

## Company Directive

### ENGINEERING SPECIFICATION EE SPEC: 19/7

#### Relating to Specification of GRP Substation Enclosures

##### Policy Summary

This Specification covers the sizes, material and physical design of GRP Enclosures suitable for the WPD Distribution Substation

Author: Andrew Reynolds

Implementation Date: February 2018

Approved by



Policy Manager

Date:

16 February 2018

*All references to Western Power Distribution or WPD must be read as National Grid Electricity Distribution or NGED*

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## **IMPLEMENTATION PLAN**

### **Introduction**

This specification document details the requirements for standard GRP enclosures for use on WPD network.

### **Main Changes**

Inclusion of revision table and removal of old Central Networks GRP designs.

### **Impact of Changes**

This specification is relevant to purchasing and all staff involved in the purchase and install of all new GRP enclosures.

### **Implementation Actions**

Procurement team shall use this specification for the next tendering exercise.

### **Implementation Timetable**

This Specification shall be implemented with immediate effect.

## REVISION HISTORY

<b>Document Revision &amp; Review Table</b>		
<b>Date</b>	<b>Comments</b>	<b>Author</b>
February 2018	<ul style="list-style-type: none"><li>• Inclusion of revision table</li><li>• Inclusion of implementation plan</li><li>• Check of relevant specs</li></ul>	Andrew Reynolds

## **1.0 INTRODUCTION**

- 1.1 This specification covers the sizes, material and physical design of GRP enclosures, roofs and doors suitable for the WPD Distribution Substations.

## **2.0 GENERAL**

- 2.1 THIS SPECIFICATION DETAILS THE MINIMUM PERMISSIBLE STANDARD. SUPPLIERS MAY SUBMIT ALTERNATIVE DESIGNS FOR CONSIDERATION AND APPROVAL BY THE POLICY MANAGER, BRISTOL. FULL DETAILS OF ALL DESIGNS, TOGETHER WITH THEIR SPECIFICATIONS, SHALL BE SUBMITTED WITH TENDERS.

- 2.2 All designs must take into account the often severe, climatic conditions experienced in the Western Power Distribution operational area. Suppliers shall be able to demonstrate that all equipment supplied will be 'Fit For Purpose'.

- 2.3 Majority of enclosures shall be delivered fully erected, to a WPD office/depot. There will be a requirement for a small number of enclosures to be delivered directly to site. There will also be a requirement to deliver a small number of units in a "flat pack" arrangement, for erection on site by WPD staff.

- 2.4 All enclosures shall be supplied complete with all necessary nuts and bolts for assembly and fixing down on site, together with assembly instructions.

- 2.5 All enclosures, when erected, shall offer degrees of protection against solid foreign objects and against water by having an 'IP Rating' of IP23, or better, as described in BS EN60529.

- 2.6 As an option, Suppliers will be required to provide suitable materials, together with fixing instructions, for sealing the base of enclosures against the ingress of water. Detailed proposals shall be submitted with tenders.

- 2.7 The Purchaser, will from time to time, wish to use one or more panels taken from normal supply and arrange tests to confirm compliance with this specification. In these circumstances the Supplier will provide replacement panels at 'Cost Price'.

- 2.8 Holes cut in the GRP in order to accommodate ventilation panels shall be coated to seal the cut edges.

### **3.0 EXPLOSION RELIEF**

- 3.1 All prefabricated distribution substation housings shall be subjected to a type test in which the effects of an internal arc within a sealed chamber mounted inside the enclosure are demonstrated.
- 3.2 The arc energy shall be 250 MVA (13.1kA) for 1 second. This may be achieved either by test at an accredited short circuit test station, or by a synthetic fuel/air explosion. Full details of the proposed method shall be submitted for approval. The method detailed in the BRE confidential report TCR 20/97 is approved.
- 3.3 The pass criteria for the test shall include:-
- Doors to remain closed and latched.
  - Minimum projection of flame through door and joint gaps.
  - No breakage of wall or roof material or any building joints.
  - If pressure relief is achieved by a lifting and tethered roof, then the roof shall return to its original position.
  - Deflection of any ejected flame away from persons directly adjacent to the housing.
- 3.4 Tests to be recorded on high speed video recorder for consideration.
- 3.5 Housings which have been previously tested shall have the type test evidence submitted for consideration at the time of tender. The undertaking of a type test for each contract is not required, however significant design changes to a tested design will require a new test.
- 3.6 Significant design changes may include, but are not limited to:
- (a) A 10% change in housing volume
  - (b) A 10% increase in door width
  - (c) A 10% change in available roof lift (if applicable)
  - (d) Any change in floor fixing or position
  - (e) Any change in panel joint system
  - (f) Any change of panel material composition
  - (g) Any change in door locking systems and their fixing
  - (h) Changes in ventilation grille type and position
- 3.7 The judgement on the acceptability of the housing design as having passed the explosion test will be based on:
- (a) A high speed video, to the requirements of BRE test report TAR 20/97.
  - (b) The written report of the approved testing Authority.

#### 4.0 MATERIALS AND STIFFENING

- 4.1 All items shall be manufactured using glass fibre polyester resin. Except where otherwise stated they will be made from at least three layers of 450 grams glass fibre per square metre, having an overall minimum thickness of 4mm. and gel-coated on all external **and internal** surfaces. **Both sides** of all finished, completed assemblies shall be constructed to BS476 Part 7 Class II, or, as a minimum standard - (Surface Spread of Flame). Suppliers shall confirm the standard to which items have been constructed, together with the method of construction of all component parts. NOTE: Use of Class II listed resin does not necessarily achieve this result.
- 4.2 **Both sides** of all finished, completed assemblies shall be constructed to BS476 Part 12 taking Source F as the 'real' ignition source as a minimum standard. An equivalent standard may be used but in any case suppliers shall confirm the standard to which items have been constructed.
- 4.3 If tests for fire resistance to BS476 Part 20, , have been conducted, the supplier will advise the results of these tests, separately, in respect of walls, doors and roof for stability, integrity and insulation.
- 4.4 Unless panels are completely gel-coated on all internal and external surfaces, all timber used in the course of manufacture will be 'pressure impregnated'. All timber used will have beveled edges and be fully encapsulated between layers of GRP.
- 4.5 All ply board used in the course of manufacture will be 'WPB grade' and have a minimum thickness of 12mm. All ply board will be fully encapsulated between layers of GRP.
- 4.6 The standard colour of completed assemblies shall be:-
- |    |     |                    |         |
|----|-----|--------------------|---------|
|    | (a) | Buff BS4800        | 08-B-21 |
| or | (b) | Dark Green BS4800  | 14-C-39 |
| or | (c) | Brown BS4800       | 08-B-25 |
| or | (d) | Light Green BS4800 | 12-B-21 |

All the above shall be in a smooth gel-coat finish which is maintenance free and UV resistant.

Other colours or finishes may be requested from time to time where site conditions so dictate. (e.g. simulated brickwork finish, and tender returns shall indicate range of colours available and cost variations.

- 4.7 The exterior appearance of all panels shall be aesthetically acceptable. Suppliers shall provide detailed drawings/photographs with tenders.

- 4.8 All assembled units must be designed to withstand normal applied direct and wind loads applicable to installation of the units within the Western Power area. In addition an external mechanical impact test using the method described in IEC 68-2-75 shall be applied to the roof, sides, rear, doors and ventilation openings. The energy impact shall be 20 joules. To pass this test the housing shall continue to function as required by this specification. Superficial surface damage shall not constitute a failure.

The roof designed to support a distribution load of 1.9 kN/m<sup>2</sup>.

## **5.0 FITTINGS**

- 5.1 In order to avoid creation of electrolytic corrosion cells, all metallic fittings, unless otherwise stated, shall be of stainless steel in a grade to be agreed between purchaser and supplier. As alternatives, ventilation panels may be constructed of suitable grade hot dipped galvanised mesh.
- 5.2 One half of the door assembly shall be provided with a spring loaded locking device that secures the door top and bottom. Second door should be fitted with a hasp and staple arrangement that will accept the WPD padlock. (Min. 10mm hasp). Door arrangement should be such that when a lock is fitted the doors cannot be opened, even if the shoot bolts are not home into the frame.
- 5.3 Compton 'type 10/10 door stays', or equivalent where otherwise approved, shall be provided in order to hold all doors in the 90 degree position whilst open.
- 5.4 Enclosure fixing brackets shall be provided to connect between panels and roof, and between panels and ground/walls. Foundation fixings shall be in the form of brackets bolted to the front and rear box sections. All fixings for joining component parts, i.e. walls, doors etc., including hinges, door bolts, padlocking points etc., shall be accessible only from within the enclosure.

## **6.0 ENCLOSURES**

- 6.1 Enclosures shall normally be supplied in the nine sizes detailed in Appendix A. However, there may be a requirement for alternative sizes to be supplied when site conditions so dictate.
- 6.2 Items (1)-(4) shall be provided with a threshold panel which mounts under the door opening to assist backfill in front of enclosure doors.
- 6.3 With the exception of mini switch covers, which will have one opening door, all enclosures will be constructed with a set of double doors, dimensioned so as to fill the area available within the steel box reinforced front frame.

- 6.4 Roofs shall be constructed of a single section which is double skinned, reinforced, pitched and domed with no joints. In order to minimise condensation, the roof shall be polyurethane foam filled with a minimum foam thickness of 18mm.
- 6.5 Lifting brackets shall be provided to lift the enclosure. The lifting brackets shall conform to the Factories Act 1961, Regulation 26, and the Construction (Lifting Operations) Regulations 1961, Regulation 10. Test Certificates shall be provided for each eyebolt supplied. Where suppliers provide lifting brackets as an alternative to eyebolts, they will be subject to the above regulations.
- 6.6 The weight of the complete enclosure shall be clearly stenciled on one of the inside panel faces.
- 6.7 Ventilation shall be fitted to the top and bottom of enclosures in positions to be agreed between purchaser and supplier and will be covered by approved cowls. Before the fitting of cowls, each unit substation enclosure will have ventilation of 0.80 sq. metre net free area shared equally between the top and bottom of the enclosures, positioned in the top and bottom rear corners of the side panels and the four corners of the rear panels as indicated on the attached drawings. Enclosure designs with an overhanging roof can incorporate the box ventilation into the overhang design of the roof. Switchgear enclosures will have ventilation of 0.02 sq. metre net free area shared equally between the top and bottom of the enclosure.
- 6.8 From time to time it may be necessary to vary the amount of ventilation in Unit Substation Enclosures. **All Unit Substation Enclosures** shall be supplied with sufficient approved ventilation panel blanking plates to blank off all, but two, panels. Blanking plates shall be securely attached on the inside of the enclosure. A labelled storage facility shall also be provided within each enclosure for any blanking plates which are not in use. The positioning of this 'store' will be agreed between purchaser and supplier.
- 6.9 To assist cable entry during installation of the substation, the bottom threshold strip below the front doors of the enclosure shall be removable.

## **7.0 NOISE/VANDAL RESISTANT ENCLOSURES. (WHEN SPECIFIED)**

- 7.1 Except where stated below Noise/Vandal Resistant Enclosures' shall be constructed to the specification described previously.
- 7.2 Such enclosures shall be robust in order to withstand vandal attack. The walls, doors and roof shall be constructed from GRP inner and outer skins totally encapsulating a rigid plywood core. Plywood may be laminated into the construction in a number of sections provided a continuous core is maintained. Ventilation louvres and grilles shall be vandal resistant.
- 7.3 The following information will be required with the tender:
- (i) Thickness of plywood reinforcement offered.
  - (ii) Grade of plywood reinforcement offered.
  - (iii) Number of GRP laminations on each face of the plywood.
  - (iv) Material and construction of framework for corner posts, walls, roof, door frame and doors.
  - (v) Materials of hinges, stays, locking facilities, and ventilation louvres and grilles.
  - (vi) Information on BS476 Parts 7, & 12, fire tests, shall be provided and Part 20 tests shall be provided if available.

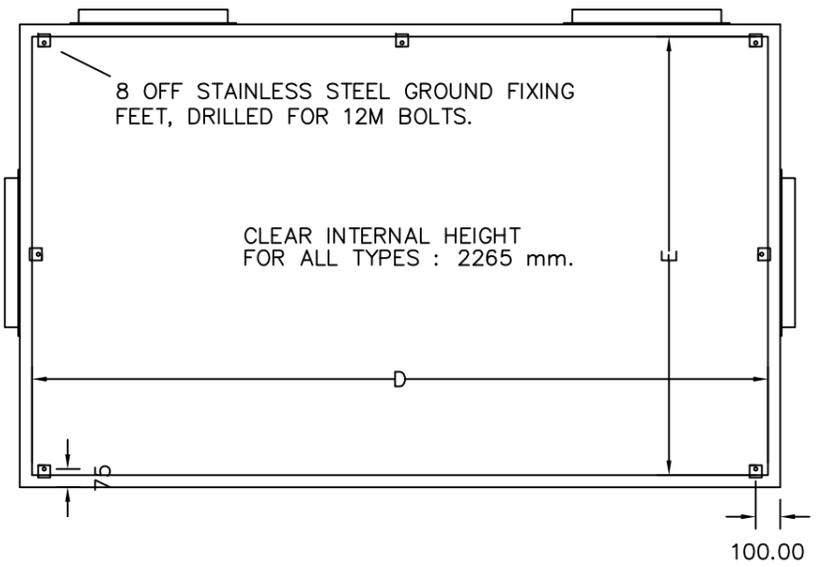
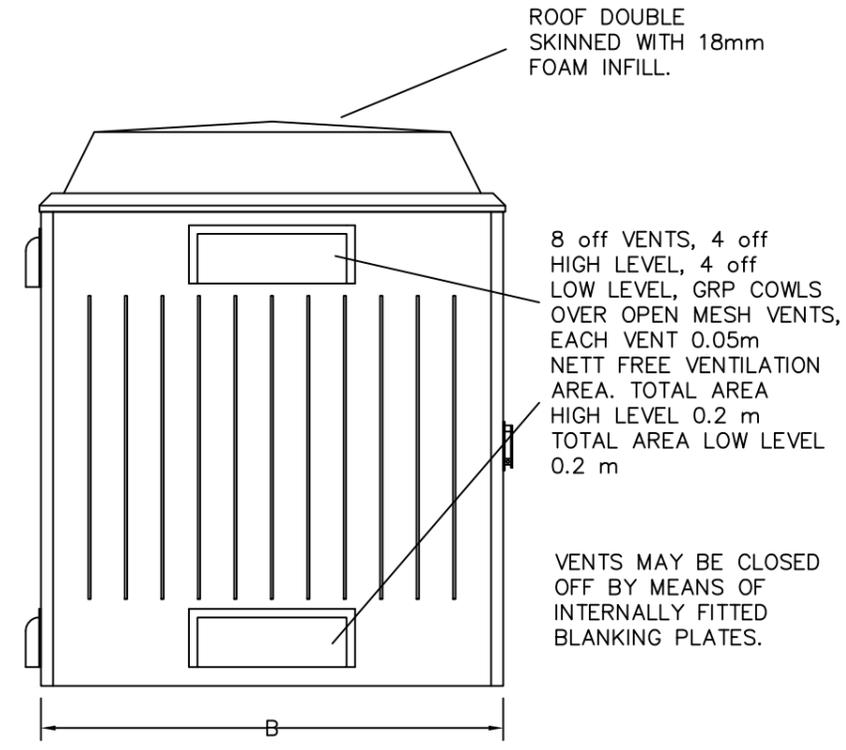
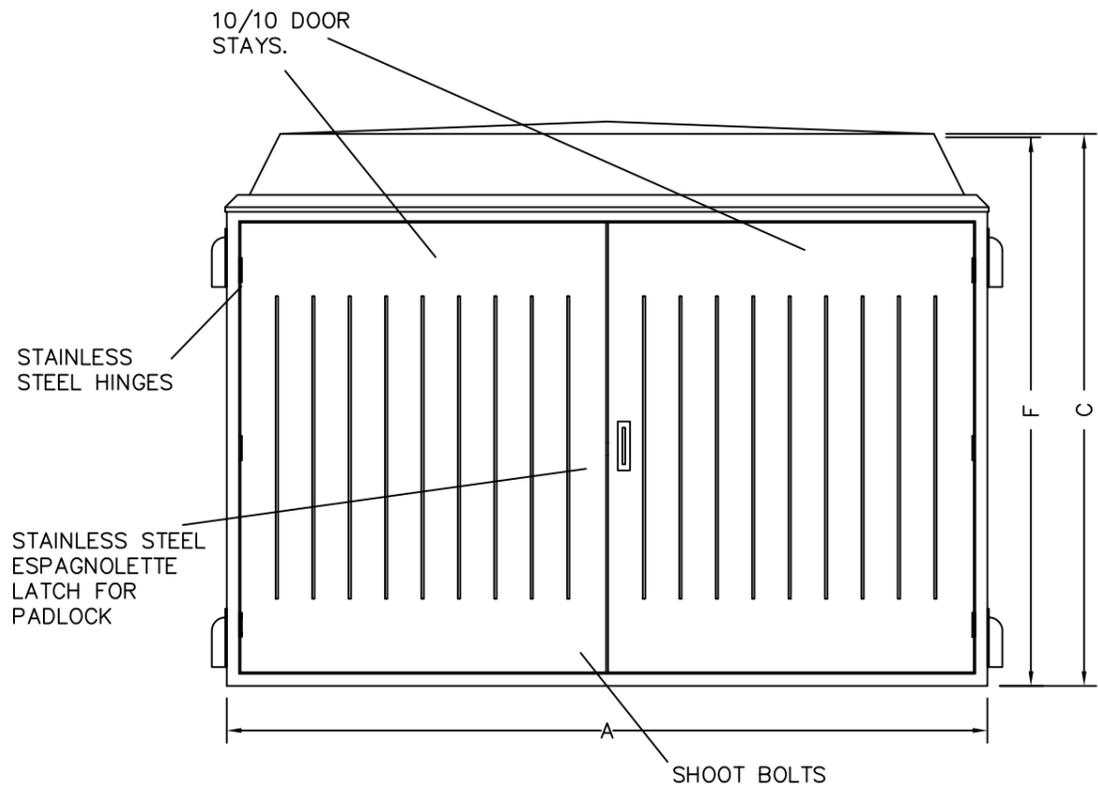
## SUMMARY OF ENCLOSURE SIZES

	1	2	3	4	5				
<b>Type of Housing</b>	<b>Unit (Large)</b>	<b>Unit (Med)</b>	<b>Unit (Small)</b>	<b>Slim line</b>	<b>Switchgear Enc.</b>				
<b>Internal Dimensions (mm)</b>									
<b>Width</b>	3000	3000	2390	2590	1290				
<b>Depth</b>	2125	1750	1750	1590	1310				
<b>Height</b>	2265	2265	2265	2300	2190				
<b>External Dimensions will be +100mm</b>									
<b>E5CODE:-</b>									
<b>Assembled</b>	40245	40247	40249	40238	40239				
<b>Flat Packed</b>	40244	40246	40248	N/A	40240				

COLOURS	BS 4800	Buff	08-B-21
		Dark Green	14-C-39
		Brown	08-B-25
		Light Green	12-B-21

**DRAWINGS EKV0031, EKV0032 AND EKV0033**

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EXTERNAL DIMS		
A.	B.	C.
3110	2265	2270
3110	1890	2270
2500	1890	2270

CLEAR INTERNAL DIMS		
D.	E.	F.
3000	2125	2265
3000	1750	2265
2390	1750	2265

Revision:	Drawn:	Date:									
Work Done											
Checked			Checked			Checked			Checked		

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Approvals for  Construction

**WESTERN POWER DISTRIBUTION**

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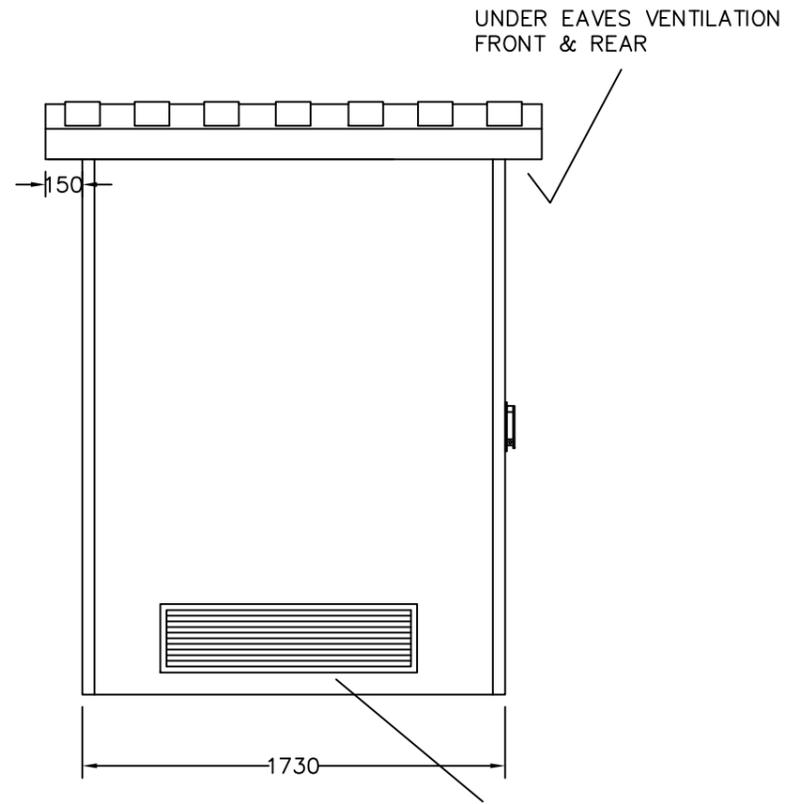
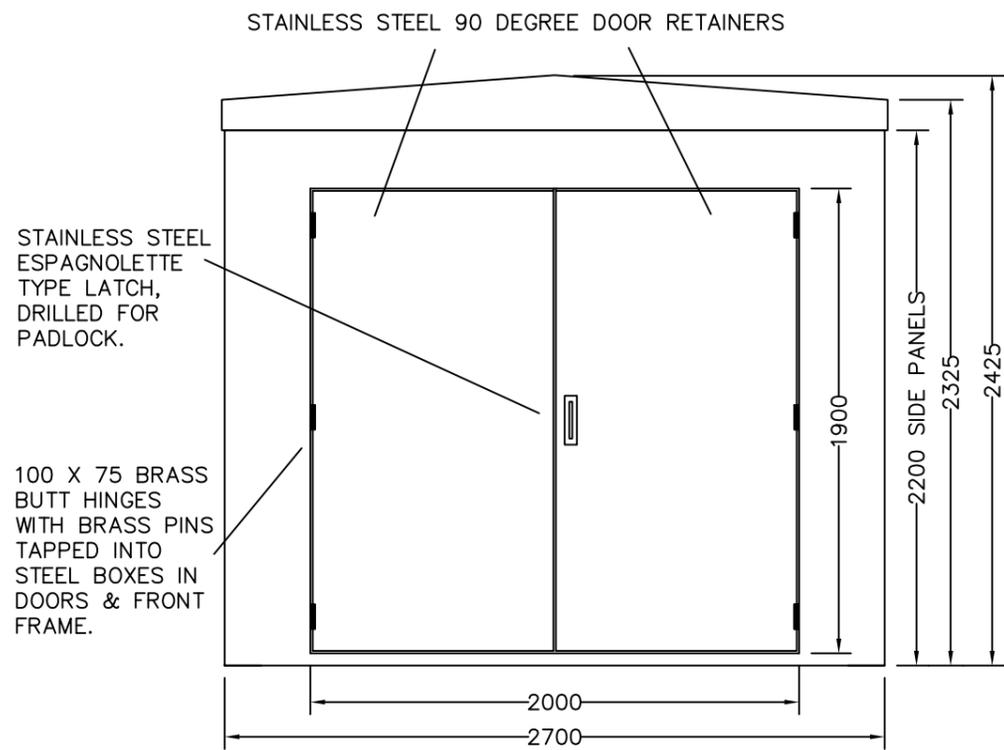
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OF GRP ENCLOSURE  
FOR UNIT SUBSTATION.

Drawn C.J.B. Checked  
Date 13.05.09 Scale of original 1:20

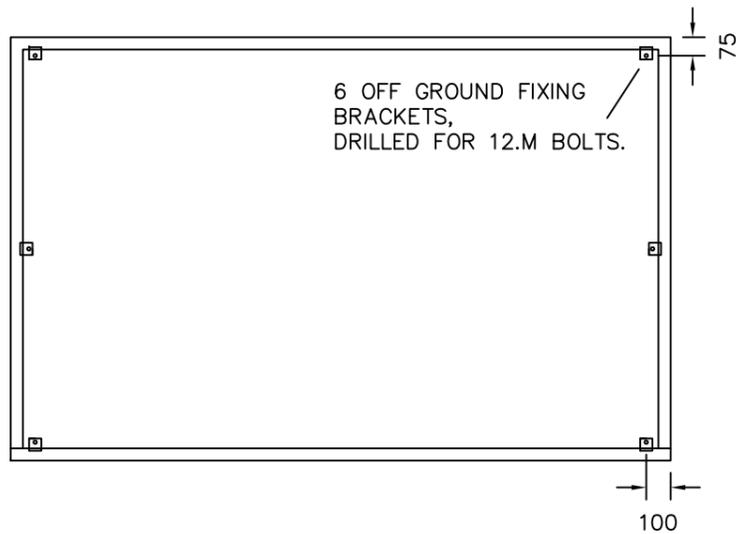
DRAWING NUMBER  
EKV0031

Revision

11kV STANDARDS



4 OFF GALV'D STEEL LOUVRED VENTS. TWO IN BACK PANEL, AND ONE IN EACH SIDE.



CLEAR INTERNAL DIMS		
WIDTH	DEPTH	HEIGHT
2590	1590	2300

Revision:	Drawn:	Date:									
Work Done											
Checked			Checked			Checked			Checked		

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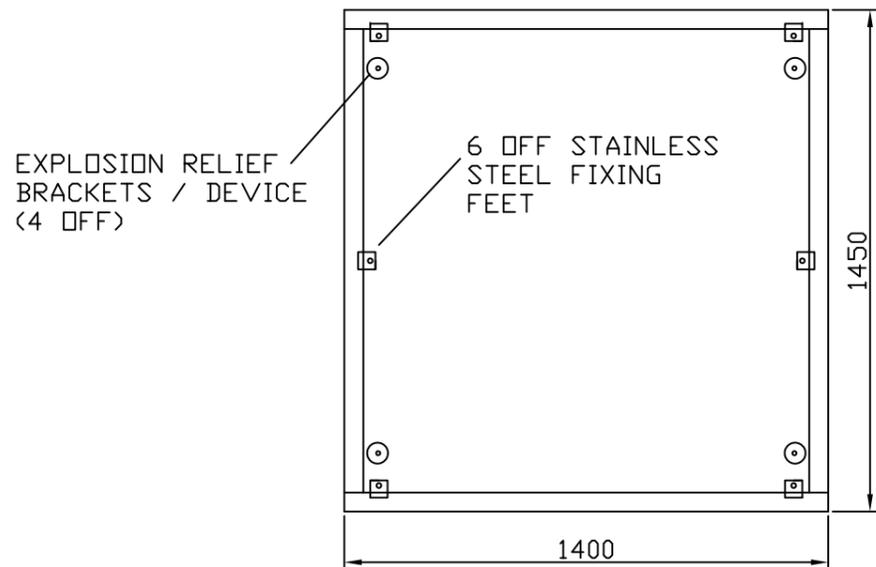
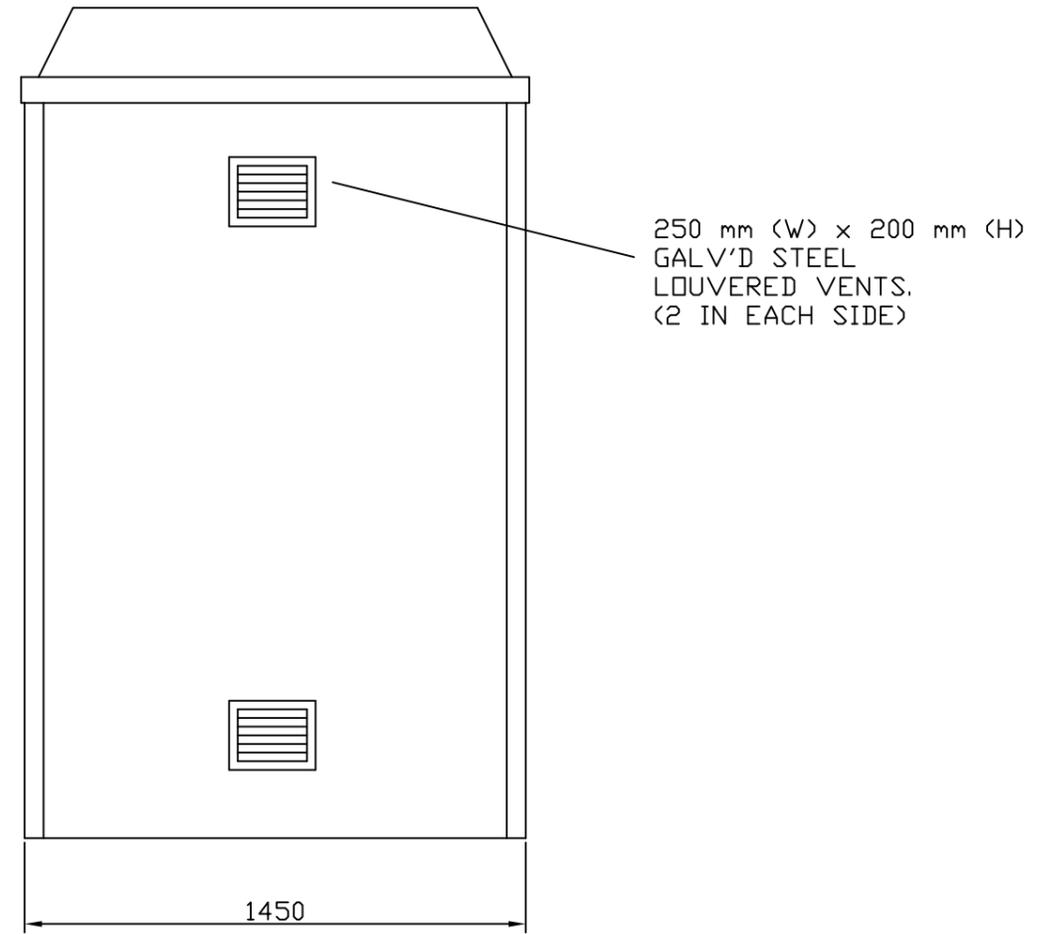
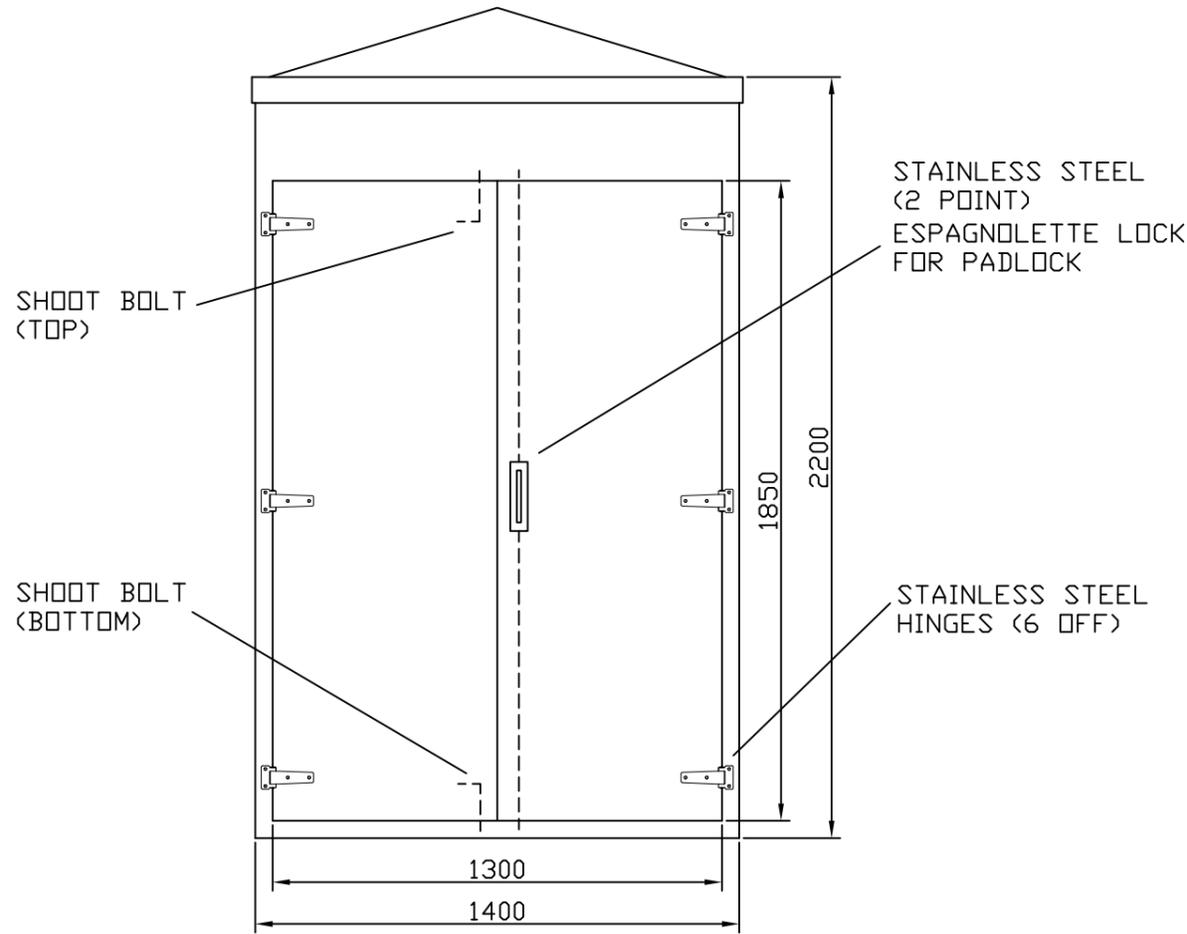
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GENERAL ARRANGEMENT OF SLIM-LINE GRP ENCLOSURE FOR UNIT SUBSTATION.

Drawn C.J.B. Checked  
Date 13.05.09 Scale of original 1:20

DRAWING NUMBER  
EKV0032

Revision

11kV STANDARDS



CLEAR INTERNAL DIMS		
WIDTH	DEPTH	HEIGHT
1290	1310	2190

Revisions	Drawn	Date															
Work Done																	
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Title: GENERAL ARRANGEMENT OF MINI GRP ENCLOSURE FOR UNIT SUBSTATION.

DRAWING NUMBER: EKV0033

Revision: 11kV STANDARDS.

Drawn: C.J.B. Checked: Date: 13.05.09 Scale of original: 1:10

Approvals for:  Construction

## **APPENDIX C**

### **SUPERSEDED DOCUMENTATION**

This document supersedes EE SPEC: 19/6 dated June 2011, which has now been withdrawn.

## **APPENDIX D**

### **ASSOCIATED DOCUMENTATION**

ST NC1V/3

## **APPENDIX E**

### **KEY WORDS**

GRP, Enclosure