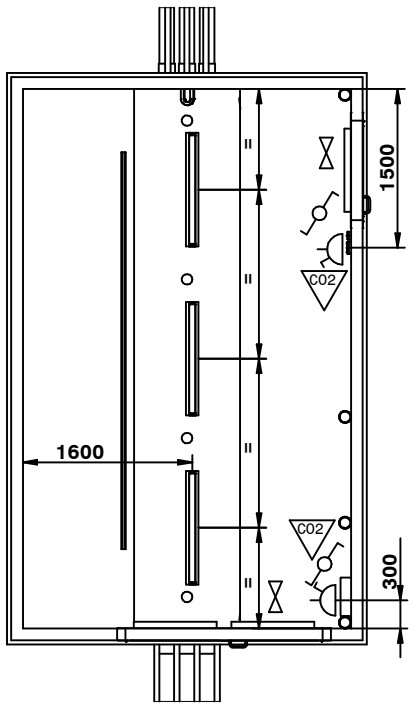
5.0kg CO2 FIRE EXTINGUISHER FITTED WITH HOSE ATTACHMENT

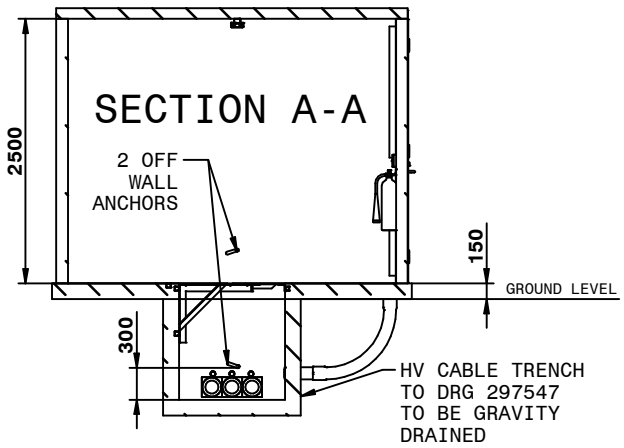
2 WAY SWITCH

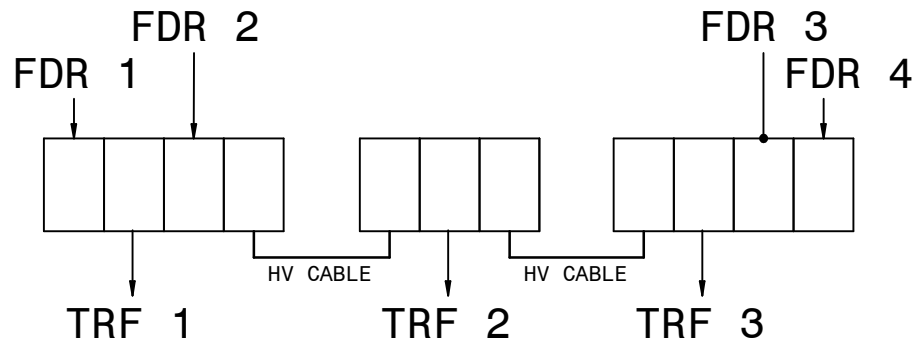
DISTRIBUTION BOARD

EXIT LIGHT FITTING NON-MAINTAINED BARDIC TYPE NMIONS/DS1A OR EQUIVALENT

FLUORESCENT FITTING TWIN 40 WATT







TYPICAL SW/GEAR MODULES FOR 3 TRF SUB

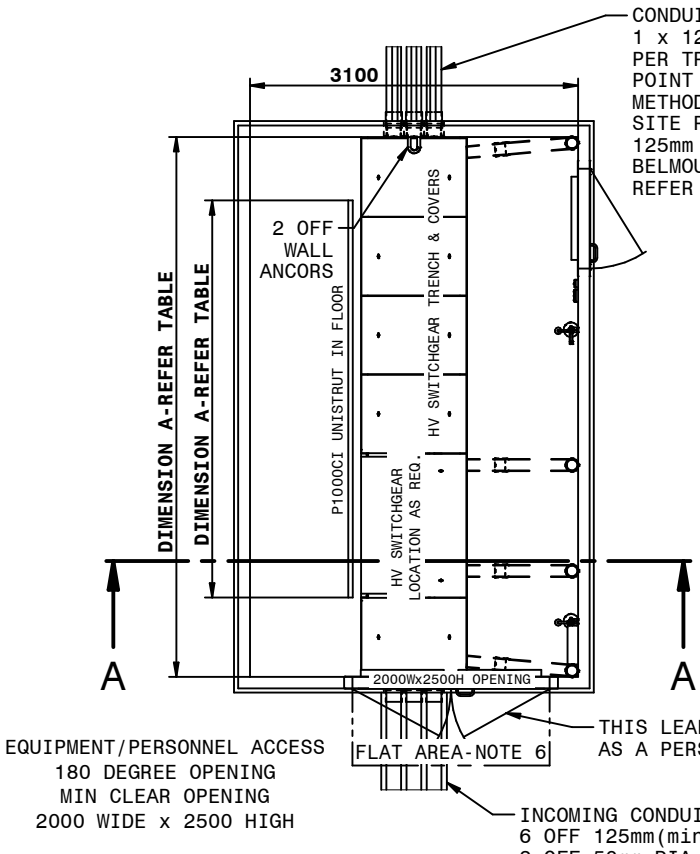


TABLE FOR CALCULATION OF HV SWITCHROOM LENGTH				
MAX NO OF TRF'S TO BE SUPPLIED	ONE	TWO	THREE	FOUR
DIMENSION 'A'	3000	3750	5350	7150
DIMENSION 'B'	4350	5100	6700	8500

MAJOR EQUIPMENT MASS		
HV SWITCHGEAR MODULES	500kg EACH	2500kg MAX

HV SW/GR TRENCH FABR. DETAIL	297556
COVER PLATE & ANGLE FABR. DTL- HV & LV SW/GR	297555
FLOOR PENETRATION & TRENCH DTL - HV & LV SW/GR	297547
CONCRETE WALL ANCHOR FABRICATION DETAIL	040879
REMOVABLE PULLING RING & SOCKET FABR. DTL	040877
INDOOR DIST SUB TYPICAL CONDUIT DETAILS	040881
-	-
-	-

REFERENCE DRAWINGS

Endeavour Energy

ORIGINAL SCALE		APPROVED	J Cook
DRAWN	F.Maio		
DATE	11/1/94		
CH'D	JKirk		INDEX REF

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED J.N.Allen/JC

G.M.Network 19/1/94

STANDARD LAYOUT FOR INDOOR HIGH VOLTAGE SWITCHROOM TO SUIT DISTRIBUTION SUBSTATION CONTAINING UP TO FOUR TRANSFORMERS

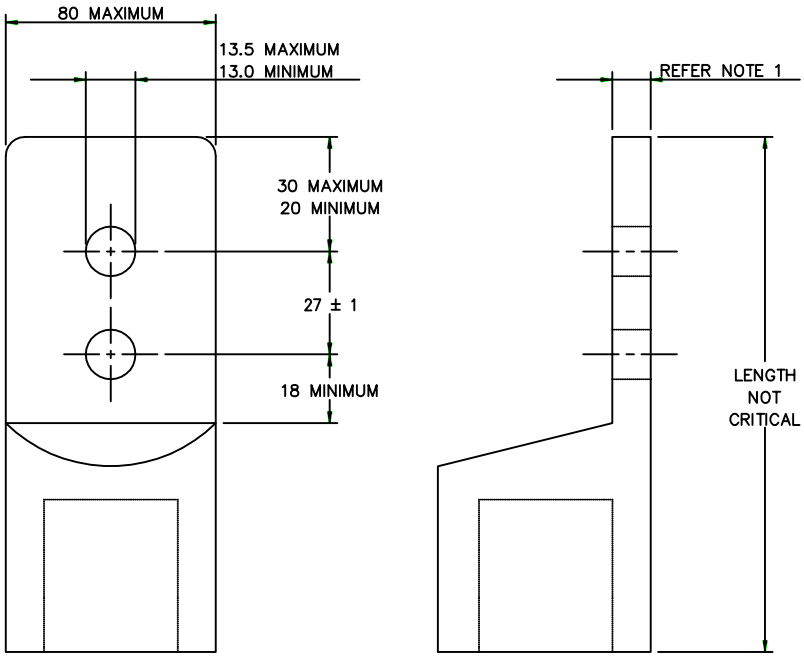
A3 077696 F

SHEET No. 1 OF 1

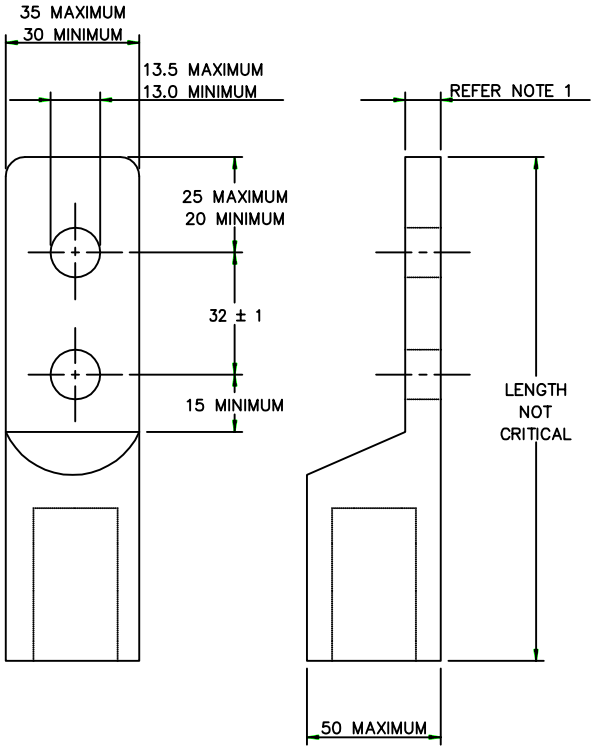
AMENDMENTS		
A	ORIGINAL ISSUE	
	J R No.	940145
B	DR'N	D.J.Z.
	CH'D	J.K.
	DATE	09-1-96
	JR No	960001
NOTE 1 ADDED.		
M.S.S.		J.K.

NOTES

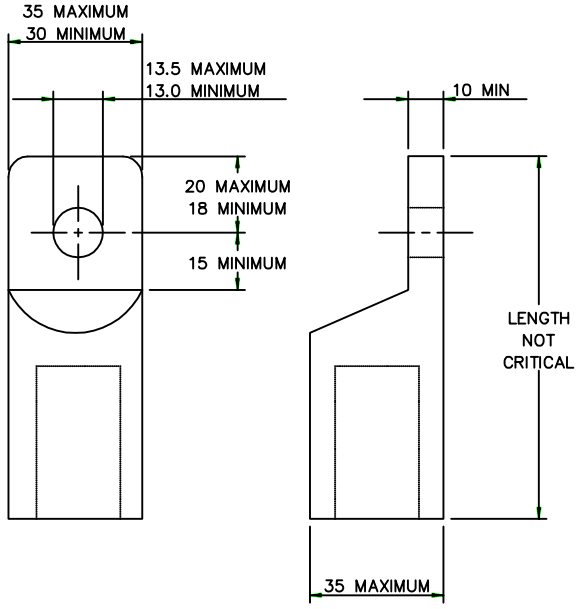
1. THE CURRENT RATING OF THE LUG SHALL BE EQUIVALENT TO THE CURRENT RATING OF THE CABLE/S TO A MAXIMUM 1400 AMPS.
   ALL DISTRIBUTION SWITCHGEAR WILL ACCEPT BOTH ALUMINIUM OR COPPER CABLES.



CIRCUIT BREAKER CABLE LUG
MAXIMUM SIZE CABLE – 630mm²
MAXIMUM No PER PHASE – 4 OFF



FEEDER FUSED DISCONNECTOR
CATEGORY 2 CABLE LUG
MAXIMUM SIZE CABLE – 240mm²
MAXIMUM No PER PHASE – 2 OFF



FEEDER FUSED DISCONNECTOR
CATEGORY 1 CABLE LUG
MAXIMUM SIZE CABLE – 240mm²
MAXIMUM No PER PHASE – 2 OFF

Endeavour Energy

ORIGINAL SCALE	APPROVED
NONE	C.Howat

DRAWN	D.J.Z.
DATE	27-9-94
CH'D	D.J.Z.

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

REFERENCE DRAWINGS	DRG. NO.	THIS ISSUE PAGE NO

C.Howat
SUBSTATION DEVELOPMENT MGR 12-10-94

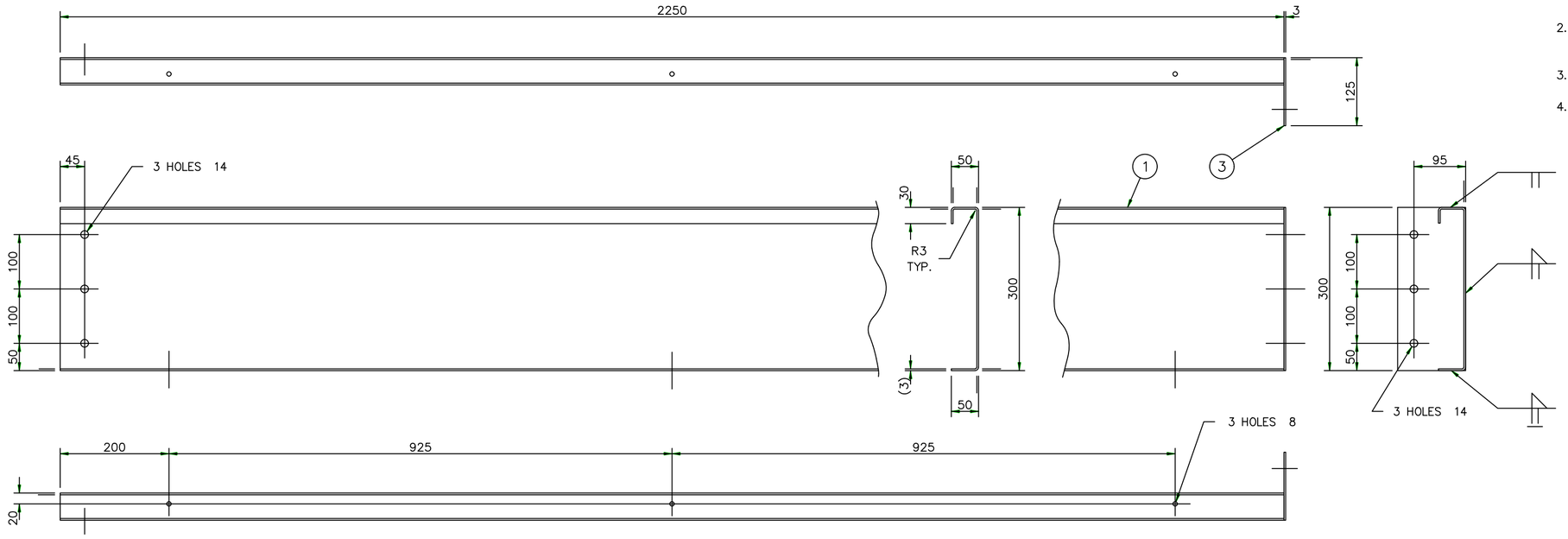
LOW VOLTAGE EQUIPMENT
CABLE LUG
CRITICAL DIMENSIONS

SUB 078239 B
SHEET No 1 OF 1 SHEETS
INDEX REF S008A

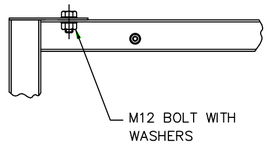
ISSUE IDENTIFICATION	
THIS ISSUE	
PAGE NO.	

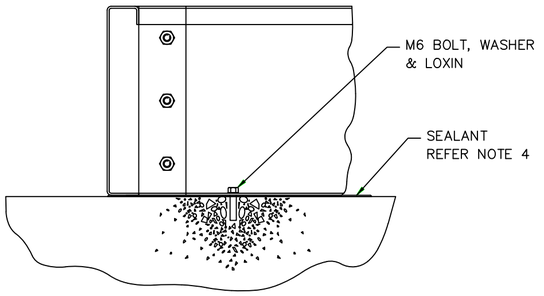
NOTES

1. TOLERANCES UNLESS OTHERWISE STATED:
   - HOLE DIMENSIONS ± 0.5mm.
   - LINEAR DIMENSIONS UP TO 50mm ± 1.5mm.
   - LINEAR DIMENSIONS OVER 50mm ± 5% UP TO A MAXIMUM OF 5mm.
2. WELDING SYMBOLS COMPLY WITH AS1101 PART 3 1987.
   WELDING TO BE IN ACCORDANCE WITH AS1554 PART 1 1991.
3. PAINT ALL BARE METAL SURFACES WITH COLD GALVANISING PAINT.
4. INSTALLATION INSTRUCTIONS:
   REFER TO THE INDOOR DISTRIBUTION SUBSTATION BUND INSTALLATION INSTRUCTION FOR THE SEALANT TYPE AND METHOD OF INSTALLING THIS BUND.

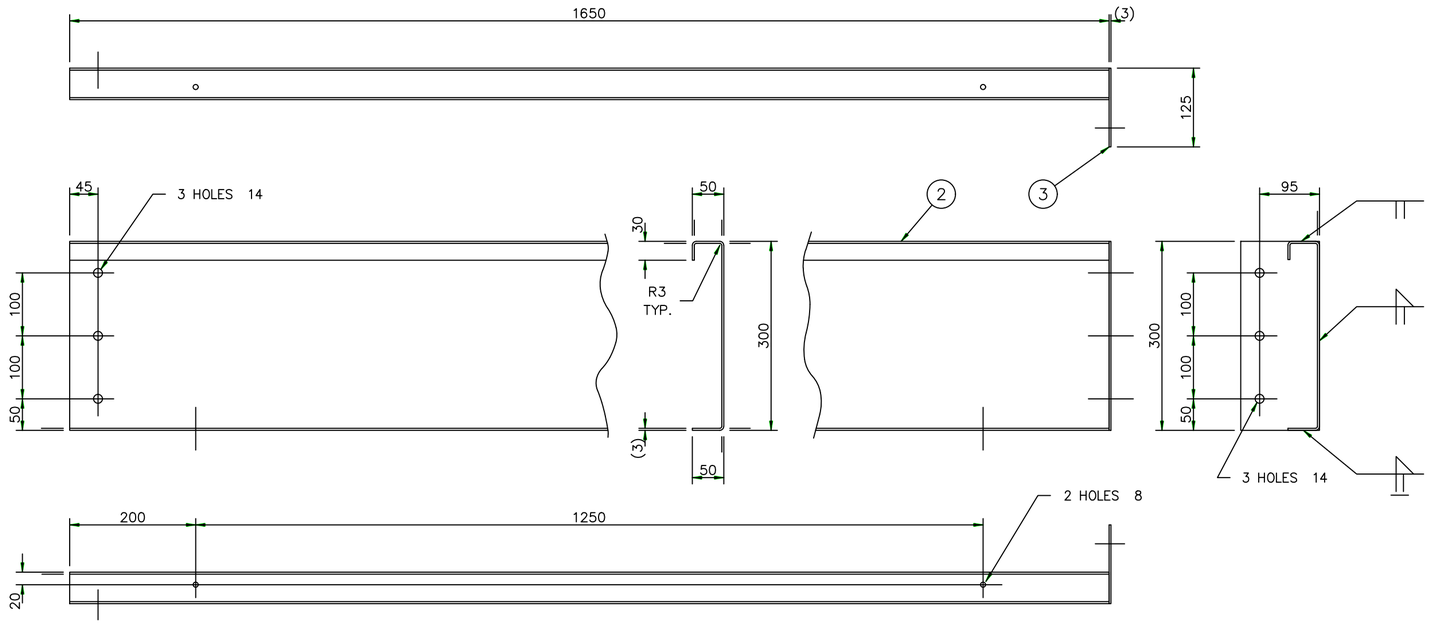


BARRIER L DETAIL
SCALE: 1:5





BUNDWALL CORNER ASSEMBLY
SCALE: 1:5



BARRIER S DETAIL
SCALE: 1:5

ITEM	PART	DRG	DESCRIPTION	QTY	REMARK
1	–	–	SHEET STEEL GALVABOND 3 x 425 x 2250 LG.	2	–
2	–	–	SHEET STEEL GALVABOND 3 x 425 x 1650 LG.	2	–
3	–	–	SHEET STEEL GALVABOND 3 x 125 x 300 LG.	4	–

AMENDMENTS

A	ORIGINAL ISSUE	J.R No.	MA	
B	DRN	BGH	K	
	CH'D	K		
	DATE	20-10-98		
	J.R No G2911100			
	2500 WAS 1550 GR-E4			
	2500 WAS 2050 GR-C4			
	3 HOLES AT 1275 CTRS WAS 2 HOLES AT 1650 CTRS GR-C4			
	MNGR	K		
C	DRN	BGH	K	
	CH'D	PJH		
	DATE	14-8-99		
	J.R No WX011223			
	DIM 2250 WAS 2950. DIM 1650 WAS 2500.			
	MNAT	K		

ORIGINAL SCALE AS NOTED
APPROVED J.Kirk

DRAWN	B.G.H.		
DATE	30-12-96		
CH'D	G.P.S.		

Endeavour Energy

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

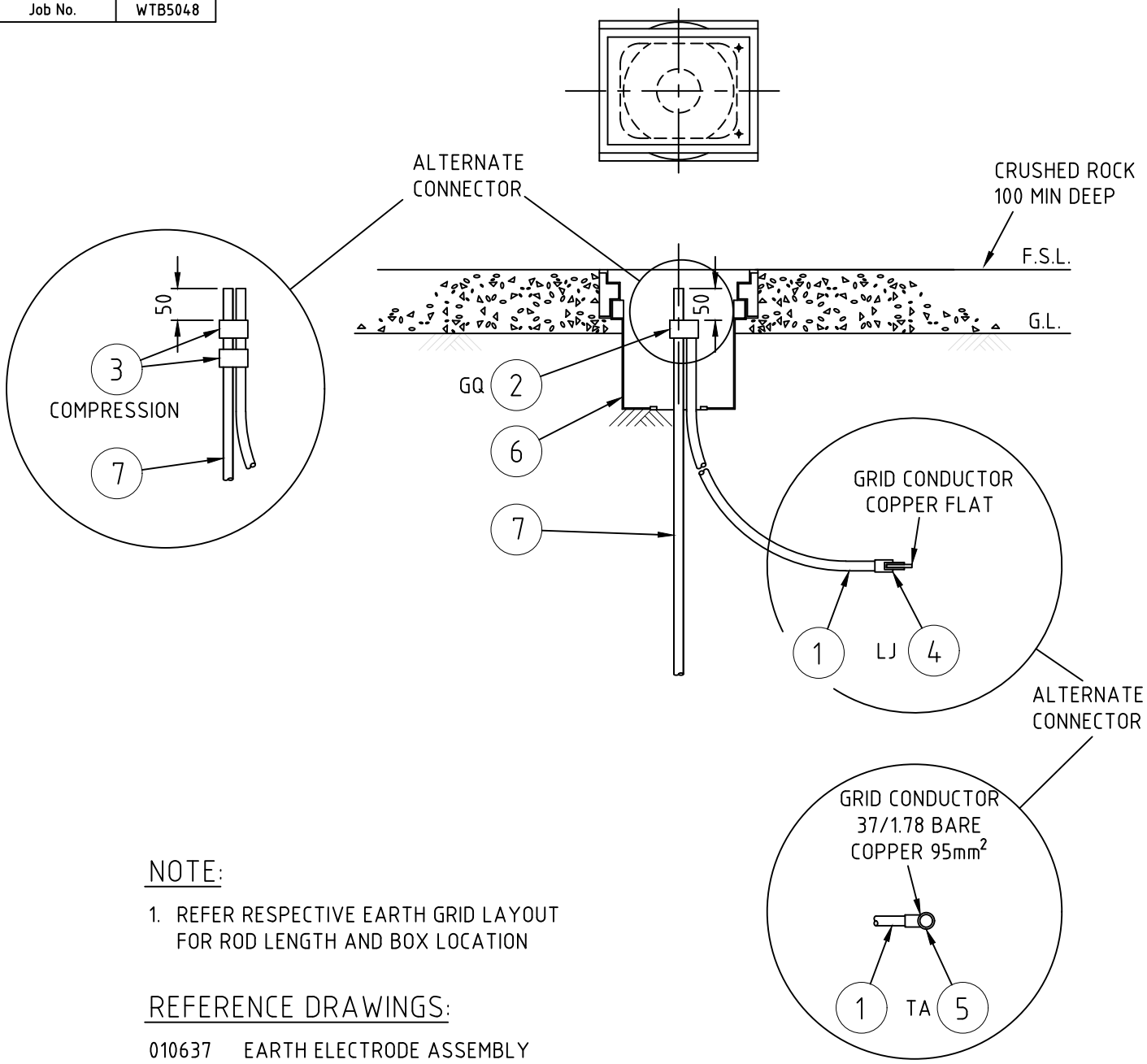
AUTHORISED
Michael Tomp/JC
MGR NETWORK SUBS ASSETS 02-01-97

INDOOR DISTRIBUTION SUBSTATION DEMOUNTABLE BUNDWALL FABRICATION DETAIL

A1 240118 C

SHEET No 1 OF 1 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
Job No.	WTB5048



NOTE:

1. REFER RESPECTIVE EARTH GRID LAYOUT FOR ROD LENGTH AND BOX LOCATION

REFERENCE DRAWINGS:

010637 EARTH ELECTRODE ASSEMBLY

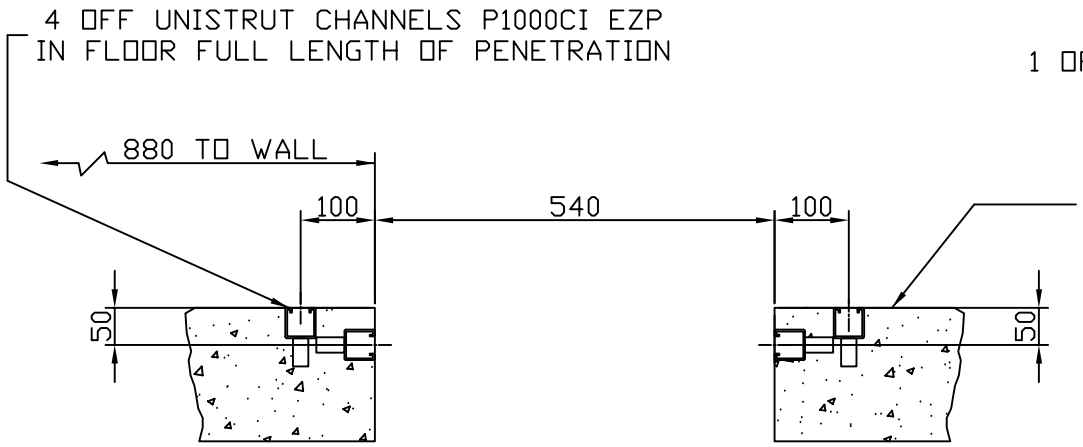
ITEM	DESCRIPTION
1	CONDUCTOR - 37/1.78 BARE OR COVERED COPPER 95mm^2
2	CADWELD - ERICO TYPE GQ
3	COMPRESSION CONNECTOR - BURNDY STYLE YGHC
4	CADWELD - ERICO TYPE LJ
5	CADWELD - ERICO TYPE TA
6	INSPECTION PIT - ERICO PIT03
7	EARTH ELECTRODE - ø15 x LENGTH INDICATED ON RESPECTIVE EARTH GRID DRG

Endeavour Energy

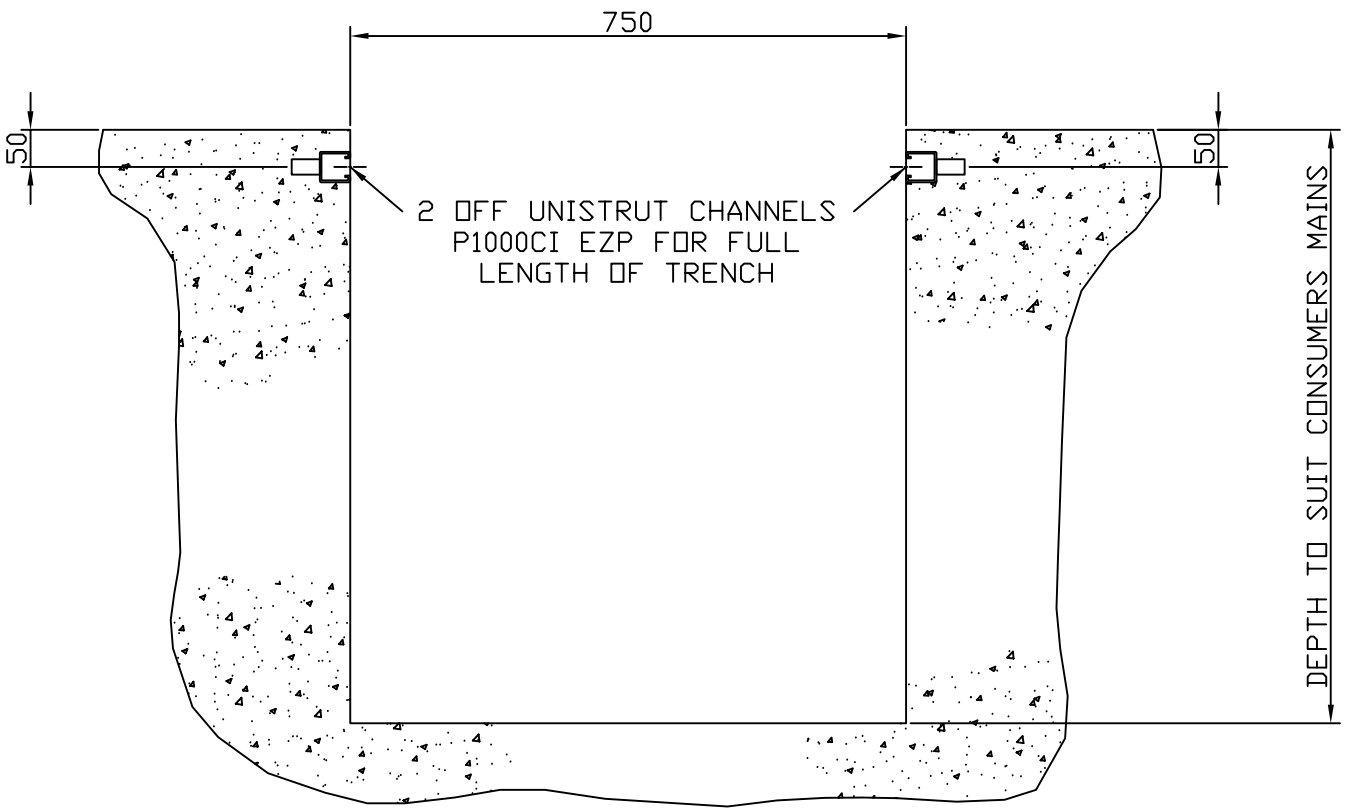
DRAWN	BF
DATE	08.12.04
CH'D	JMcD

SUBSTATION
EARTH STAKE PROTECTION BOX
15mm ROD
ARRANGEMENT

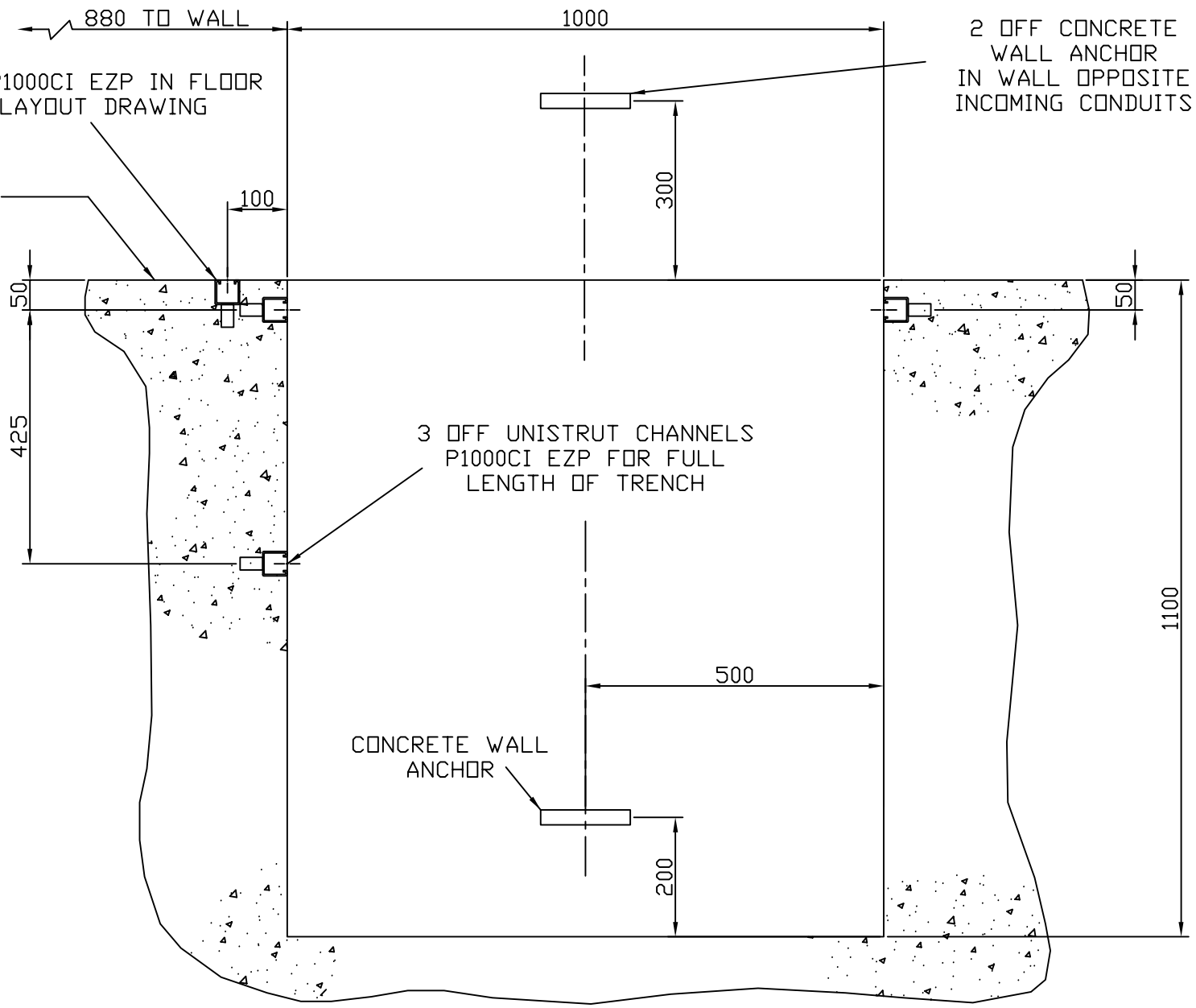
ORIGINAL SCALE NTS	APPROVED D.Asvestas/GST
MGR TRANSMISSION CAP PROJECTS	14.04.05
A4	292712 A
SHEET No 1 OF 1 SHEETS	



HV SWITCHGEAR FLOOR PENETRATION DETAIL
NOTE: FOR CABLE BASEMENT TYPE SUBSTATIONS ONLY



LOW VOLTAGE TRENCH DETAIL



HIGH VOLTAGE SWITCHGEAR TRENCH DETAIL
NOTE: FOR HIGH VOLTAGE TRENCHES ONLY

AMENDMENTS	
A	ORIGINAL ISSUE

ORIGINAL SCALE		APPROVED	G. Ford
DRAWN	G. Ford		
DATE	20-07-2005		
CH'D	G. Ford	INDEX REF.	S002A

Endeavour Energy

CONCRETE WALL ANCHOR FABR. DTLS	40879
TRENCH COVER PLATE DETAILS	297555
SW/GR SUPPORT BRACKET DETAILS	297556
REFERENCE DRAWINGS	

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 20-07-2005

INDOOR DISTRIBUTION SUBSTATION
FLOOR PENETRATION AND TRENCH DETAILS
FOR HV AND LV SWITCHGEAR

A3 297547 A
SHEET No 1 OF 1 SHEETS

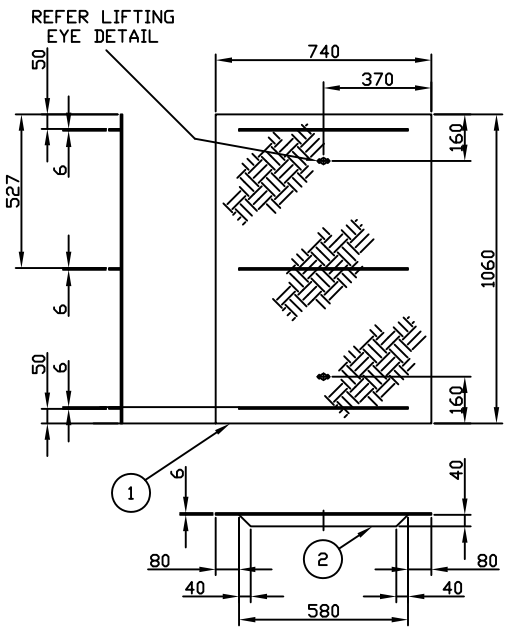
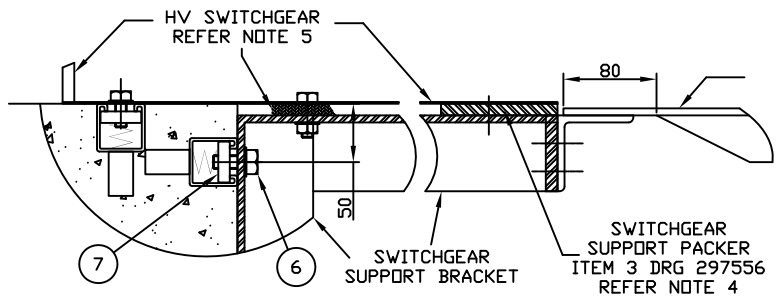
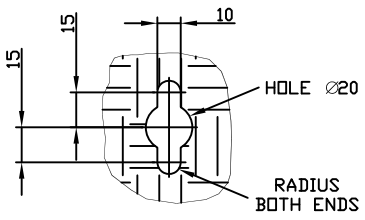


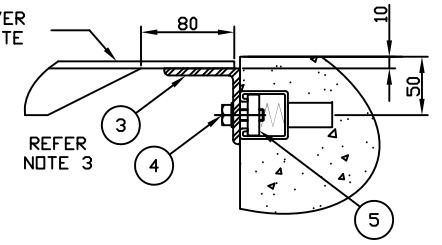
PLATE 6 DETAIL



HV SWITCHGEAR SUPPORT BRACKET DETAIL
SCALE NONE



LIFTING EYE DETAIL
SCALE NONE



COVER PLATE MOUNTING DETAIL
SCALE NONE
REFER NOTE 2

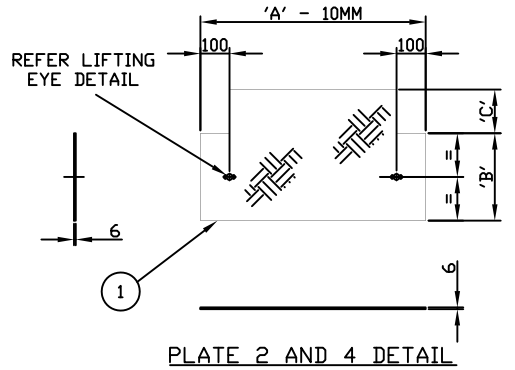


PLATE 2 AND 4 DETAIL
(DEPENDS ON SWITCHGEAR WIDTH)

NOTES

1. ALL WELDED CONSTRUCTION TO BE USED IN ACCORDANCE WITH AS1665.

2. ITEM 3 TO BE HOT DIP GALVANISED AFTER FABRICATION. NOTE, THIS ITEM IS REQUIRED ON BOTH SIDES OF TRENCH. IT IS NOT REQUIRED FOR THE SECTION OF TRENCH WHERE THE SWITCHGEAR IS TO BE MOUNTED.
SEE EXAMPLE.
ANGLES TO BE BOLTED AT 500mm CENTRES MAXIMUM WHERE POSSIBLE.
SEE MOUNTING DETAIL DELOW.

3. WHERE FEWER UNITS OF SWITCHGEAR ARE REQUIRED REDUCE QUANTITY OF PLATE 2 AND ADD PLATE 3 ACCORDINGLY.

4. SWITCHGEAR SUPPORT PACKER ONLY REQUIRED WHEN SWITCHGEAR SITS ON CONCRETE AT REAR OF TRENCH.

5. ALL SWICHGEAR TO SIT ON CONCRETE AT REAR OF TRENCH EXCEPT SAFELINK WHICH SITS FULLY ON SUPPORT BRACKETS.

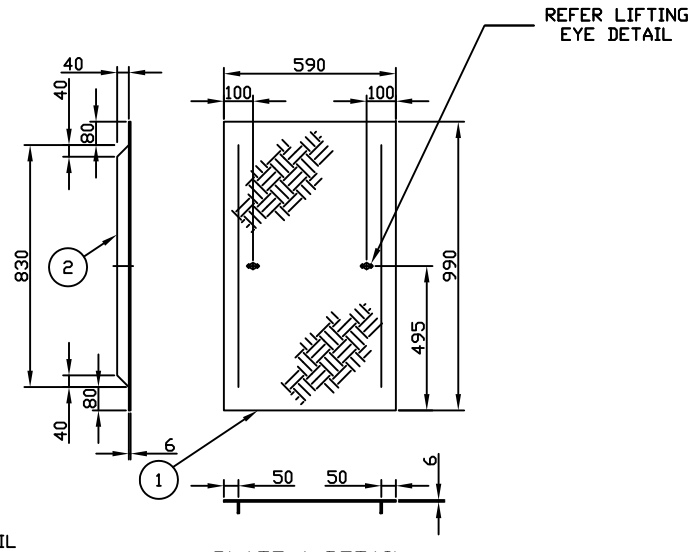
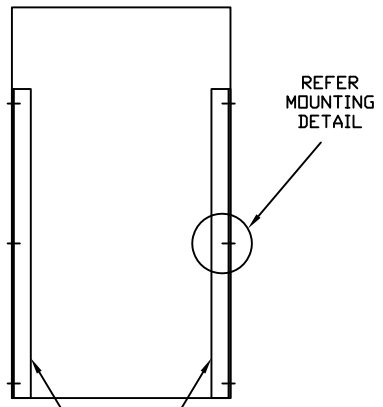
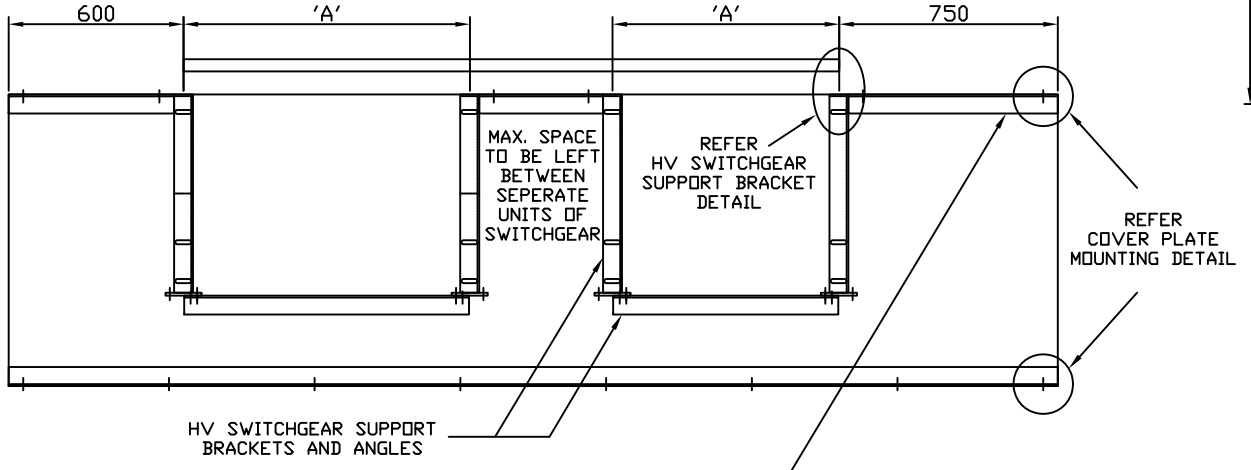


PLATE 1 DETAIL

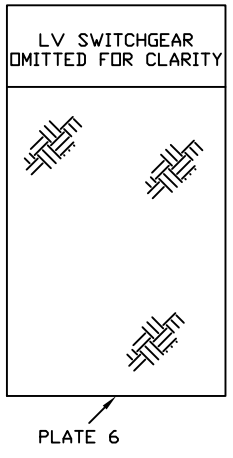
PLATE 3 AND 5 DETAIL
(AS FOR PLATE 1 BUT WIDTH AS REQUIRED
- MAX WIDTH ANY PLATE 750MM)

QUANTITIES	
PLATE 1	
PLATE 2	
PLATE 3	
PLATE 4	
PLATE 5	
PLATE 6	

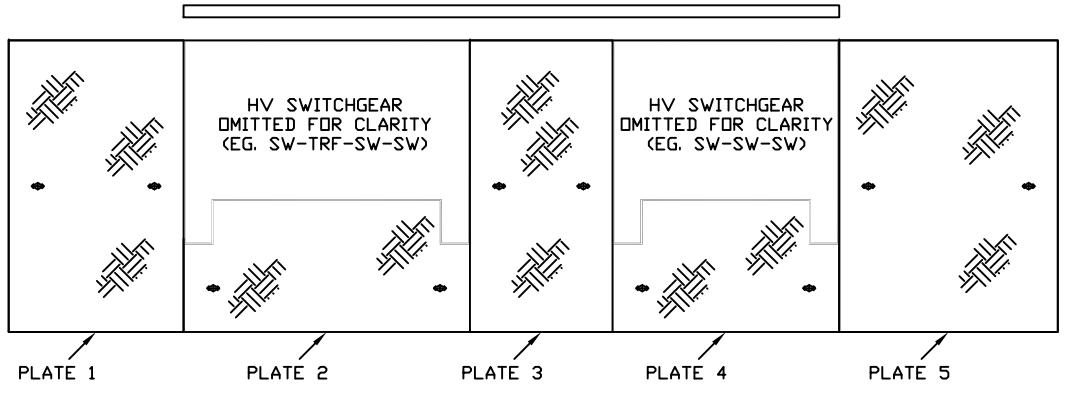




TYP. SW/GEAR DIMENSIONS			
BRAND	'A'	'B'	'C'
SM6	375	300	0
SVS	420	430	0
SAFELINK 3 FUNCTION	775	320	150
SAFELINK 4 FUNCTION	980	320	150
RM6 3 FUNCT.	1186	410	0
RM6 4 FUNCT.	1619	410	0
8DJH-SFS	1050	410	0
8DJH-SFSS	1360	410	0
8DJH-SSS	930	410	0
8DJH-SSSS	1240	410	0
-	-	-	-



COVER PLATE AND SUPPORT LAYOUT
TO SUIT LV TRENCH
SCALE: NIL



TYPICAL COVER PLATE AND SUPPORT LAYOUT TO SUIT A 3600 LONG TRENCH
WITH 2 SEPARATE UNITS OF HV SWITCHGEAR INSTALLED
SCALE: NIL

MARKED UP FOR PROPOSED SUBSTATION AT:

ITEM NO	VOCAB /DRG	DESCRIPTION	QTY	REFER
1	N/A	TREADPLATE ALUMINIUM 6mm x WIDTH & LENGTH TO SUIT	AR	-
2	N/A	BAR ALUMINIUM FLAT 40 x 6 x LENGTH TO SUIT	AR	-
3	N/A	ANGLE STEEL 65 x 65 x 6 x LENGTH TO SUIT	AR	NOTE 2
4	N/A	BOLT STEEL HEX HD GALV M10 x 35 LG	AR	-
5	N/A	NUT UNISTRUT SPRING LOADED P1008 M10	AR	-
6	N/A	BOLT STEEL HEX HD GALV M12 x 35 LG	AR	-
7	N/A	NUT UNISTRUT SPRING LOADED P1008 M12	AR	-

AMENDMENTS				
A	ORIGINAL ISSUE	DR'N	GSF	
		CH'D	GSF	
		DATE	14-04-07	
B	REDRAWN TO ACCOMODATE PADMOUNT STYLE HV SWITCHGEAR.	JR No	--	
		DR'N	GSF	
		CH'D	GSF	
		DATE	14-07-15	
C	SIEMENS 8DJH DETAIL ADDED	JR No	--	
		NSM	C.Crisafulli	

DO NOT SCALE
DIMENSIONS
IN MILLIMETRES

REFERENCE DRAWINGS	
COVER PLATE LIFTING HANDLE DETAIL	69526
SW/GR SUPPORT DRACKET DETAIL	297556
HV AND LV SW/GR TRENCH DETAIL	297547

	ORIGINAL SCALE	APPROVED
		G. Ford
DRAWN	G. Ford	
DATE	08/07/2005	
CH'D	G. Ford	INDEX REF. S008A

INTEGRAL ENERGY

INDOOR DISTRIBUTION SUBSTATION
STANDARD SWITCHGEAR TRENCH
COVER PLATE AND SUPPORT ANGLE FABRICATION
WITH INSTALLATION DETAILS

AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 08/07/2005

A3 297555 C

SHEET No 1 OF 1 SHEETS

AMENDMENTS		
A	ORIGINAL ISSUE	
B	DR'N	G.S.F.
	CH'D	G.S.F.
	DATE	14-04-07
	JR No	N/A
MODIFIED TO ALLOW STD PADMOUNT SWITCHGEAR TO BE USED ON ID SUBS.		
DSM		GSF
C	DR'N	G.S.F.
	CH'D	G.S.F.
	DATE	06-07-15
	JR No	N/A
NOTE 4 ADDED. SW/GR BRANDS INCREASED. TOP VIEW DIMENSIONS REVISED.		
NSM		C.Crisafulli

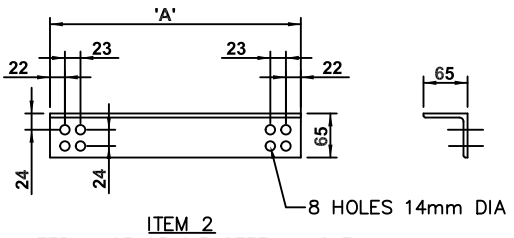
NOTES

1) ALL DIMENSIONS IN MILLIMETRES.
2) WELDED CONSTRUCTION THROUGHOUT. ALL WELDS TO COMPLY WITH AS1554.1.
3) COMPLETE ITEMS TO BE HOT DIP GALVANISED AFTER FABRICATION.
4) CHECK SWITCHGEAR AND DIMENSION 'A' BEFORE FABRICATION. SWITCHGEAR TO SIT ON HALF THE WIDTH OF THE FRAME WITH THE CHECKERPLATE (OR NEXT SWITCH) TO SIT ON THE OTHER HALF.

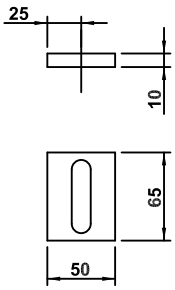
ITEM	QTY	DESCRIPTION	REMARKS

MARKED UP FOR PROPOSED SUBSTATION AT:

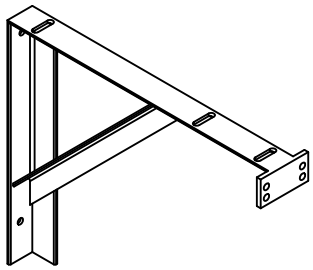
QUANTITIES	
ITEM 1	
ITEM 2	
ITEM 3	

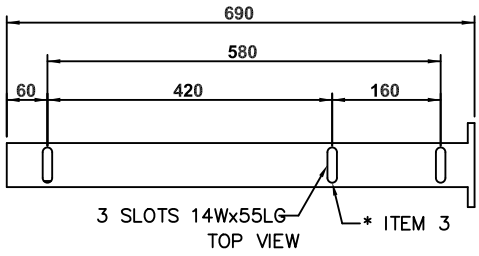


ITEM 2
MATERIAL: 65x65x6.5 STEEL ANGLE
8 OFF HOLES MAY BE SLOTS OF SAME SIZE

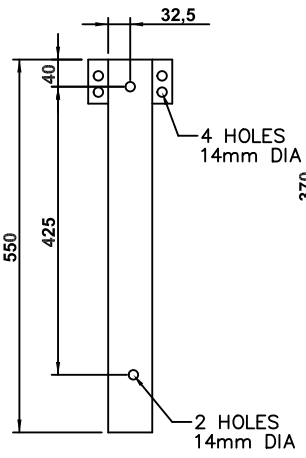


ITEM 3
MATERIAL: 50x65x6.5 MILD STEEL
*–SPACER MOUNTS HERE WHEN SWITCHGEAR SITS ON CONCRETE AT REAR

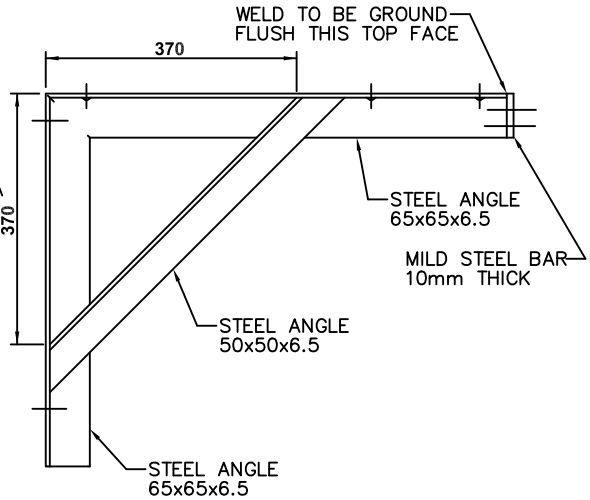




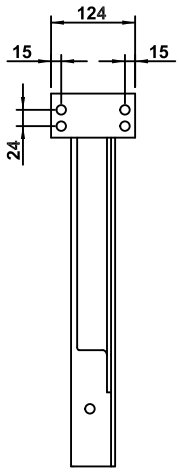
TOP VIEW



REAR VIEW



SIDE VIEW



FRONT VIEW

ITEM 1

SWITCHGEAR (REFER NOTE 4)	
BRAND	'A'
SM6	370
SVS	370
SAFELINK 3 FUNCT.	772
SAFELINK 4 FUNCT.	969
RM6 3 FUNCT.	1170
RM6 4 FUNCT.	1605
8DJH-SFS	1046
8DJH-SFSS	1360
8DJH-SSS	930
8DJH-SSSS	1240

Endeavour Energy

ORIGINAL SCALE	APPROVED G. Ford
DRAWN	G. Ford
DATE	08/07/05
CH'D	G. Ford
INDEX REF.	S008A

HV & LV SW/GR TRENCH DETAIL COVER PLATE & SUPPORT ANGLE — 297547 297555
DT
REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED W. Isley
MANAGER ASSET ENGINEERING 08/07/05

INDOOR DISTRIBUTION SUBSTATION
STANDARD 11/22KV SWITCHGEAR
TRENCH MOUNTING SUPPORT BRACKET
FABRICATION DETAIL

A4 297556 C
SHEET No. 1 OF 1

AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N G.S.F; CH'D G.S.F; DATE 04-01-16; JR No --
NOTE 1 WAS SDI105 NOW MDI0028. NOTE 3 AMENDED NOTE 5&6 ADDED.	
NSM	C.Crisafulli

NOTES

1) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DISTRIBUTION STANDARDS MDI0028 & MCI0006.

2) BUND WALLS TO BE ERECTED AS PER STANDARD AFTER INSTALLATION OF OIL/FLUID FILLED TRANSFORMERS.

3) VENTILATORS ARE SHOWN IN TYPICAL LOCATIONS ONLY. VENTILATORS IN WALLS ADJACENT TO HV SWITCHGEAR SHALL BE INSTALLED 2000mm ABOVE FLOOR LEVEL.

4) REFER TO INDIVIDUAL HV SWITCHGEAR SUBSTATION DESIGN INSTRUCTION FOR DETAILS OF INSTALLING SWITCHGEAR MOUNTING STEELWORK.

5) ALL CONDUITS TO BE SEALED BY FIRE PROOF SEALANT AT ALL TIMES. CONDUITS TO RUN TO PROPERTY BOUNDARY.

6) A FLAT AREA AT LEAST 1.5m DEEP x 1.5m WIDE TO SUPPORT 5 TONNES IS REQUIRED IN FRONT OF EQUIPMENT LOADING DOORS TO ALLOW THE TRANSFORMER TO BE SET DOWN AFTER UNLOADING FROM THE TRUCK.

ITEM	QTY	DESCRIPTION	REMARKS

SWITCHED SOCKET

CO2 5.0kg CO2 FIRE EXTINGUISHER FITTED WITH HOSE ATTACHMENT

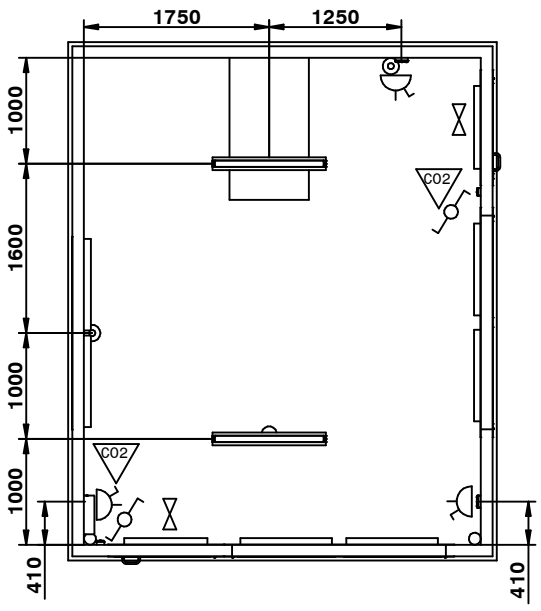
2 WAY SWITCH

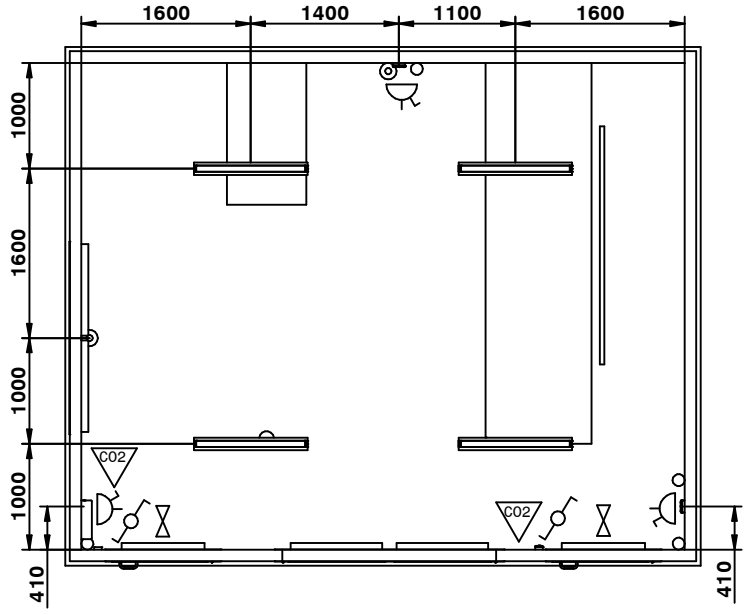
PULLING RING

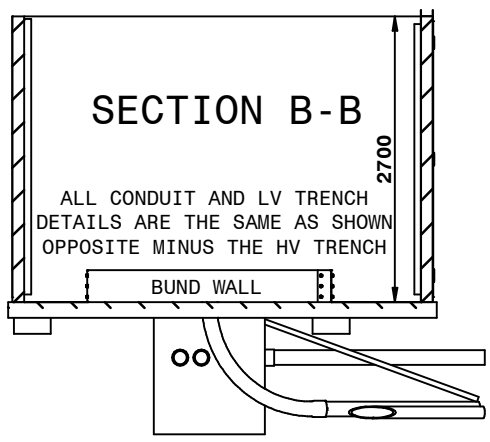
DISTRIBUTION BOARD

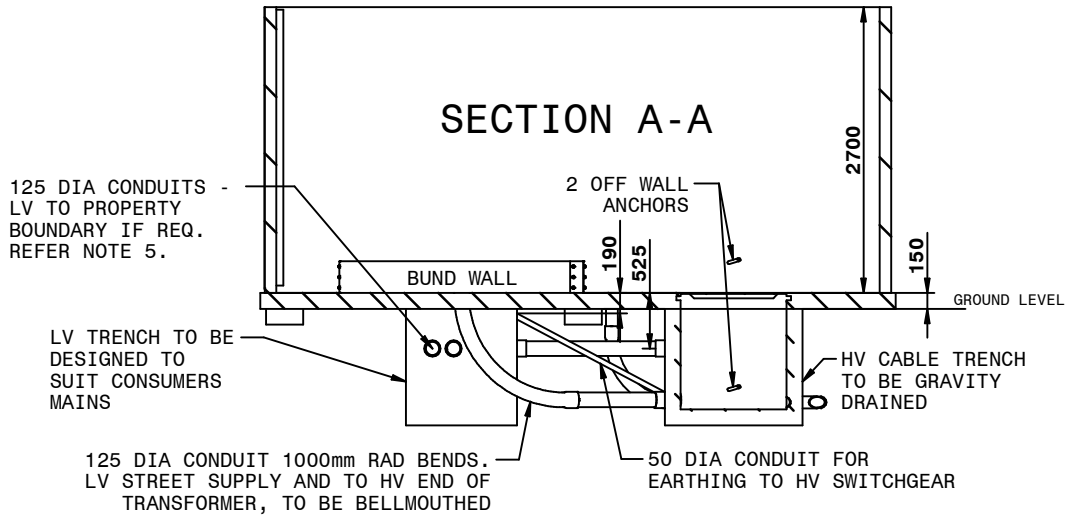
EXIT LIGHT FITTING NON-MAINTAINED BARDIC TYPE NMIONS/DS1A OR EQUIVALENT

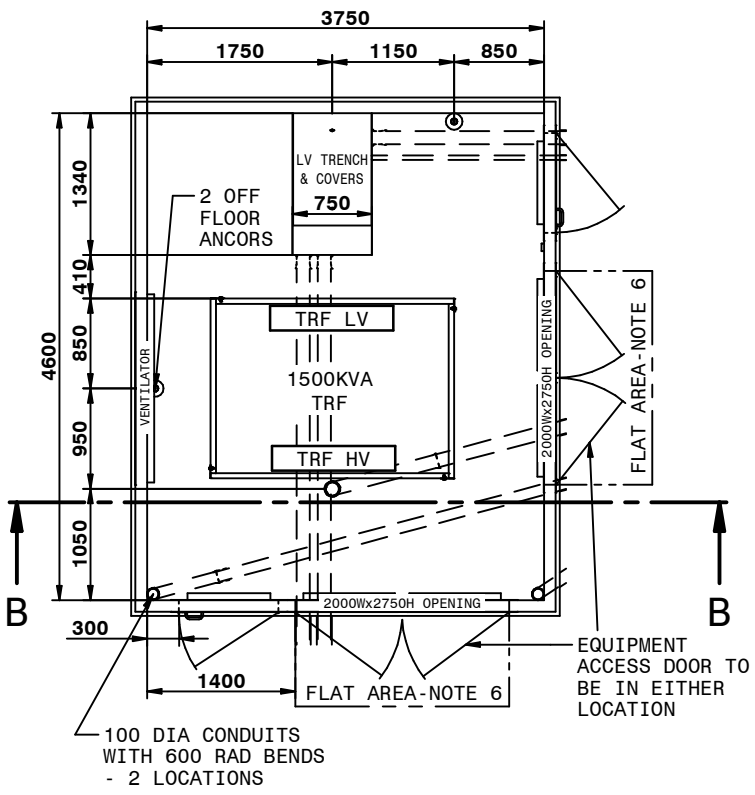
FLUORESCENT FITTING TWIN 40 WATT

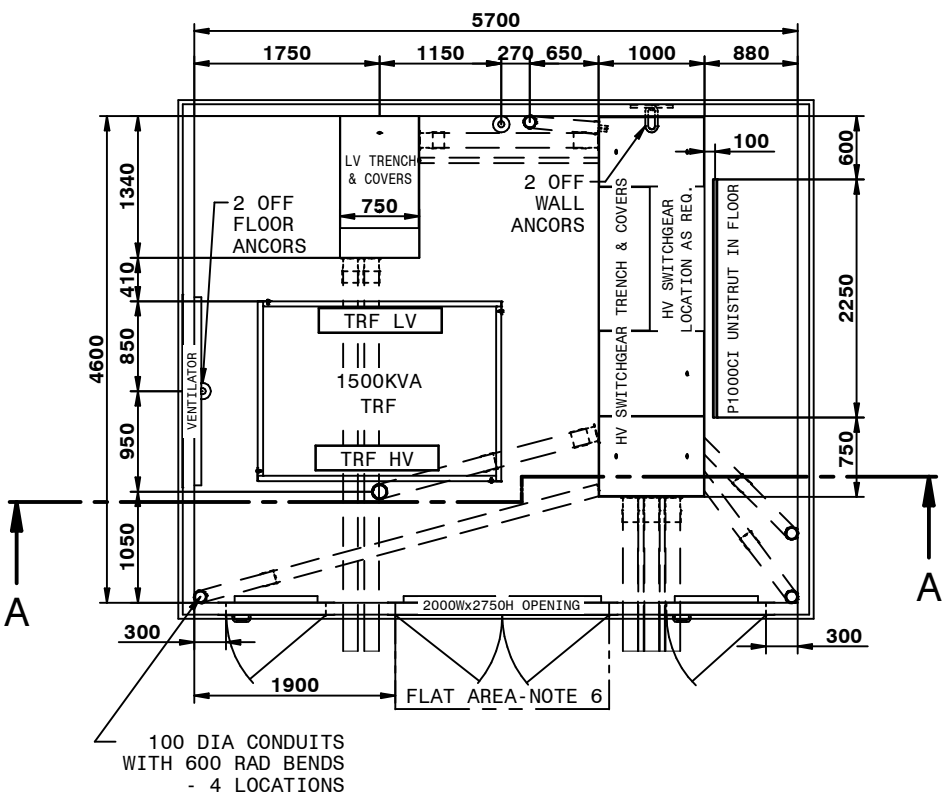












MAJOR EQUIPMENT MASS	
HV SWITCHGEAR MODULES	500kg EACH
POWER TRANSFORMER	5000kg EACH

HV SW/GR TRENCH FABR. DETAIL	297556
COVER PLATE & ANGLE FABR. DTL- HV & LV SW/GR	297555
FLOOR PENETRATION & TRENCH DTL - HV & LV SW/GR	297547
CONCRETE WALL ANCHOR FABRICATION DETAIL	040879
REMOVABLE PULLING RING & SOCKET FABR. DTL	040877
INDOOR DIST SUB TYPICAL CONDUIT DETAILS	040881
-	-

REFERENCE DRAWINGS

Endeavour Energy

ORIGINAL SCALE — DO NOT SCALE, DIMENSIONS IN MILLIMETRES

APPROVED G. Ford

AUTHORISED W. Isley

MANAGER ASSET ENGINEERING 20/07/05

DRAWN	G. Ford		
DATE	20/07/05		
CH'D	G. Ford		INDEX REF SD01A

STANDARD LAYOUT FOR A SINGLE TRANSFORMER INDOOR DISTRIBUTION SUBSTATION WITH & WITHOUT HV AND LV TRENCHES TO SUIT UPTO 1500KVA DRY OR OIL FILLED TRANSFORMERS

A3 297557 B

SHEET No. 1 OF 1

AMENDMENTS		
A	ORIGINAL ISSUE	
B	DR'N	G.S.F
	CH'D	G.S.F
	DATE	30-11-05
	JR No	--
WIDTH OF ROOM WITHOUT SW/GEAR WAS 7600 NOW 6100		
	DSM	G.S.F
C	DR'N	G.S.F
	CH'D	G.S.F
	DATE	04-01-16
	JR No	--
NOTE 1 WAS SDI105 NOW MDI0028. NOTE 3 AMENDED NOTE 5&6 ADDED.		
	NSM	C.Crisafulli

NOTES

1) THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DISTRIBUTION STANDARDS MDI0028 & MCI0006.

2) BUND WALLS TO BE ERECTED AS PER STANDARD AFTER INSTALLATION OF OIL/FLUID FILLED TRANSFORMERS.

3) VENTILATORS ARE SHOWN IN TYPICAL LOCATIONS ONLY. VENTILATORS IN WALLS ADJACENT TO HV SWITCHGEAR SHALL BE INSTALLED 2000mm ABOVE FLOOR LEVEL.

4) REFER TO INDIVIDUAL HV SWITCHGEAR SUBSTATION DESIGN INSTRUCTION FOR DETAILS OF INSTALLING SWITCHGEAR MOUNTING STEELWORK.

5) ALL CONDUITS TO BE SEALED BY FIRE PROOF SEALANT AT ALL TIMES. CONDUITS TO RUN TO PROPERTY BOUNDARY.

6) A FLAT AREA AT LEAST 1.5m DEEP x 1.5m WIDE TO SUPPORT 5 TONNES IS REQUIRED IN FRONT OF EQUIPMENT LOADING DOORS TO ALLOW THE TRANSFORMER TO BE SET DOWN AFTER UNLOADING FROM THE TRUCK.

ITEM	QTY	DESCRIPTION	REMARKS

SWITCHED SOCKET

CO2 5.0kg CO2 FIRE EXTINGUISHER FITTED WITH HOSE ATTACHMENT

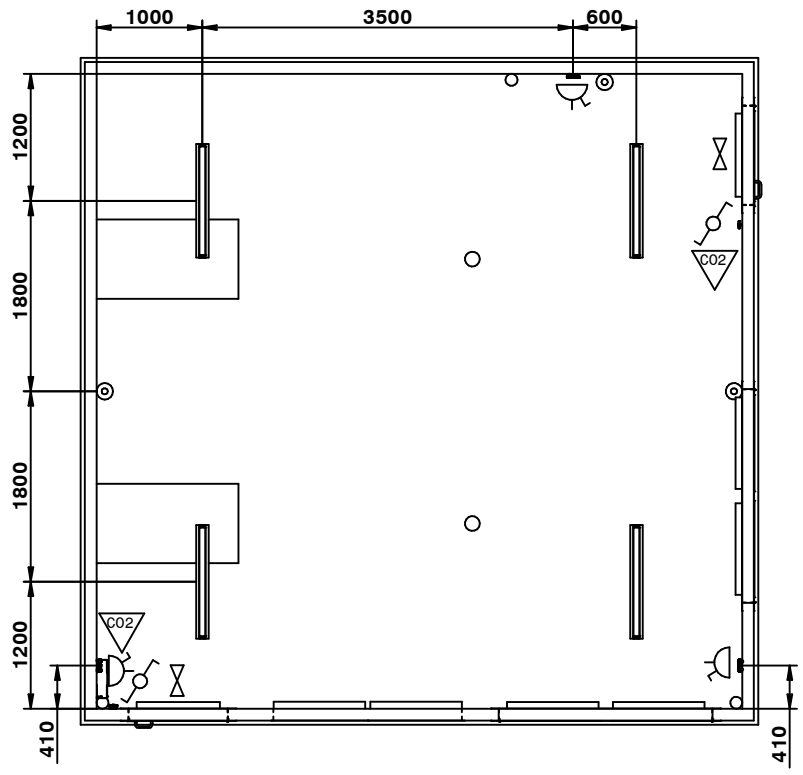
2 WAY SWITCH

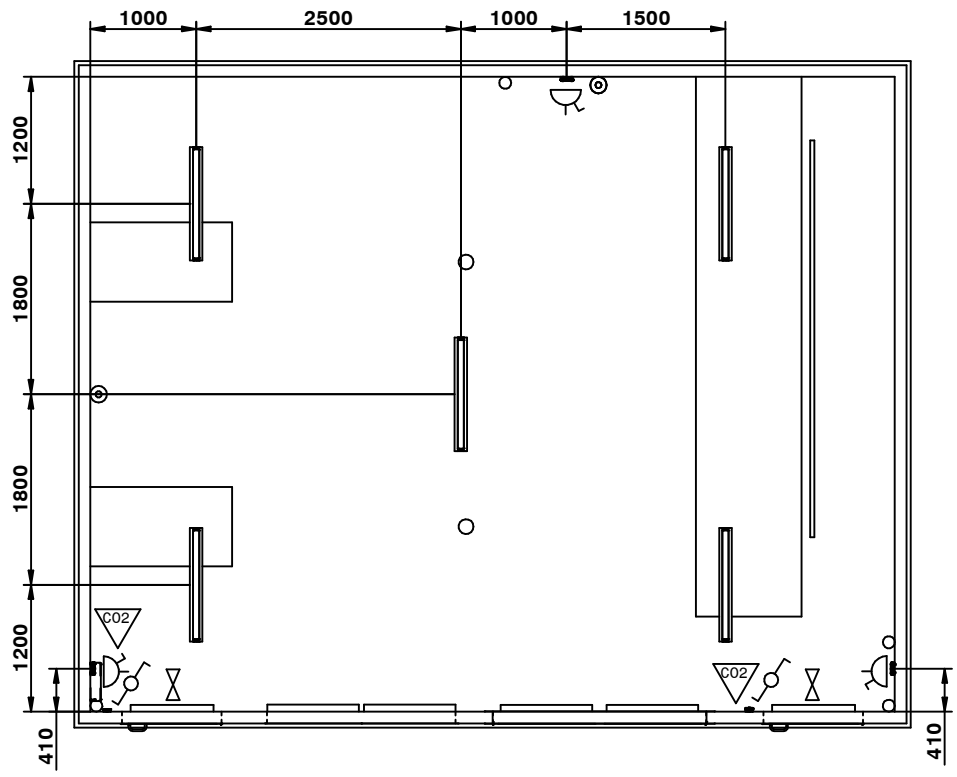
PULLING RING

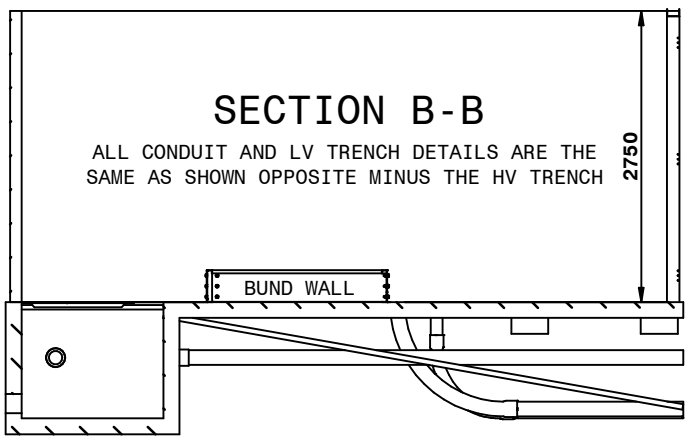
DISTRIBUTION BOARD

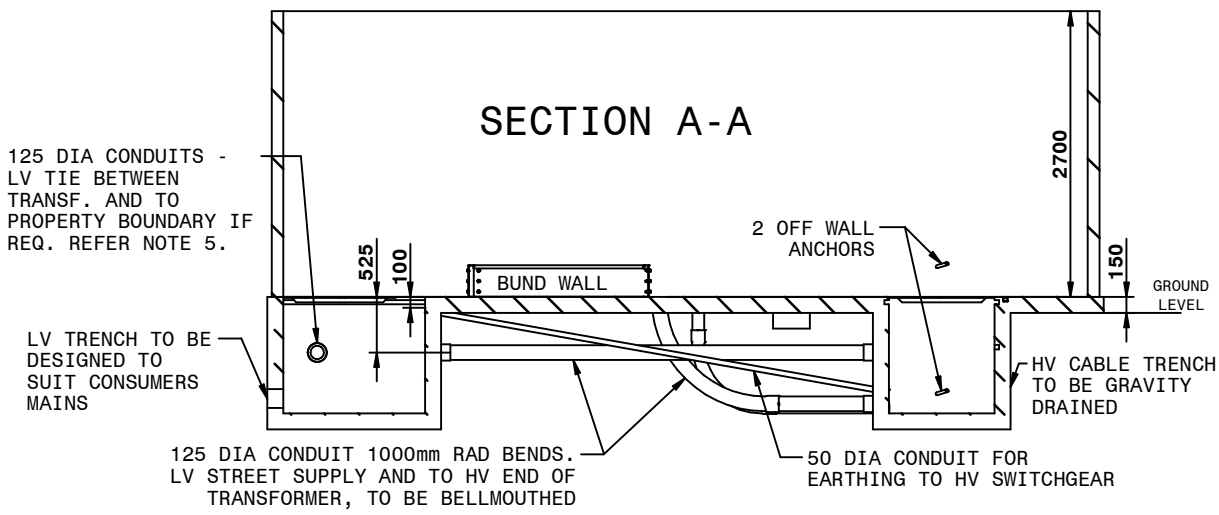
EXIT LIGHT FITTING NON-MAINTAINED BARDIC TYPE NMIONS/DS1A OR EQUIVALENT

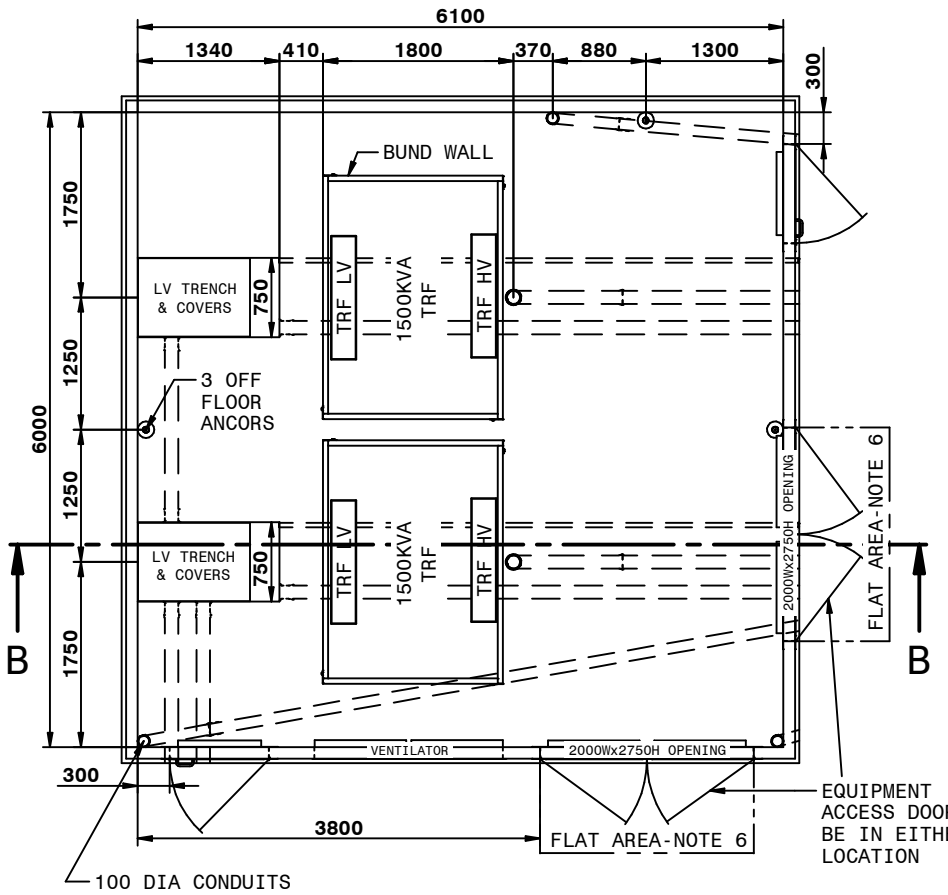
FLUORESCENT FITTING TWIN 40 WATT

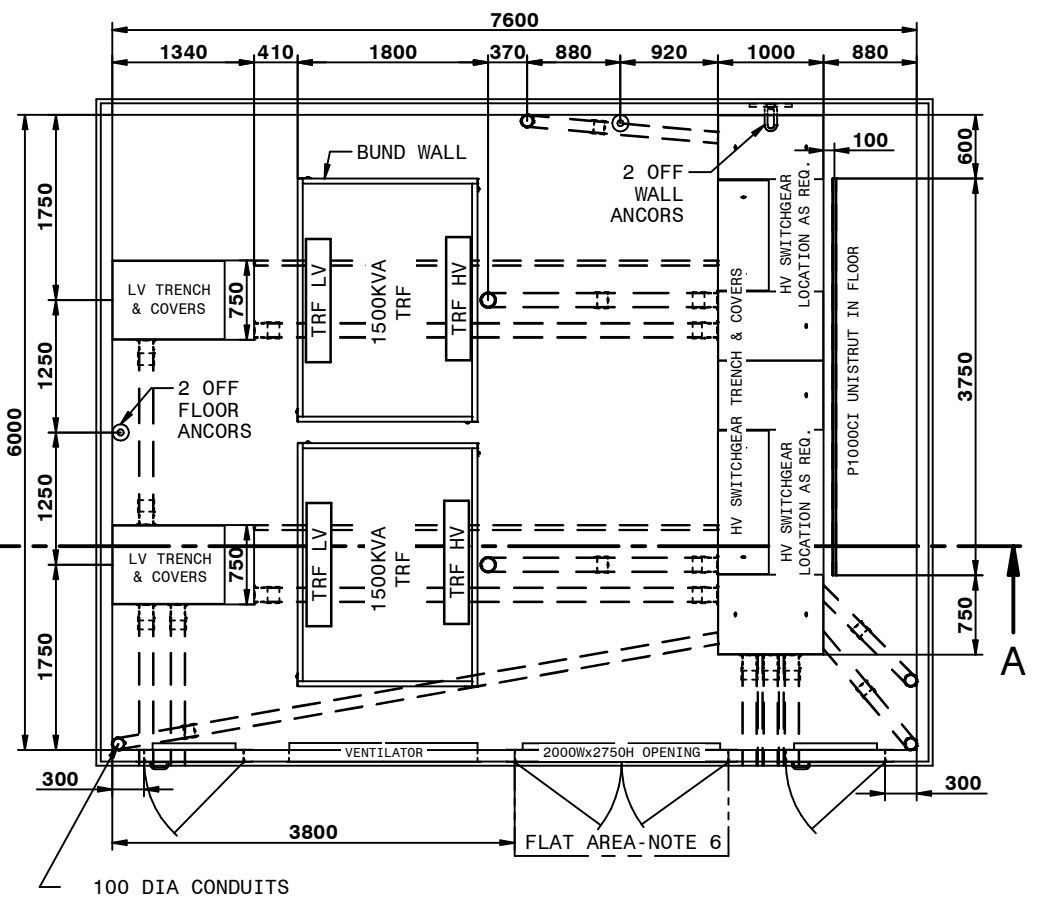












MAJOR EQUIPMENT MASS	
HV SWITCHGEAR MODULES	500kg EACH
POWER TRANSFORMER	5000kg EACH

HV SW/GR TRENCH FABR. DETAIL	297556
COVER PLATE & ANGLE FABR. DTL- HV & LV SW/GR	297555
FLOOR PENETRATION & TRENCH DTL - HV & LV SW/GR	297547
CONCRETE WALL ANCHOR FABRICATION DETAIL	040879
REMOVABLE PULLING RING & SOCKET FABR. DTL	040877
INDOOR DIST SUB TYPICAL CONDUIT DETAILS	040881
-	-

REFERENCE DRAWINGS

Endeavour Energy

ORIGINAL SCALE	APPROVED
	G. Ford

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 08/07/05

DRAWN	G. Ford
DATE	08/07/05
CH'D	G. Ford

INDEX REF S001A

STANDARD LAYOUT FOR A TWO TRANSFORMER INDOOR DISTRIBUTION SUBSTATION WITH & WITHOUT HV AND LV TRENCHES TO SUIT UPTO 1500KVA DRY OR OIL FILLED TRANSFORMERS

A3 297558 C

SHEET No. 1 OF 1

AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N G.S.F.
	CH'D G.S.F.
	DATE 26-11-15
	JR No N/A
	REDRAWN. HV TRENCH EXTENDED
	NSM C.Crisafulli

NOTES

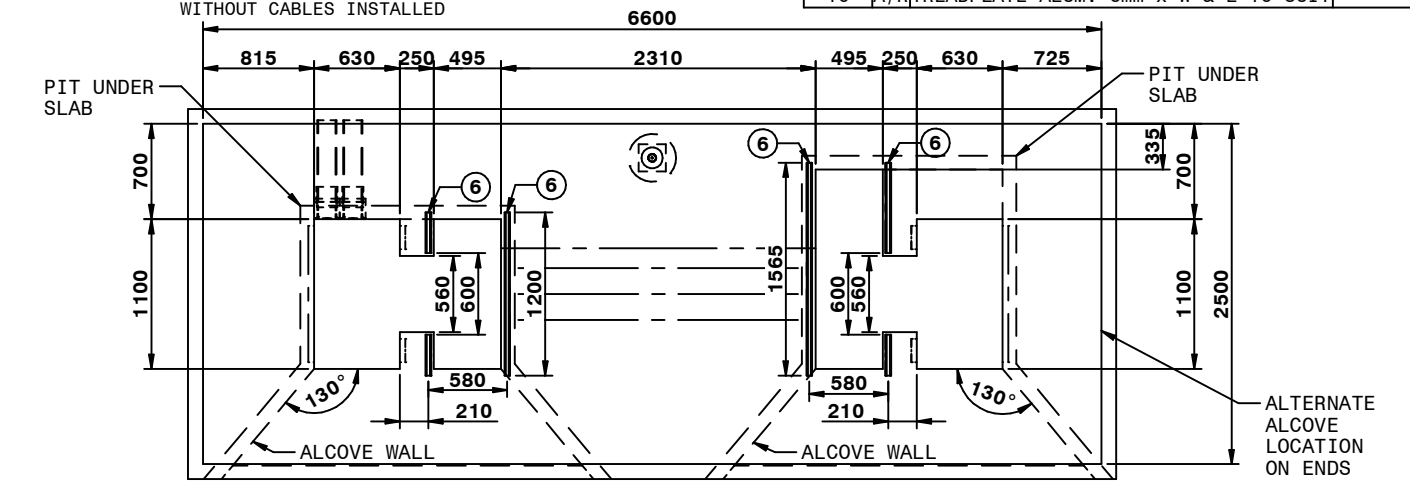
1) ALL WELDED CONSTRUCTION TO BE IN ACCORDANCE WITH AS1665.

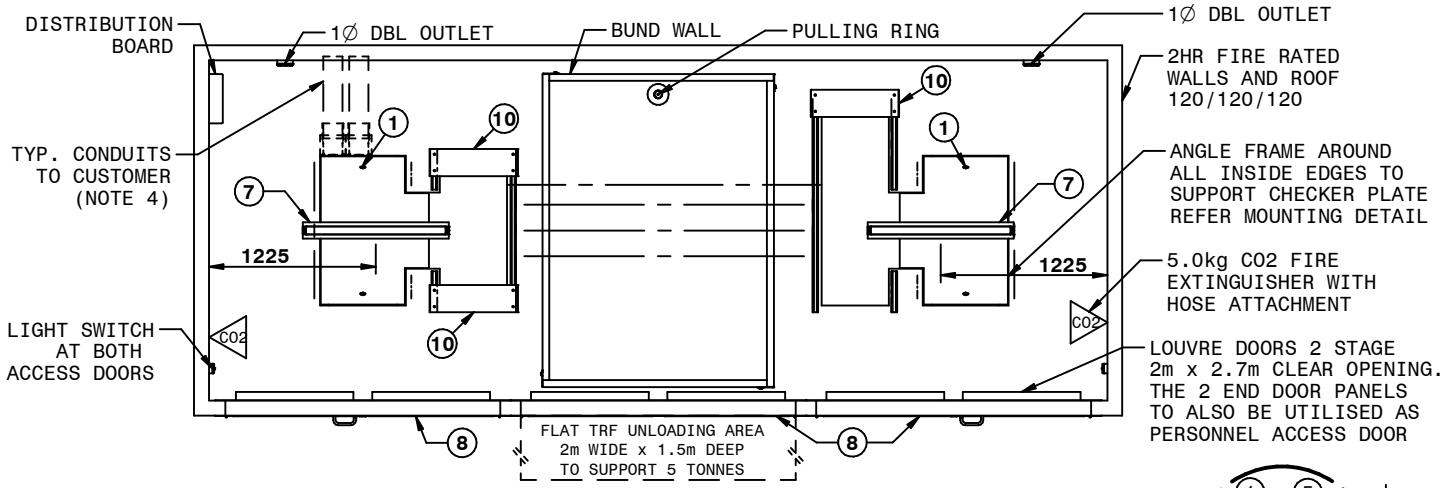
2) ITEM 3 TO BE HOT DIP GALVANISED AFTER FABRICATION. NOTE: THIS ITEM IS REQUIRED ON ALL SIDES OF PENETRATION. ANGLE IRON TO BE BOLTED AT 400mm CENTRES MAX WHERE POSSIBLE. SEE MOUNTING DETAIL BELOW.

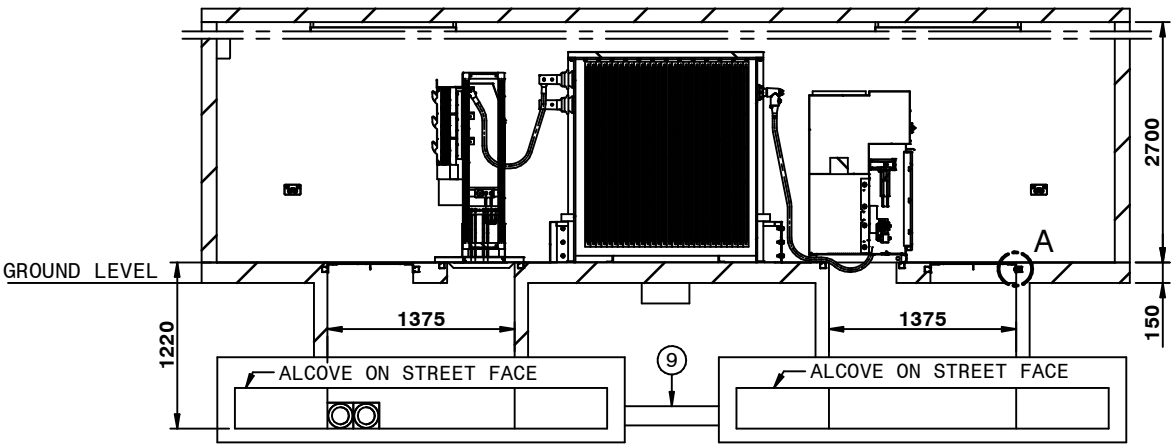
3) ALL HV & LV CABLES TO BE HORIZONTAL & LEVEL WITH SUB FLOOR BEFORE ENTERING SUB TO FACILITATE CABLE TERM.

4) CONDUITS TO BE SEALED FOR 2HR FIRE RATING WITH OR WITHOUT CABLES INSTALLED

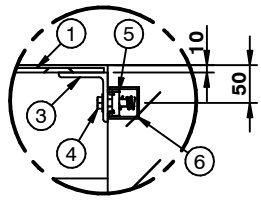
ITEM	QTY	DESCRIPTION	REMARKS
1	2	TREADPLATE ALUM. 6mm x W & L TO SUIT	
2	A/R	BARE ALUMINIUMFLAT 40x6 LEN TO SUIT	
3	A/R	ANGLE STEEL 65x65x6x LEN TO SUIT	NOTE 2
4	A/R	BOLT STEEL HEX HD GALV. M10x35 LG	
5	A/R	NUT UNISTRUT SPRING LOADED P1000 M10	
6	A/R	UNISTRUT CHANNEL P1000CI EZP	
7	2	FLUORECENT FITTING TWIN 40 WATT	
8	3	LOUVRE DOOR 2 STAGE 2mWx2.7mH CLEAR	
9	A/R	CONDUITS 3x125mm + 1x50mm HV TO LV	NOTE 4
10	A/R	TREADPLATE ALUM. 6mm x W & L TO SUIT	

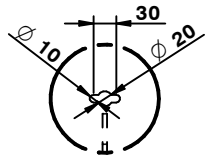


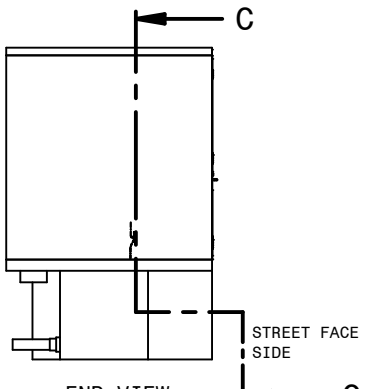




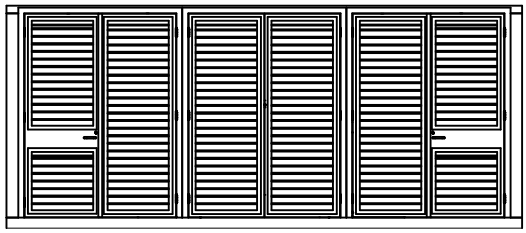
SECTION C-C



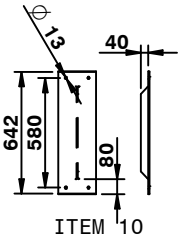




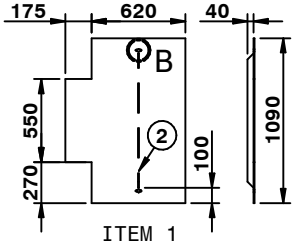
END VIEW
WITH SECTION C-C CUT



ELEVATION



ITEM 10



ITEM 1

Endeavour Energy

ORIGINAL SCALE	APPROVED
	G. Ford

DRAWN	G. Ford		
DATE	06/09/07		
CH'D	G. Ford		

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 06/09/07

STANDARD LAYOUT FOR A SINGLE TRANSFORMER INDOOR PADMOUNT STYLE DISTRIBUTION SUBSTATION WITH MINIMAL HV SWITCHING TO SUIT UP TO 1500kVA OIL OR DRY TRANSFORMER

A4 317522 B

SHEET No. 1 OF 1

7.7.3 Padmount switching station – associated drawings

Drawing no.	Amendment no.	Subject
075027	J	11/22kV padmount and switching station invert culvert construction details
078559	B	11kV switching station heater and thermostat mounting detail
264890	B	Size 14 and 16 padmount substation fibreglass cubicle door
264891	C	Size 14 and 16 padmount substation fibreglass cubicle HV and LV compartment
282539	A	11 and 22kV HV switching station two and four pier footing details
282540	A	Size 16 switching station fibreglass cubicle HV compartment
282551	B	Size 16 switching station easement layout
292827	A	Size 14 and 16 HV switching station precast concrete plinth construction detail

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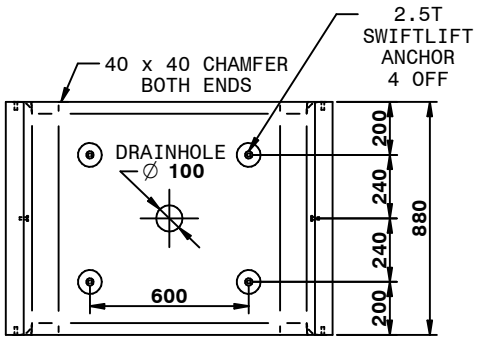
AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N D.J.Z. / CH'D D.J.Z. / DATE 16-03-93 / JR No 920294 — DRAINHOLE WAS Ø90. DIM 1234 WAS 1240. DIM 100 WAS 250. DIM 400 WAS 250. DIM 1092 ADDED. LIFT LUGS DELETED. S.D.E. D.T.G.
C	DR'N D.J.Z. / CH'D D.J.Z. / DATE 13-07-93 / JR No 930125 — TITLE REVISED, END SHEET DETAILS ADDED. ISSUE ID SDI104 ADDED. S.D.E. D.T.G.
D	DR'N T.A.B. / CH'D T.A.B. / DATE 27-05-94 / JR No 940063 — DIM 2800 WAS 2464, DIM 1160 WAS 1163, DIM 800 WAS 750, DIM 600 WAS 515, DIM 70 WAS 80, DIM 350 WAS 400, DIM 30 WAS 28, DIM 1235 WAS 1234, DIM 110 WAS 1092, DIM 1165 WAS 1015, DIM 560 WAS 490, ANCHORS WERE 820 APART, INTERNAL FERRULES ADDED, MASS WAS 1800KG, VOCAB ADDED, 22KV ADDED TO TITLE, HOLES WERE Ø14, CHAMFER ADDED, SDI114 ADDED. S.D.M. D.T.G.
E	DR'N D.J.Z. / CH'D D.J.Z. / DATE 16-11-94 / JR No 940162 — SDI117 WAS TP9. S.D.M. JK
F	DR'N J.W / CH'D R.J.H / DATE 18-04-95 / JR No 950077 — CHANGE END SHEET DETAIL WAS LV END SHEET DETAIL QUANTITY: 2 OFF WAS 1 OFF. DELETED: HV END SHEET DETAIL. S.D.M. JK
G	DR'N D.J.Z / CH'D D.J.Z. / DATE 20-12-96 / JR No 960097 — NOTE 1 ADDED. ISSUE ID'S DELETED. END SHEET COVER AND CUTOUT END SHEET DETAILS ADDED. END SHEET DETAIL DIM 1080 WAS 800. M.N.S.A. JK
H	DR'N G.Ford / CH'D G.Ford / DATE 09-12-04 / JR No --- — SWITCHING STATION CULVERT DETAILS ADDED. M.N.S.A. G.Ford
J	DR'N G.Ford / CH'D G.Ford / DATE 03-12-13 / JR No --- — SWIFTLIFT RATING 2.5T WAS 1.3T. END SHEET FIBREGLASS WAS PLASTIC. END SHEET RIBS ADDED. CUT OUT END SHEET AND NOTE 1 DELETED. M.P.S. G.Ford

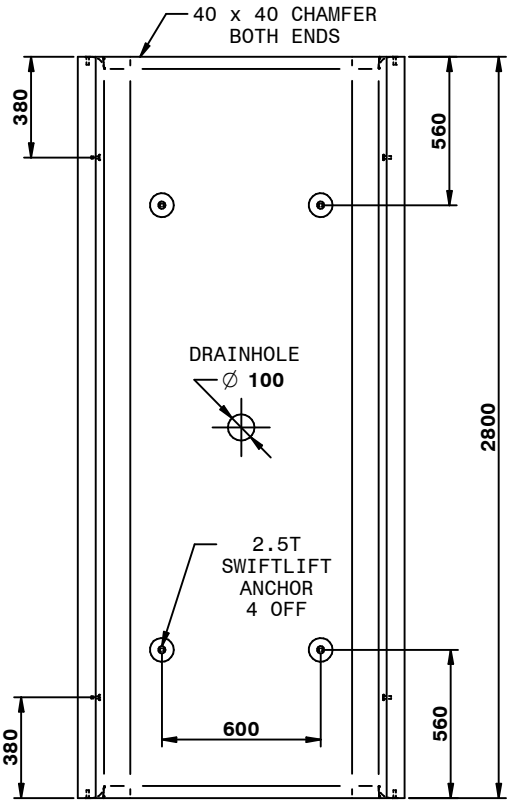
NOTES

1) -

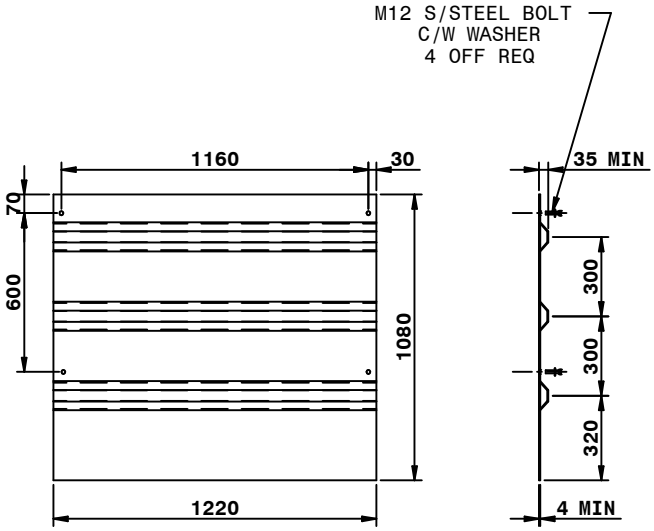
ITEM	QTY	DESCRIPTION	REMARKS



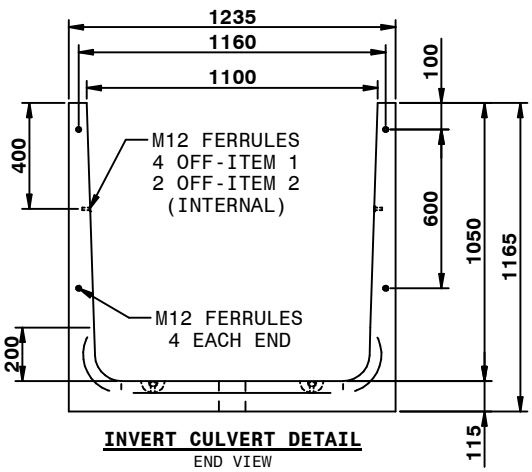
ITEM 2
INVERT CULVERT DETAIL
SWITCHING STATION PLAN VIEW



ITEM 1
INVERT CULVERT DETAIL
PADMOUNT PLAN VIEW



END SHEET DETAIL
MATERIAL: RIGID FIBREGLASS - MIN 4mm
THICK WITH STRENGTHENING RIBS
QUANTITY: 2 OFF PER CULVERT



INVERT CULVERT DETAIL
END VIEW

	PADMOUNT	SWITCHING STATION
APPROX. MASS:	2280kg	720kg
STOCK CODE:	YT10165	1554336

Endeavour Energy

ORIGINAL SCALE — APPROVED C.Howat

DRAWN T.A.B. — DATE 28/10/92 — CH'D D.J.Z — INDEX REF S002A

PM SUB INVERT CULVERT FTG INST 076665

REFERENCE DRAWINGS

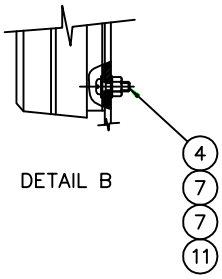
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED D.B.Britten/CH
ASSIST. G.G. ENG. 28/10/92

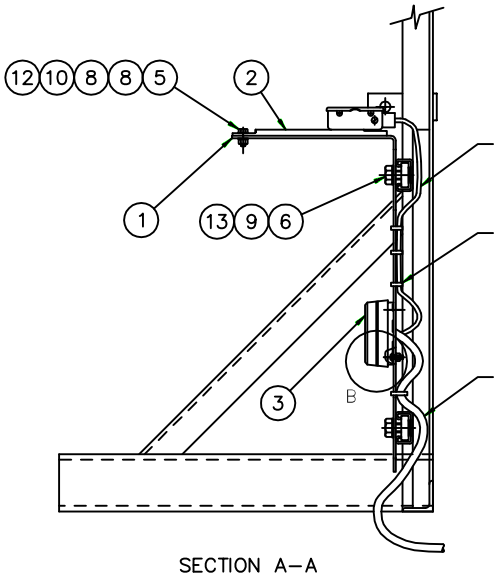
11 & 22kV PADMOUNT & SWITCHING STATION
INVERT CULVERT
CONSTRUCTION DETAILS

A4 075027 J
SHEET No. 1 OF 1

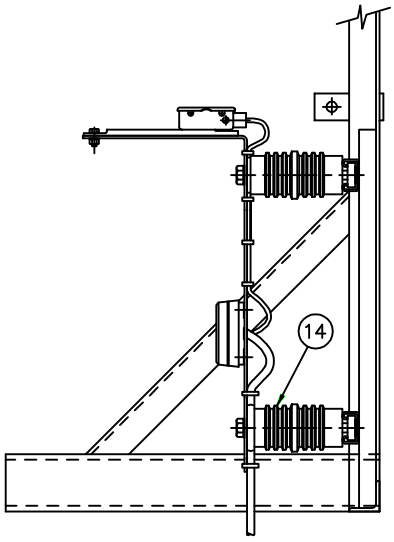
AMENDMENTS		
A	ORIGINAL ISSUE	
B	J R No.	940199
	DR'N	C.R.T.
	CH'D	C.R.T.
	DATE	31-10-95
	JR No	950179
HV SWITCH STATION ADDED TO TITLE.		
MNSS		S.O.



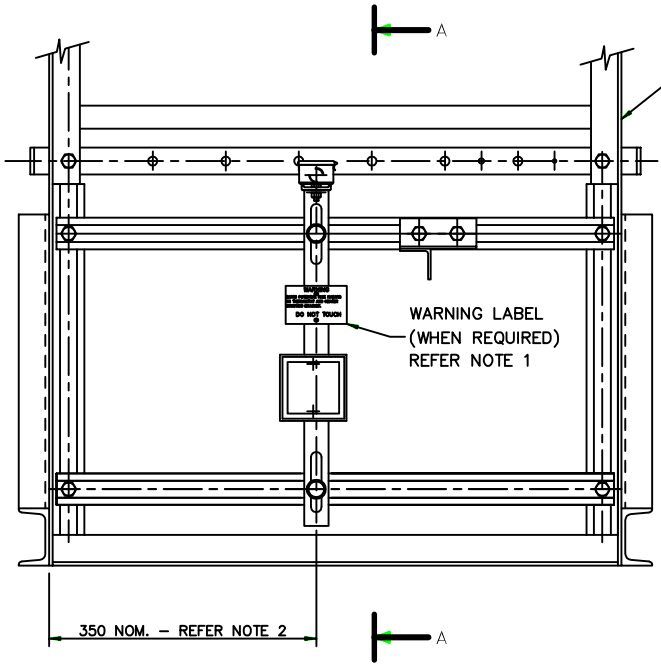
DETAIL B



SECTION A–A

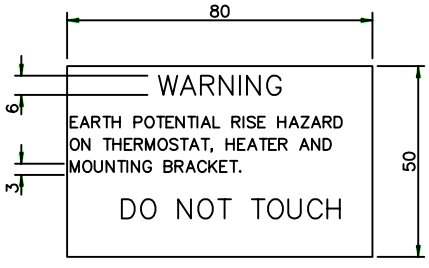


ALTERNATIVE MOUNTING ARRANGEMENT
WITH STANDOFF INSULATORS
REFER NOTE 1



NOTES

1. WHEN SWITCHGEAR IS LOCATED IN AN AREA WITH SEPARATE EARTHING THE MOUNTING BRACKET IS TO BE INSULATED FROM THE SUPPORT FRAME USING POST INSULATORS (ITEM 14) AND THE WARNING LABEL BE FIXED APPROXIMATELY WHERE SHOWN VIA 2 SELF TAPPING SCREWS.
2. MINIMUM CLEARANCE BETWEEN MOUNTING BRACKET AND UNSCREENED HV CABLE IS TO BE 70mm.
3. THERMOSTAT IS TO BE SET AT 20 C.



WARNING LABEL DETAIL
SCALE 1:1
MATERIAL: GRAVOPLY – WHITE LETTERING
ON RED BACKGROUND.

ITM NO	VOCAB /DRG	DESCRIPTION	QTY	REFER
1	078558	BRACKET HEATER AND THERMOSTAT MTG	1	NOTE 2
2	SH10220	HEATER ANTI–CONDENSATION 50W	1	–
3	ST10708	THERMOSTAT (SUNVIC TLM2453)	1	NOTE 3
4	NA	SCREW STEEL PAN HD Z/P M4 X 16 LG	2	–
5	SS19816	SCREW S/STEEL HEX HD M6 X 20 LG	1	–
6	SS19581	SCREW S/STEEL HEX HD M12 X 25 LG	2	–
7	NA	WASHER STEEL FLAT RND Z/P 4	4	–
8	SW11341	WASHER S/STEEL FLAT RND 6	2	–
9	SW10159	WASHER S/STEEL FLAT RND 12	2	–
10	SW11465	WASHER STEEL SPRING Z/P 6	1	–
11	NA	NUT STEEL HEX Z/P M4	2	–
12	SN12491	NUT S/STEEL HEX M6	1	–
13	SN12564	NUT SPRING M12 UNISTRUT No P4010/M12	2	–
14	SY10204	INSULATOR POST WITH M12 STUD	2	NOTE 1

Endeavour Energy

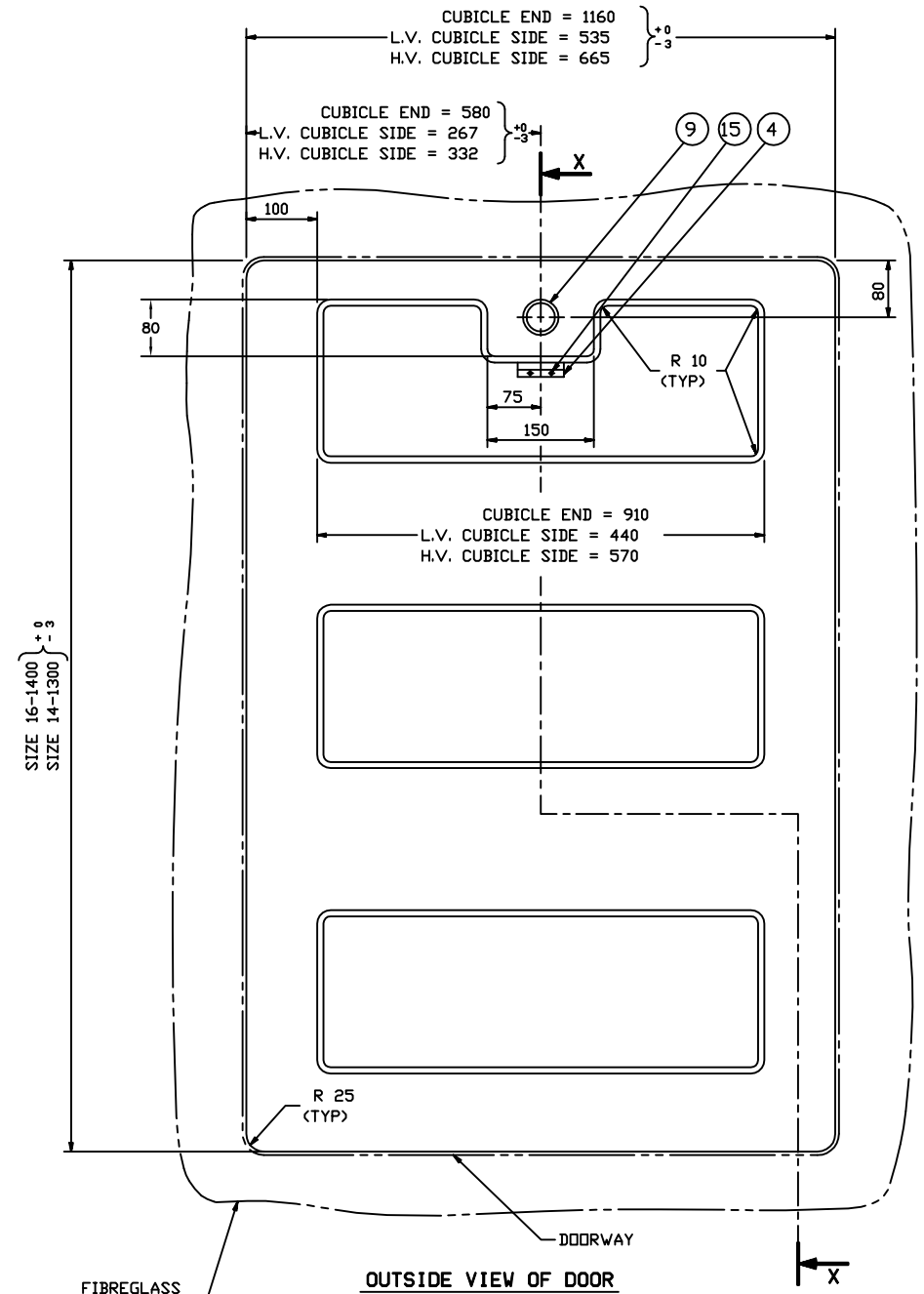
ORIGINAL SCALE 1:5 & 1:1	APPROVED C.Howat
DRAWN J.W	
DATE 21–4–95	
CH'D R.J.H	

REFERENCE DRAWINGS	DRG. NO.	THIS ISSUE PAGE NO
DO NOT SCALE DIMENSIONS IN MILLIMETRES	C.Howat SUBSTATION DEVELOPMENT MGR 21–04–95	ISSUE IDENTIFICATION SDI 100

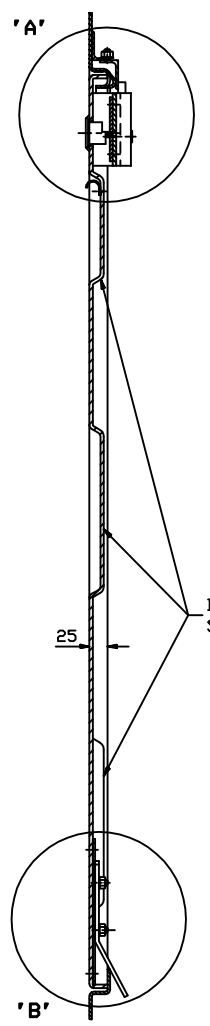
11kV PADMOUNT SUB/HV SWITCH STATION
KRONE SWITCHGEAR
HEATER & THERMOSTAT MOUNTING DETAIL

SUB 078559 B
SHEET No 1 OF 1 SHEETS
INDEX REF S008A

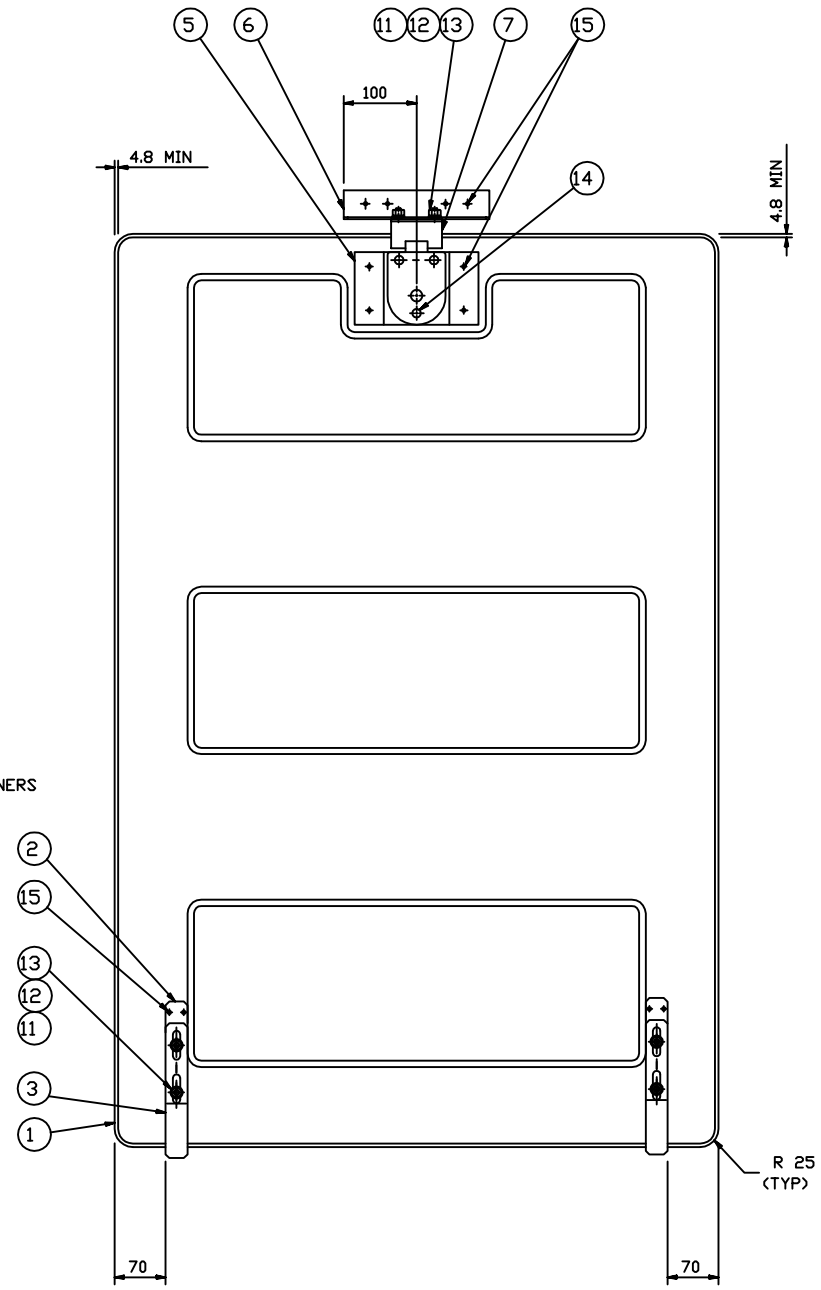
THIS ISSUE
PAGE NO.



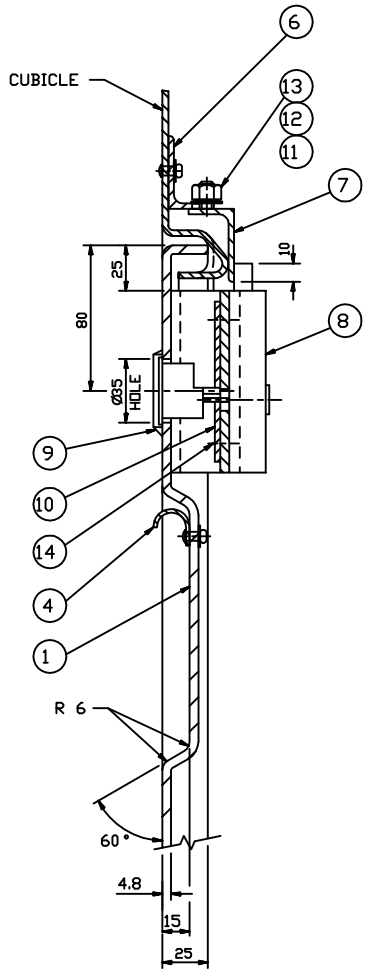
OUTSIDE VIEW OF DOOR
SCALE 1:5
DOOR SHOWN IN DOORWAY
ALL HIDDEN DETAILS OMITTED



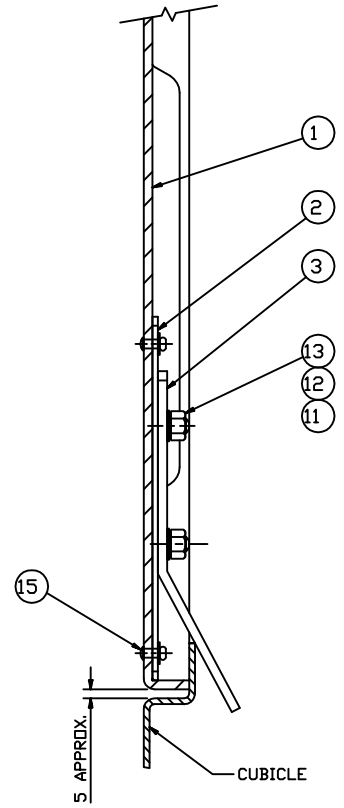
SECTION X-X
SCALE 1:5



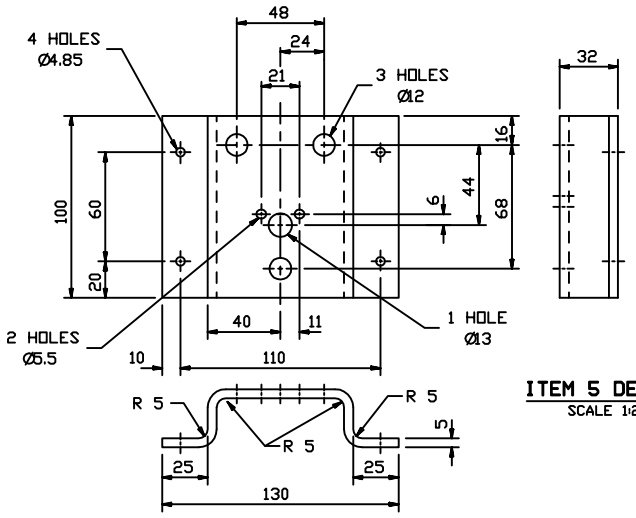
INSIDE VIEW OF DOOR
SCALE 1:5
DOORWAY OMITTED FOR CLARITY



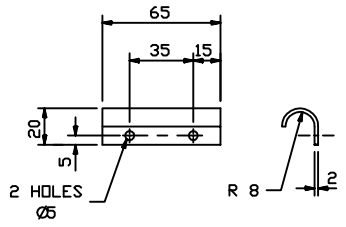
DETAIL 'A'
SCALE 1:2



DETAIL 'B'
SCALE 1:2



ITEM 5 DETAILS
SCALE 1:2



ITEM 4 HANDLE DETAILS
SCALE 1:2

ITM NO	VOCAB /DRG	DESCRIPTION	QTY	REFER
1	NA	FIBREGLASS DOOR SKIN	1	NOTE 1&2&7
2	NA	DOOR LOWER SECURITY PLATE	2	DRG 264889
3	NA	DOOR SECURITY BRACKET	2	DRG 264889
4	NA	STEEL HANDLE GALV	1	DETAIL
5	NA	RETAINING BRACKET LOCK - FIBREGLASS	1	DETAIL
6	NA	DOOR LATCH STRIKER PLATE RETAINING BRACKET	1	DRG 264889
7	NA	DOOR LATCH STRIKER PLATE	1	DRG 264889
8	NA	BACKSET CASE	1	NOTE 6
9	NA	LOCK CYLINDER - YALE (SUPPLIED BY INTEGRAL)	1	-
10	NA	RETAINING PLATE STEEL BACKSET CASE	1	DRG 264889
11	NA	WASHER STEEL FLAT RND GALV 8	6	-
12	NA	WASHER STEEL SPRING Z/P 8	6	-
13	NA	NUT STEEL HEX HD GALV M8	6	-
14	NA	SCREW STEEL C'SUNK HD GALV M5 x 25 LG	3	-
15	NA	POP RIVET AL DIA 4.8 (AD612)	18	NOTE 8

NOTES

1. THIS DRAWING TO BE USED IN CONJUNCTION WITH THE RELEVANT Endeavour Energy PADMOUNT SUBSTATION CUBICLE SPECIFICATION. THE INTERNAL AND EXTERNAL CUBICLE FINISH IS ALSO DETAILED IN THIS SPECIFICATION.
2. TOLERANCE - UP TO AND INCLUDING 300 ±0
   OVER 300 ±2.0
   UNLESS OTHERWISE NOTED.
3. ALL UNSPECIFIED RADII TO BE R6 MIN.
4. ITEM 1 (FIBREGLASS DOOR SKIN) TO HAVE A MINIMUM WALL THICKNESS OF 4.8mm (EXCLUDING GELCOAT).
5. ITEMS SHOWN IN MATERIAL LIST ARE SUFFICIENT FOR 1 DOOR ONLY.
6. BACKSET CASE (ITEM 8) TO BE SUPPLIED WITHOUT THUMB TURN. SUITABLE LOCK TYPES ARE: - LOCKWOOD TYPE 100 CASE WITH TYPE 213 DEAD BOLT ASSEMBLY OR LANE CAT. No. 606 ELECTRIC SC (372099).
7. DRILL 18 HOLES Ø4.85 (No.11 DRILL) IN ITEM 1 (FIBREGLASS DOOR) TO SUIT ITEMS 2,4,5 & 6.
8. SUITABLE WASHER TO BE FITTED TO ITEM 15 (POP RIVET) ON INSIDE OF DOOR PRIOR TO FIXING RIVET IN PLACE. HEAD OF POP RIVET TO BE ON OUTSIDE OF DOOR.

AMENDMENTS					
A	ORIGINAL ISSUE				
B	DR'N	GSF			
	CH'D	GSF			
	DATE	01-10-03			
	JR No	--	SIZE 14 DOOR NOW TALLER BY 100MM TO 1300MM.	MDEB	GSF

ORIGINAL SCALE

APPROVED G. Ford

DRAWN	G. Ford		
DATE	13/08/2001		
CH'D	G. Ford		

Endeavour Energy

STEELWORK DETAIL	264889
FIBREGLASS CUBICLE ARRGT	264887

REFERENCE DRAWINGS

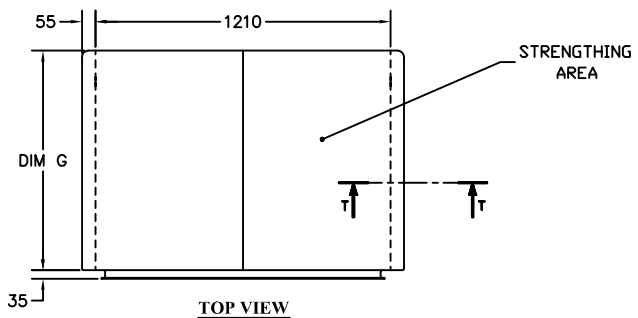
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET SERVICES 13/08/2001

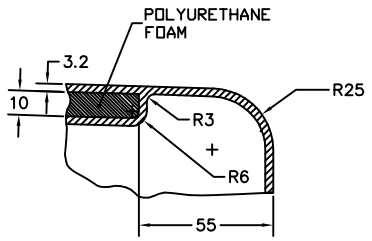
SIZE 14 & 16 - PADMOUNT SUBSTATION
FIBREGLASS CUBICLE
DOOR DETAILS

A3 | 264890 | B

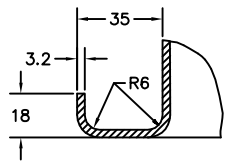
SHEET No 1 OF 1 SHEETS



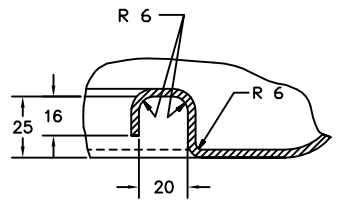
TOP VIEW



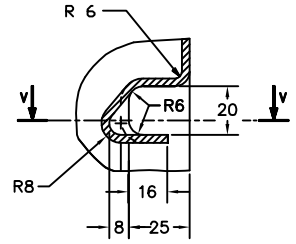
PART SECTION T-T



TYPICAL DETAIL 'A'



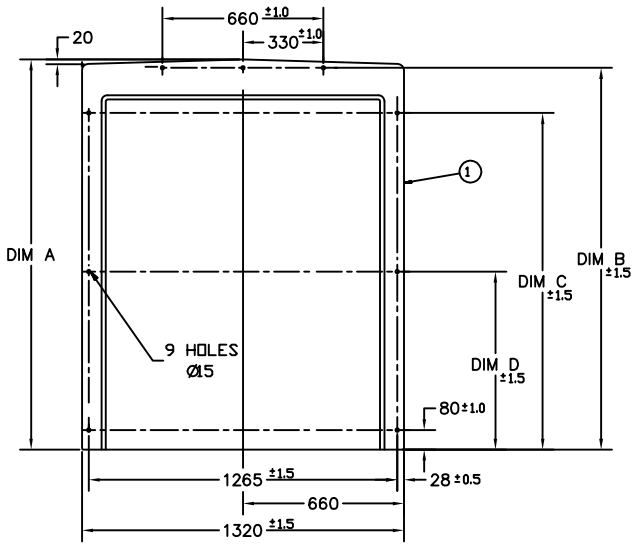
TYPICAL DETAIL 'B'



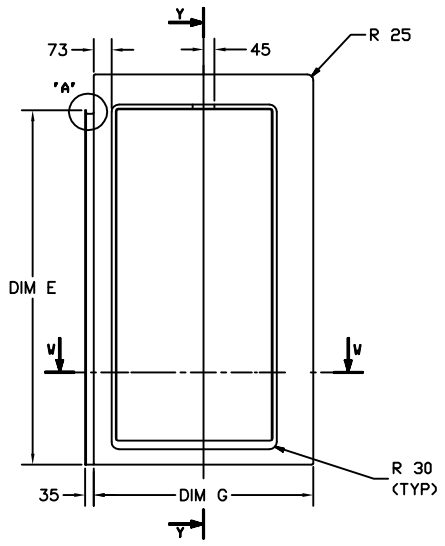
DETAIL 'C'

NOTES

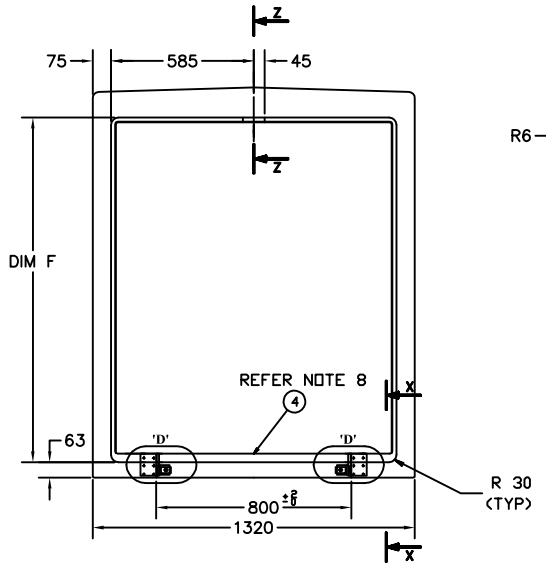
1. THIS DRAWING TO BE USED IN CONJUNCTION WITH THE RELEVANT Endeavour Energy PADMOUNT SUBSTATION CUBICLE SPECIFICATION THE INTERNAL AND EXTERNAL CUBICLE FINISH IS ALSO DETAILED IN THIS SPECIFICATION.
2. ITEM 1 (FIBREGLASS CANOPY) TO HAVE A MINIMUM WALL THICKNESS OF 3.2mm (EXCLUDING GELCOAT).
3. ALL UNSPECIFIED RADII TO BE R6 MIN.
4. TOLERANCE – UP TO AND INCLUDING 300 ±1.0
   OVER 300 ±2.0
   UNLESS OTHERWISE NOTED.
5. FOR LOCATION & FIXING DETAILS OF DOOR LATCH STRIKER PLATE RETAINING BRACKET & DOOR LOWER SECURITY PLATE & BRACKET REFER DOOR DETAIL DRAWING No 076842.
6. DRILL 12 HOLES Ø4.85 (No 11 DRILL) IN ITEM 1 (FIBREGLASS CUBICLE) TO SUIT ITEM 2 (ANCHOR PLATE).
7. SUITABLE WASHER TO BE FITTED TO ITEM 3 (POP RIVET) ON INSIDE OF CANOPY PRIOR TO FIXING RIVET IN PLACE. HEAD OF POP RIVET TO BE ON OUTSIDE OF CANOPY.
8. ITEM 4 – REMOVABLE MULLION REQUIRED ON HV AND LV END



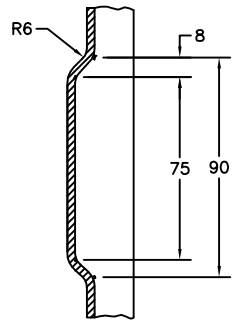
LEFT SIDE VIEW
DETAIL BEYOND 'Y-Y' OMITTED FOR CLARITY



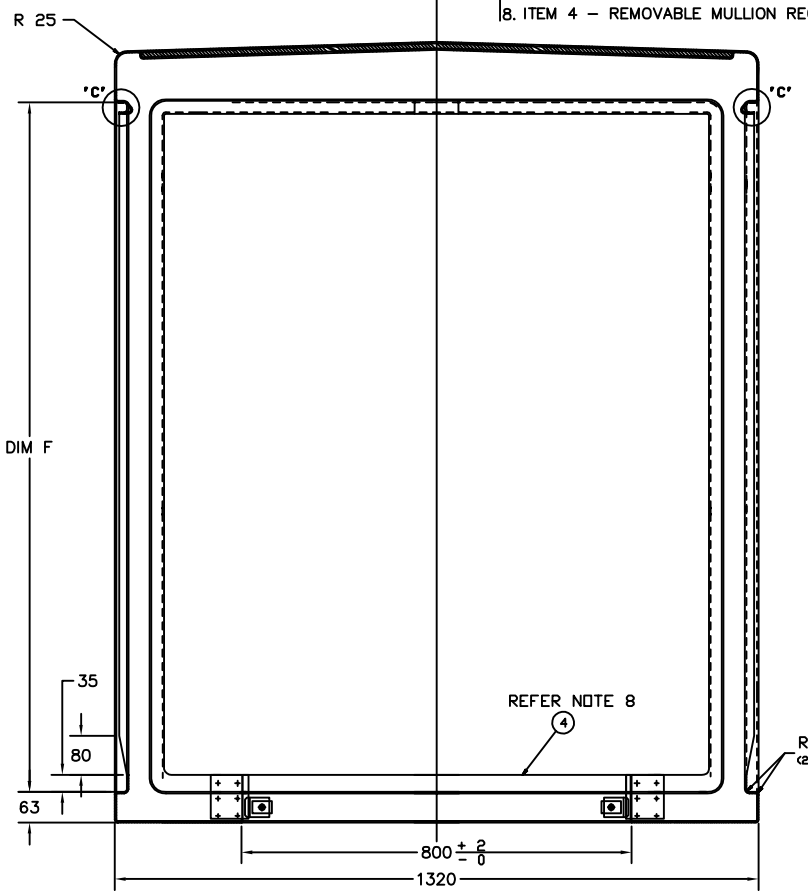
FRONT VIEW



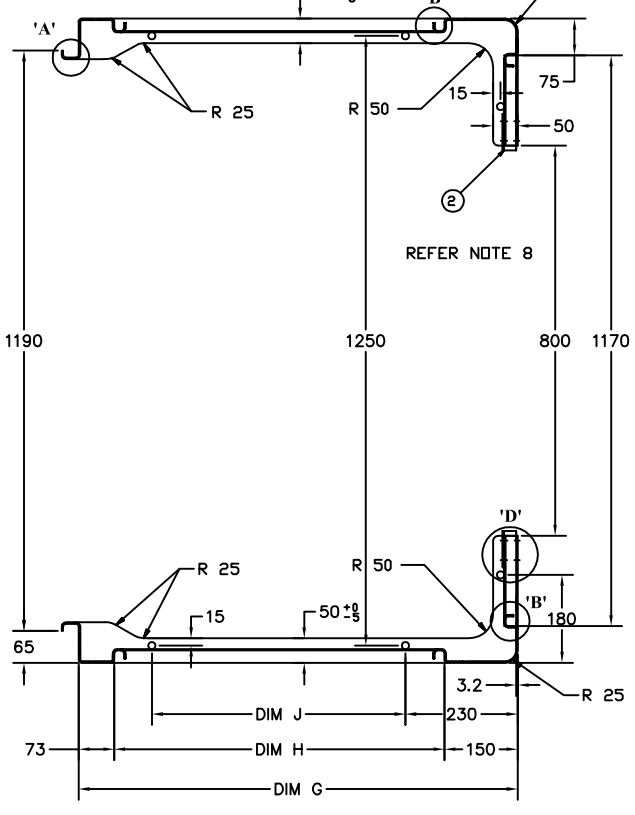
RIGHT SIDE VIEW



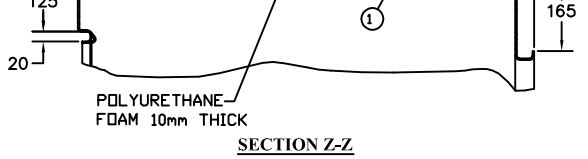
PART SECTION V-V



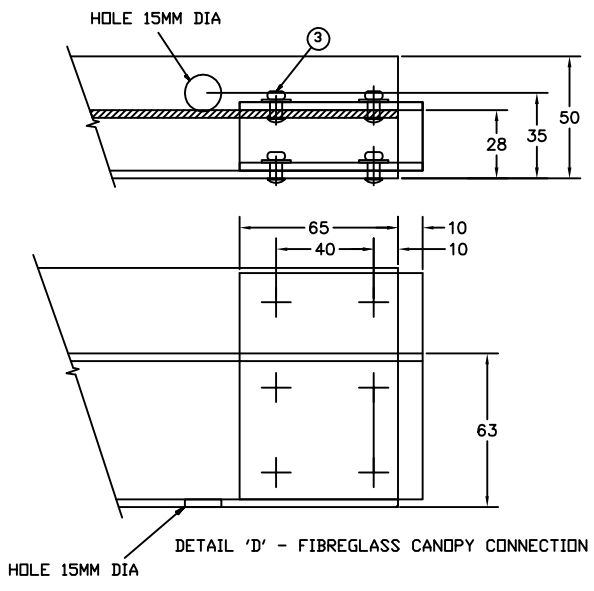
SECTION Y-Y
SYMETRICAL ABOUT CENTRE LINE



SECTION W-W

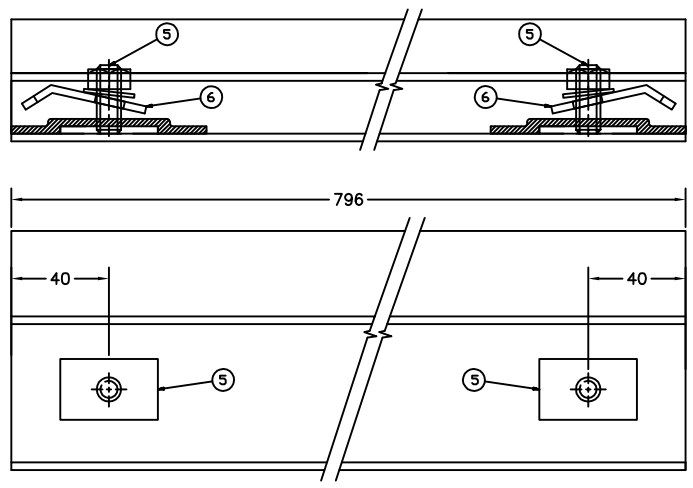


SECTION Z-Z

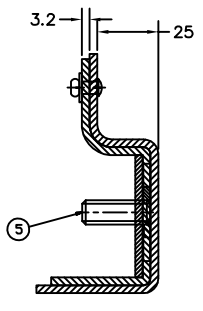


DETAIL 'D' – FIBREGLASS CANOPY CONNECTION

DETAIL 'D'
ITEM 4 - HV & LV END



DETAIL 'D' – FIBREGLASS REMOVABLE MULLION



	CUBICLE HEIGHT DIMENSIONS	
	SIZE 14	SIZE 16
DIM A	1450	1600
DIM B	1415	1565
DIM C	1230	1380
DIM D	630	730
DIM E	1253	1453
DIM F	1313	1413

	CUBICLE LENGTH DIMENSIONS	
	HV END	LV END
DIM G	900	770
DIM H	677	547
DIM J	520	390

ITEM NO	VOCAB / DRG	DESCRIPTION	QTY	REFER
1	NA	FIBREGLASS CANOPY	1	NOTE 2
2	NA	FIBREGLASS ANCHOR PLATE	2	–
3	NA	POP RIVET AL DIA 4.8 (AD612)	12	–
4	NA	FIBREGLASS MULLION	2	–
5	NA	CLAMPING STUD 10MM DIA	2	–
6	NA	MULLION CLAMP PLATE	2	–
7	–	–	–	–
8	–	–	–	–

AMENDMENTS

A	ORIGINAL ISSUE			
B	DR'N GSF CH'D GSF DATE 01-10-03 JR No ––	SIZE 14 DIM F, G, H & J CHANGED. HEIGHT NOW 1450MM. DOOR 100MM HIGHER. MULLION CLAMP CHANGED.	MDEB GSF	
C	DR'N GSF CH'D GSF DATE 27-02-04 JR No ––	REMOVABLE MULLION ADDED TO LV END. NOTE 8 MODIFIED.	MDEB GSF	

ORIGINAL SCALE NONE

APPROVED G. Ford

DRAWN	G. Ford		
DATE	10/08/2001		
CH'D	G. Ford		

Endeavour Energy

STEELWORK DETAILS	264889
DOOR DETAILS	264890
FIBREGLASS CUBICLE ARRGT	264887

REFERENCE DRAWINGS

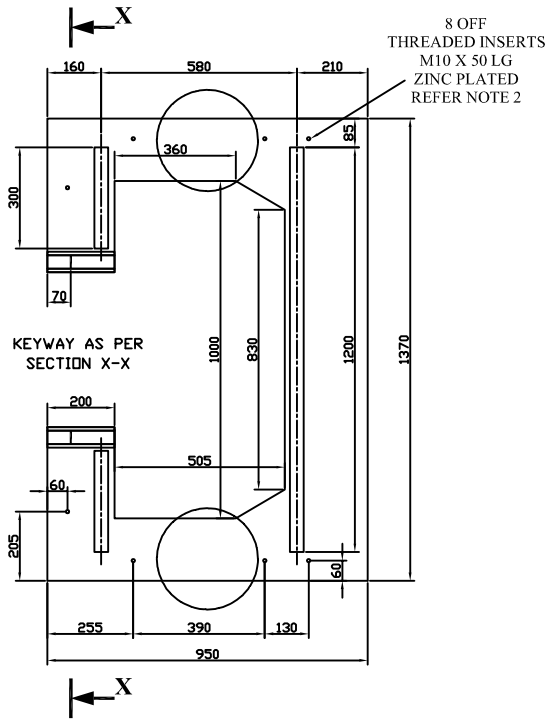
DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED W. Isley
MANAGER ASSET SERVICES 10/08/2001

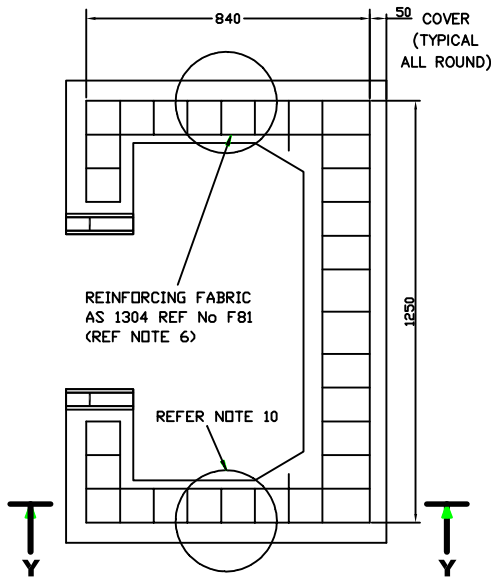
SIZE 14 & 16 PADMOUNT SUBSTATION
FIBREGLASS CUBICLE
HV & LV COMPARTMENTS

A3 264891 C
SHEET No 1 OF 1 SHEETS

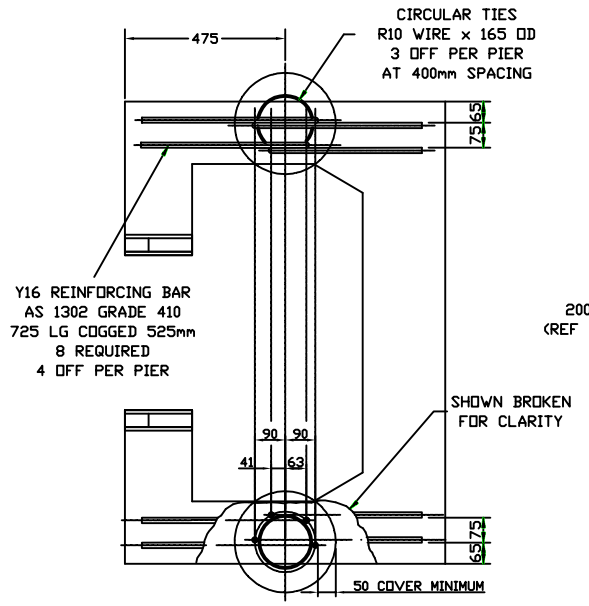
TWO PIER CONSTRUCTION DETAIL



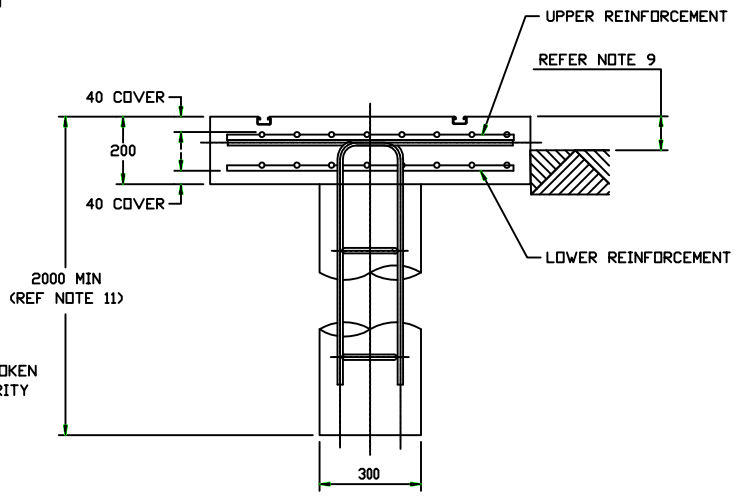
OVERALL DIMENSIONS
& UNISTRUT LOCATION



UPPER & LOWER REINFORCING DETAIL



PIER REINFORCING DETAIL



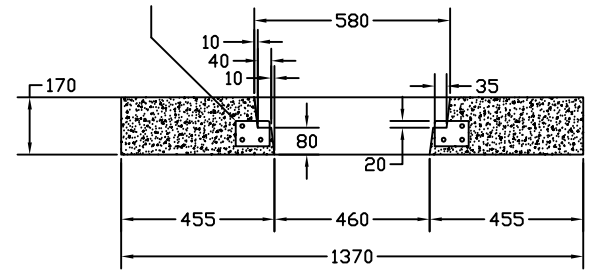
SECTION Y - Y

NOTES

1) CONCRETE TO HAVE MINIMUM COMPRESSIVE STRENGTH OF 25MPa AFTER 28 DAYS. MAXIMUM SLUMP 80mm.
2) UNISTRUT CHANNELS & THREADED INSERTS TO BE POSITIONED LEVEL WITH SURFACE OF CONCRETE.
3) TOP & SIDES OF PLINTH TO BE FLAT & LEVEL & HAVE A STEEL TROWEL FINISH FREE FROM CRACKS & DEFECTS.
4) ALL MATERIAL AND WORKMANSHIP TO BE ACCURATELY LOCATED & TIED PRIOR TO POURING CONCRETE.
5) MATERIAL: GLASS REINFORCED CONCRETE.
   WALL THICKNESS = 8mm. APPROXIMATE MASS = 8kg
6) REINFORCEMENT & UNISTRUT CHANNEL TO BE ACCURATELY LOCATED AND TIED PRIOR TO POURING CONCRETE.
7) MATERIAL: STAINLESS STEEL.
   APPROX. SIZE = 100 x 75 x 6mm THICK
8) ALL MATERIAL & WORKMANSHIP TO BE IN ACCORDANCE WITH SAA CONCRETE STRUCTURES CODE (AS 3600).
9) TOP OF SLAB TO BE 100mm ABOVE HIGHEST POINT OF FINISHED GROUND LEVEL ADJACENT TO FOOTING.
10) TOP OF PIER TO FINISH LEVEL WITH BOTTOM OF SLAB.
11) 2000mm DIMENSION IS A MINIMUM & IS TO BE INCREASED IF NECESSARY TO NCLUDE 600mm OF VIRGIN SOIL.
12) QTY OF CONCRETE IS APPROX. 0.5 Cu METRES.

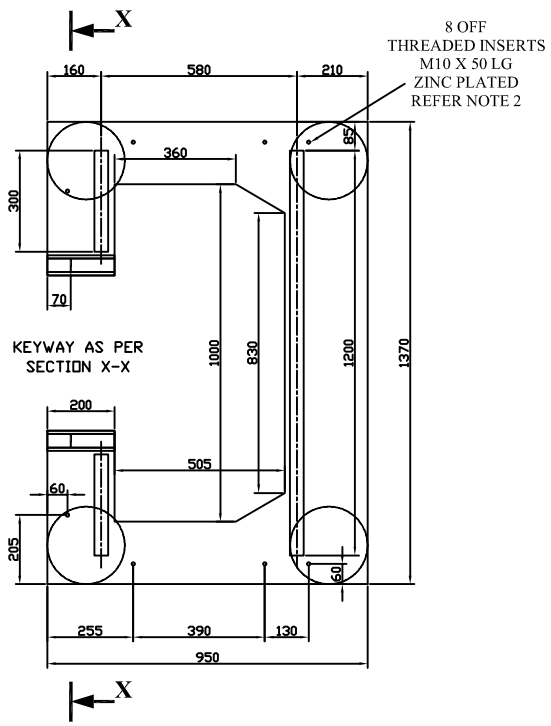
KEYWAY CONSTRUCTION DETAIL

KEY LOCATING BAR - REFER NOTE 7
TO BE SECURELY ANCHORED INTO
CONCRETE

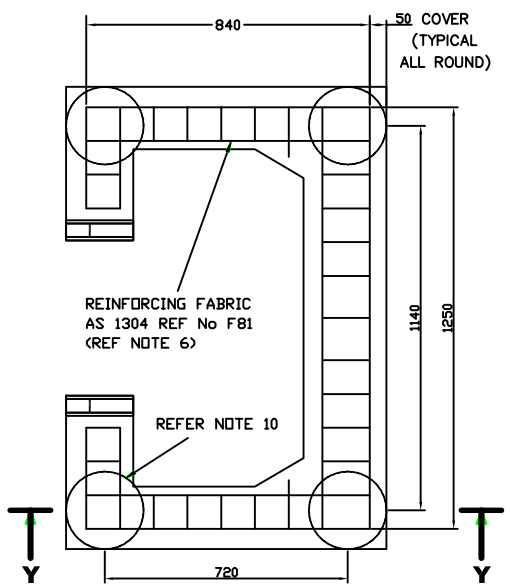


SECTION X - X

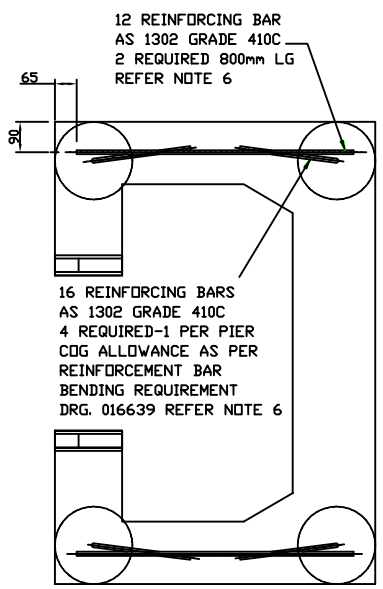
FOUR PIER CONSTRUCTION DETAIL



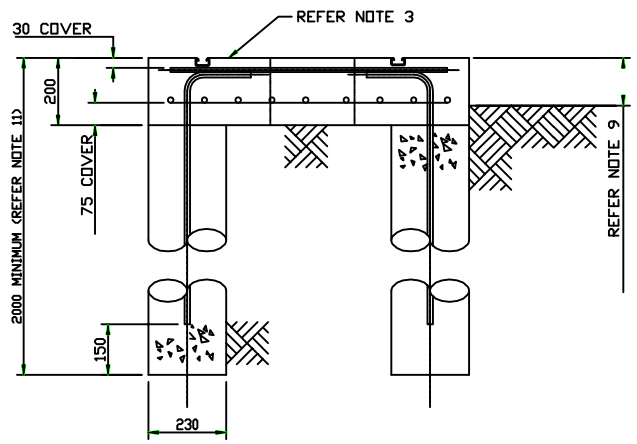
OVERALL DIMENSIONS
& UNISTRUT LOCATION



UPPER & LOWER REINFORCING DETAIL



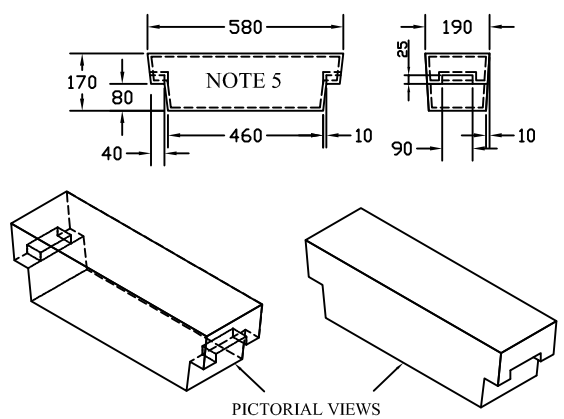
PIER REINFORCING DETAIL



SECTION Y - Y

CABLE ACCESS KEY DETAIL

VOCAB No. 1548411



PICTORIAL VIEWS

AMENDMENTS	
ORIGINAL ISSUE	A

Endeavour Energy

ORIGINAL SCALE		APPROVED	G. Ford
DRAWN	G. Ford		
DATE	11/09/2003		
CH'D	G. Ford	INDEX REF	S002A

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

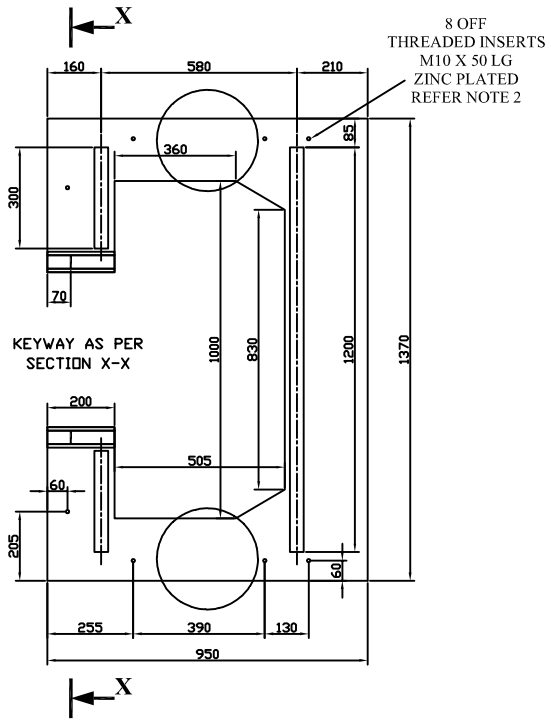
AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 11/09/2004

11 & 22 KV HV SWITCHING STATION
TWO & FOUR PIER CONCRETE PLINTH
CONSTRUCTION DETAILS

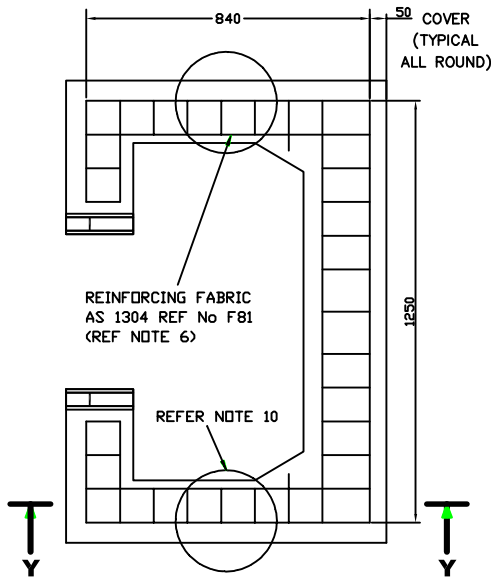
A3 | 282539 | A

SHEET No 1 OF 1 SHEETS

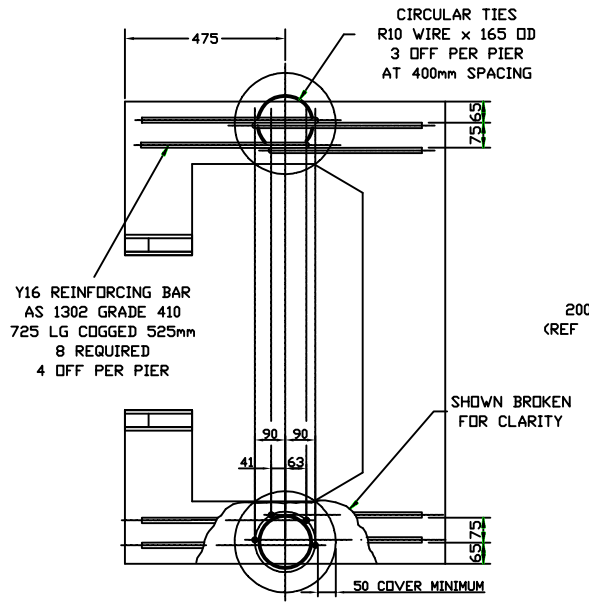
TWO PIER CONSTRUCTION DETAIL



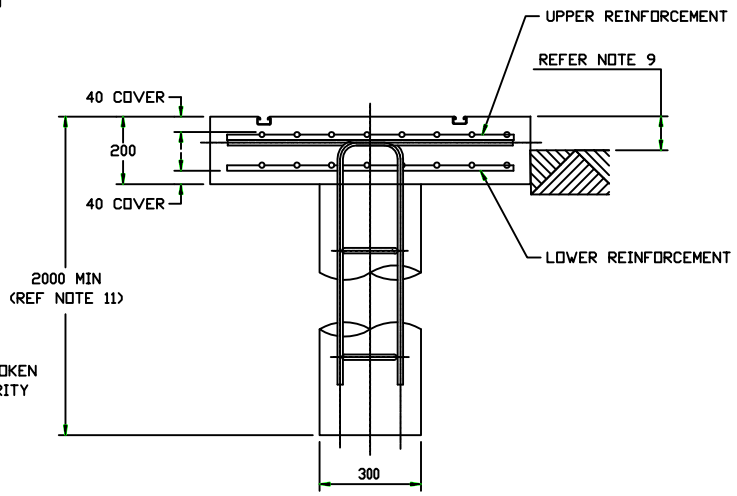
OVERALL DIMENSIONS
& UNISTRUT LOCATION



UPPER & LOWER REINFORCING DETAIL



PIER REINFORCING DETAIL



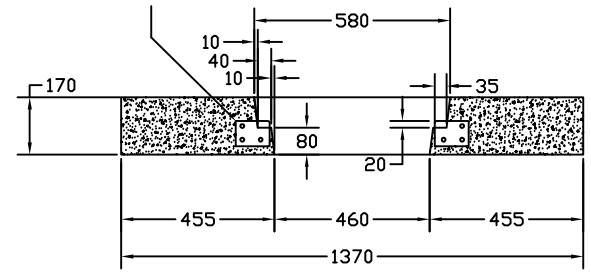
SECTION Y - Y

NOTES

1) CONCRETE TO HAVE MINIMUM COMPRESSIVE STRENGTH OF 25MPa AFTER 28 DAYS. MAXIMUM SLUMP 80mm.
2) UNISTRUT CHANNELS & THREADED INSERTS TO BE POSITIONED LEVEL WITH SURFACE OF CONCRETE.
3) TOP & SIDES OF PLINTH TO BE FLAT & LEVEL & HAVE A STEEL TROWEL FINISH FREE FROM CRACKS & DEFECTS.
4) ALL MATERIAL AND WORKMANSHIP TO BE ACCURATELY LOCATED & TIED PRIOR TO POURING CONCRETE.
5) MATERIAL: GLASS REINFORCED CONCRETE.
   WALL THICKNESS = 8mm. APPROXIMATE MASS = 8kg
6) REINFORCEMENT & UNISTRUT CHANNEL TO BE ACCURATELY LOCATED AND TIED PRIOR TO POURING CONCRETE.
7) MATERIAL: STAINLESS STEEL.
   APPROX. SIZE = 100 x 75 x 6mm THICK
8) ALL MATERIAL & WORKMANSHIP TO BE IN ACCORDANCE WITH SAA CONCRETE STRUCTURES CODE (AS 3600).
9) TOP OF SLAB TO BE 100mm ABOVE HIGHEST POINT OF FINISHED GROUND LEVEL ADJACENT TO FOOTING.
10) TOP OF PIER TO FINISH LEVEL WITH BOTTOM OF SLAB.
11) 2000mm DIMENSION IS A MINIMUM & IS TO BE INCREASED IF NECESSARY TO NCLUDE 600mm OF VIRGIN SOIL.
12) QTY OF CONCRETE IS APPROX. 0.5 Cu METRES.

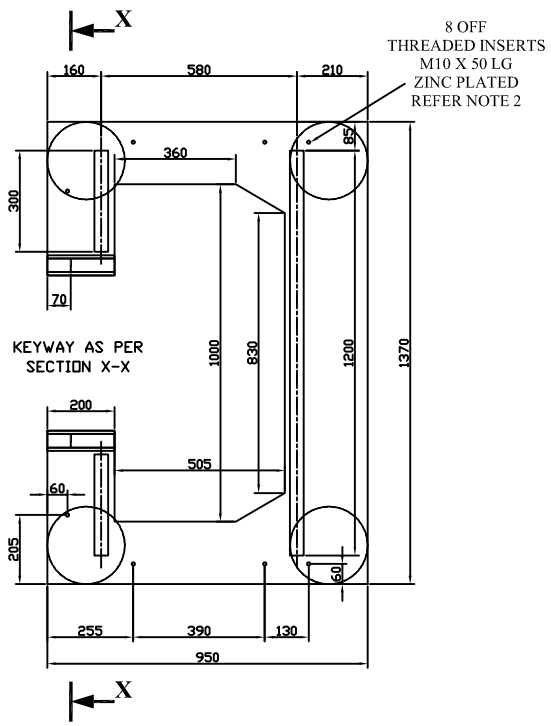
KEYWAY CONSTRUCTION DETAIL

KEY LOCATING BAR - REFER NOTE 7
TO BE SECURELY ANCHORED INTO
CONCRETE

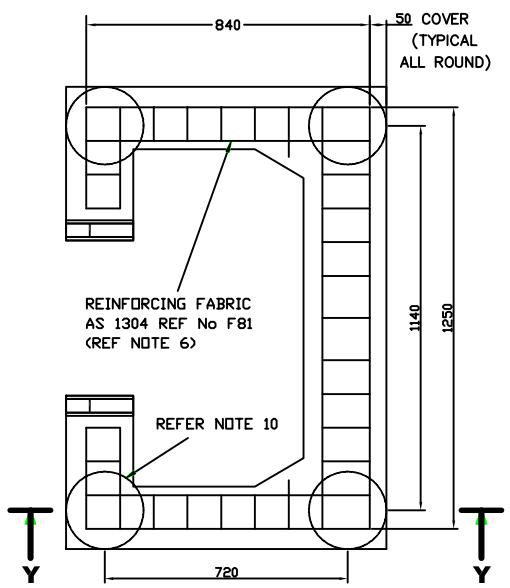


SECTION X - X

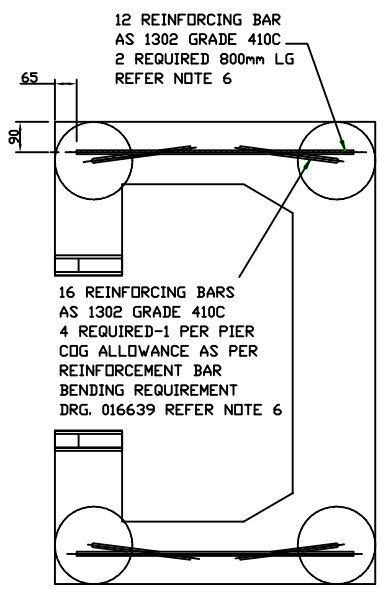
FOUR PIER CONSTRUCTION DETAIL



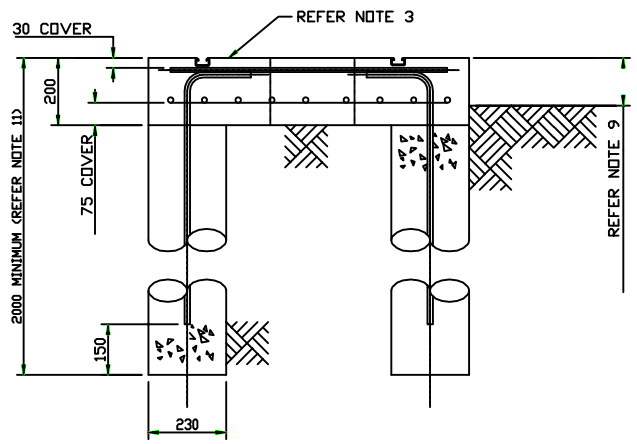
OVERALL DIMENSIONS
& UNISTRUT LOCATION



UPPER & LOWER REINFORCING DETAIL



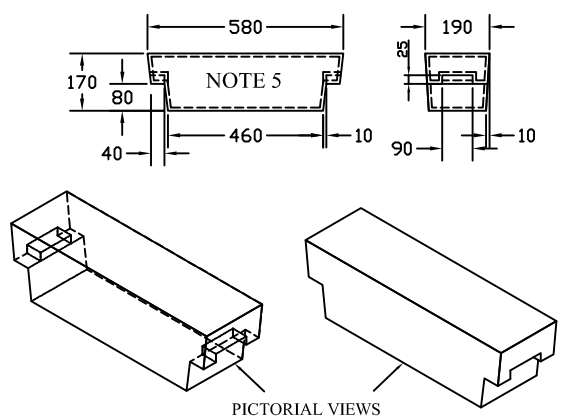
PIER REINFORCING DETAIL



SECTION Y - Y

CABLE ACCESS KEY DETAIL

VOCAB No. 1548411



PICTORIAL VIEWS

AMENDMENTS	
ORIGINAL ISSUE	A

Endeavour Energy

ORIGINAL SCALE		APPROVED	G. Ford
DRAWN	G. Ford		
DATE	11/09/2003		
CH'D	G. Ford	INDEX REF	S002A

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 11/09/2004

11 & 22 KV HV SWITCHING STATION
TWO & FOUR PIER CONCRETE PLINTH
CONSTRUCTION DETAILS

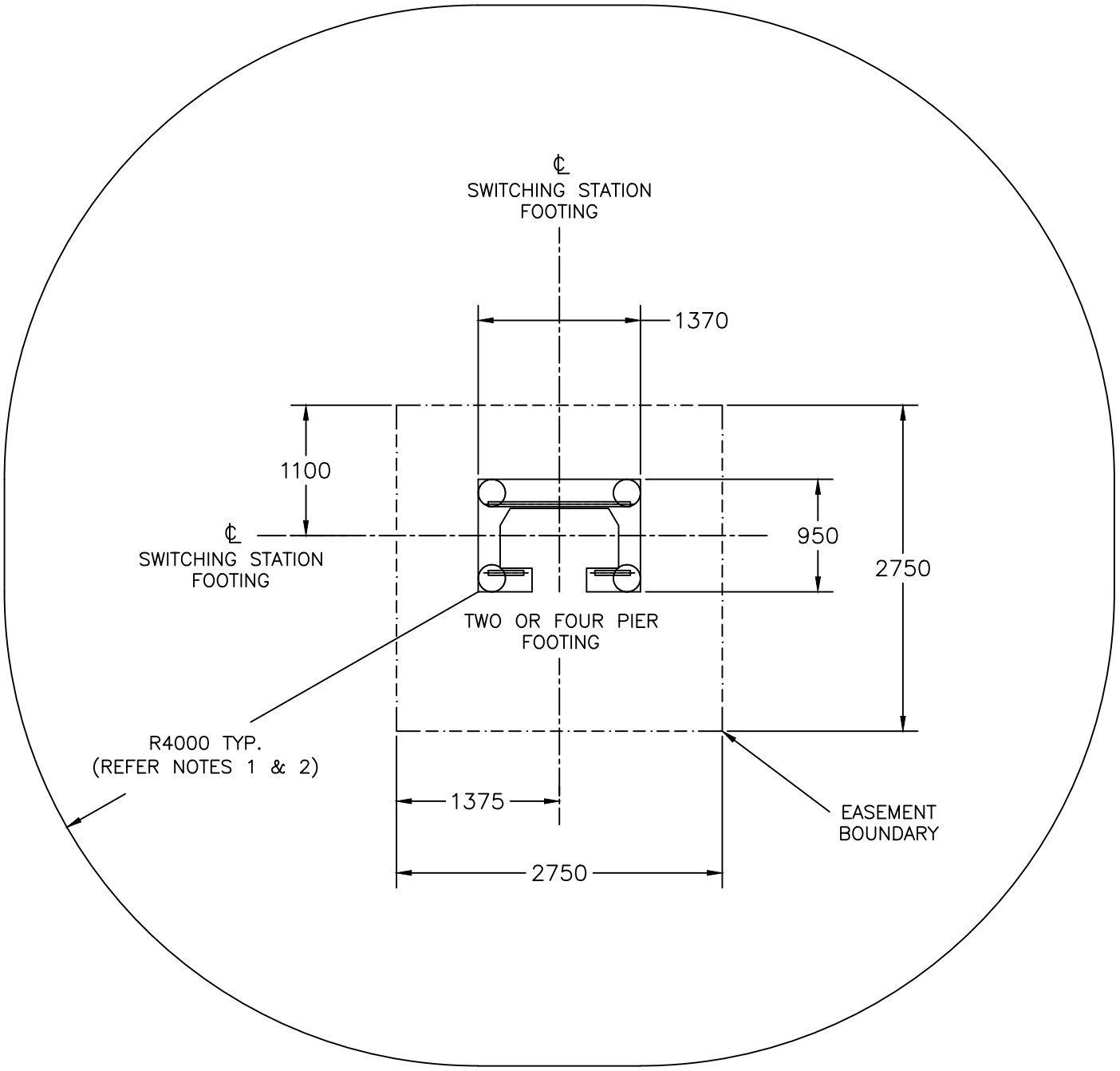
A3 | 282539 | A

SHEET No 1 OF 1 SHEETS

AMENDMENTS	
A	ORIGINAL ISSUE
B	DR'N GSF CH'D GSF DATE 24-10-14 IR No ---
NOTE 1 & 2 WAS SDI104 NOW REFER TO RELEVANT STANDARDS	
NSM	C.Cnsafulli

NOTES

1. EXCEPT AS NOTED IN THE RELEVANT EARTHING AND CONSTRUCTION STANDARDS ANY METAL FENCING BETWEEN THE AREA DEFINED BY A LINE 4000mm FROM THE FOOTING EXTREMITIES & THE EASEMENT BOUNDARY SHOULD BY CONSTRUCTED SO THAT THE POSTS INSULATE ADJACENT PANELS FROM EACH OTHER & THE GROUND.
2. EXCEPT AS NOTED IN THE RELEVANT EARTHING AND CONSTRUCTION STANDARDS ANY METAL CLAD BUILDING SHOULD NOT ENCROACH WITHIN THE AREA DEFINED BY A LINE 4000mm FROM THE FOOTING EXTRMITIES.

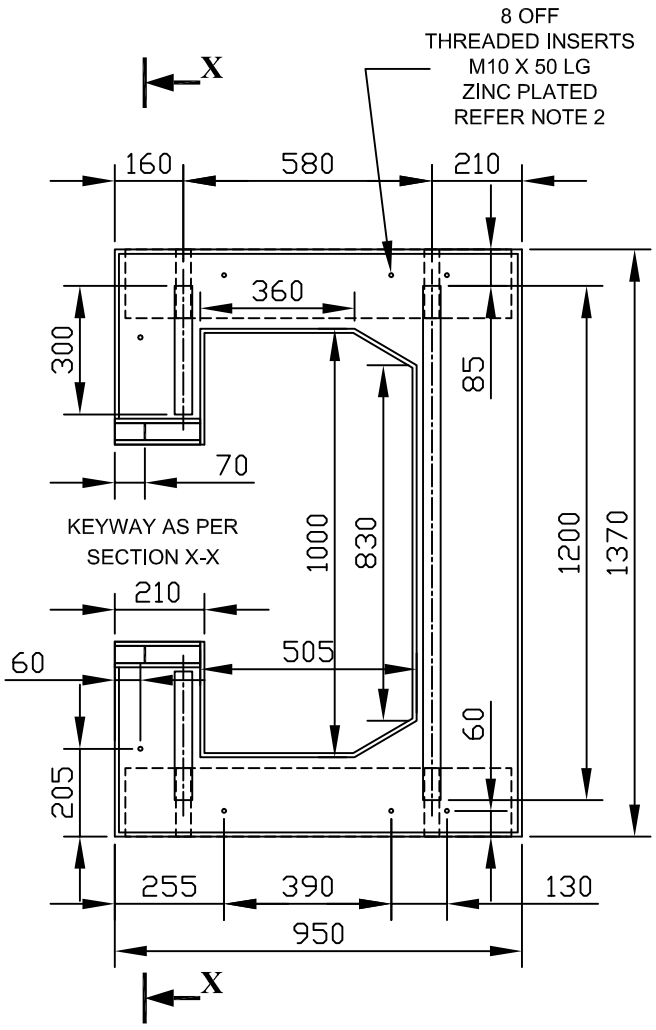


ORIGINAL SCALE	APPROVED G. Ford	11 & 22KV HV SW / STN 2 & 4 PIER FTG	282539
		REFERENCE DRAWINGS	
		DO NOT SCALE DIMENSIONS IN MILLIMETRES	AUTHORISED W. Isley
DRAWN G. Ford		SIZE 16 SWITCHING STATION EASEMENT LAYOUT	MANAGER ASSET ENGINEERING 15/09/2003
DATE 15/09/2003			A3 282551 B
CH'D G. Ford	INDEX REF S002A		SHEET No 1 OF 1 SHEETS

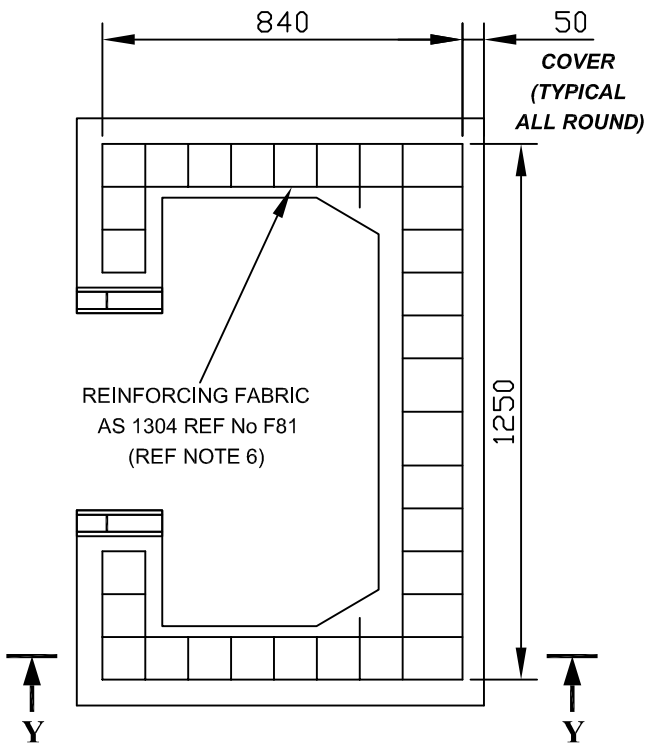
Endeavour Energy

AMENDMENTS	
A	ORIGINAL ISSUE

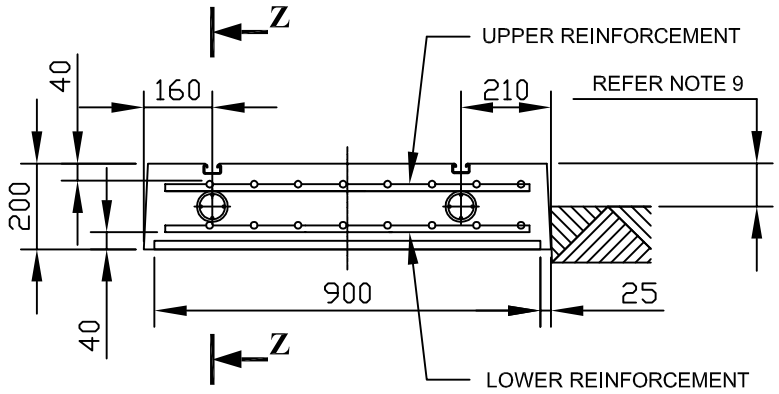
PLINTH DETAIL



OVERALL DIMENSIONS & UNISTRUT LOCATION



UPPER & LOWER REINFORCING DETAIL



SECTION Y - Y

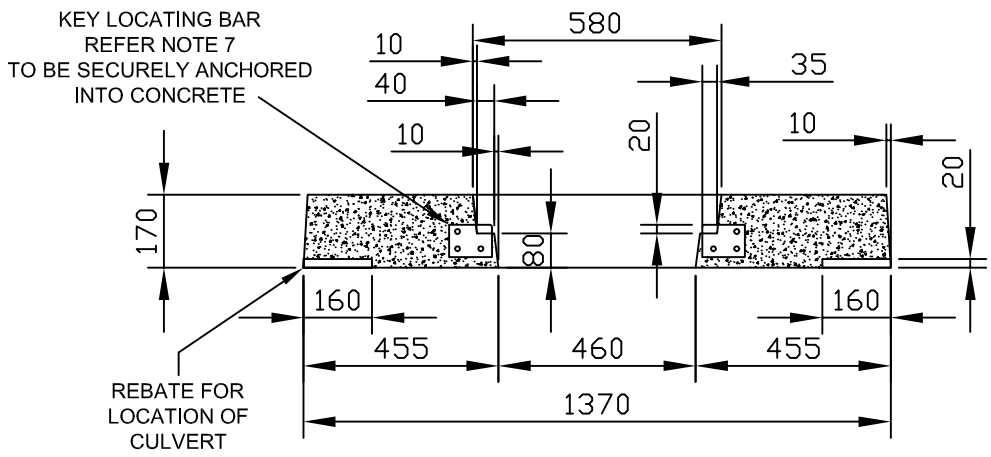
APPROX. MASS : 290kg

VOCAB No. : To be advised

NOTES

1) CONCRETE TO HAVE MINIMUM COMPRESSIVE STRENGTH OF 25MPa AFTER 28 DAYS. MAXIMUM SLUMP 80mm.
2) UNISTRUT CHANNELS & THREADED INSERTS TO BE POSITIONED LEVEL WITH SURFACE OF CONCRETE.
3) TOP & SIDES OF PLINTH TO BE FLAT & LEVEL & HAVE A STEEL TROWEL FINISH FREE FROM CRACKS & DEFECTS.
4) ALL MATERIAL AND WORKMANSHIP TO BE ACCURATELY LOCATED & TIED PRIOR TO POURING CONCRETE.
5) MATERIAL: GLASS REINFORCED CONCRETE.
   WALL THICKNESS = 8mm. APPROXIMATE MASS = 8kg
6) REINFORCEMENT & UNISTRUT CHANNEL TO BE ACCURATELY LOCATED AND TIED PRIOR TO POURING CONCRETE.
7) MATERIAL: STAINLESS STEEL.
   APPROX. SIZE = 100 x 75 x 6mm THICK
8) ALL MATERIAL & WORKMANSHIP TO BE IN ACCORDANCE WITH SAA CONCRETE STRUCTURES CODE (AS 3600).
9) TOP OF SLAB TO BE 100mm ABOVE HIGHEST POINT OF FINISHED GROUND LEVEL ADJACENT TO FOOTING.
9) PLINTH TO BE SUITABLE FOR LIFTING, TRANSPORTING & SUPPORTING IN SERVICE UP TO 500kg AS FOLLOWS:
   - HV SWITCHGEAR UP TO 400kg, A CUBICLE UP TO 100kg

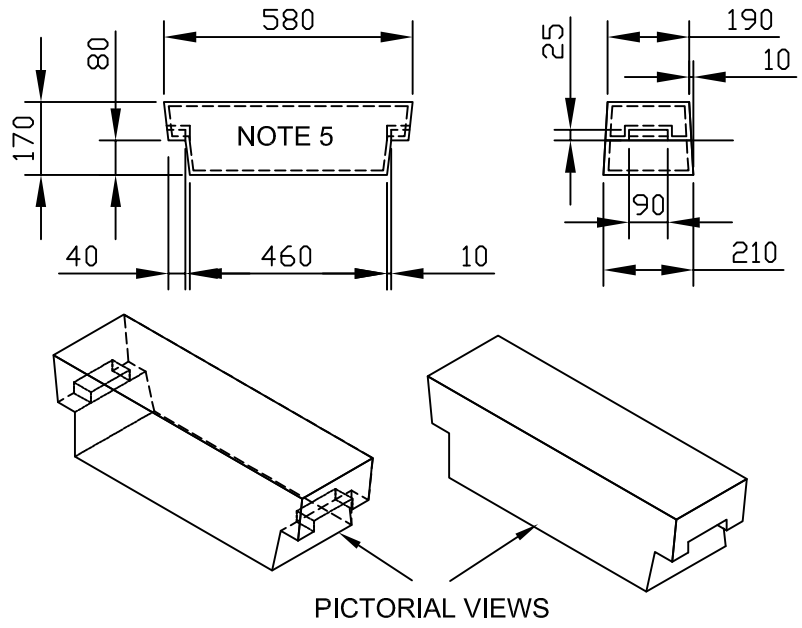
KEYWAY CONSTRUCTION DETAIL



SECTION X - X

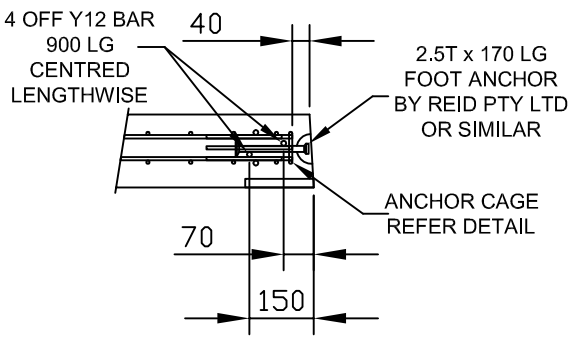
CABLE ACCESS KEY DETAIL

VOCAB No. 1548411

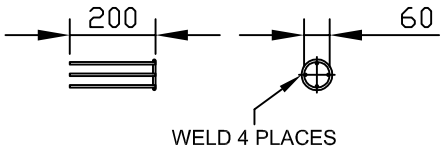


PICTORIAL VIEWS

LIFTING ANCHOR DETAIL



PART SECTION Z - Z



ANCHOR CAGE DETAIL

MATERIAL: R6 BAR
QUANTITY: 4 OFF

Endeavour Energy

ORIGINAL SCALE		APPROVED G. Ford	
DRAWN	G. Ford		
DATE	07/12/2004		
CH'D	G. Ford		INDEX REF S002A

REFERENCE DRAWINGS

DO NOT SCALE
DIMENSIONS IN MILLIMETRES

AUTHORISED
W. Isley
MANAGER ASSET ENGINEERING 07/12/2004

SIZE 14 & 16 HV SWITCHING STATION
PRECAST CONCRETE PLINTH
CONSTRUCTION DETAILS

A3 | 292827 | A

SHEET No 1 OF 1 SHEETS