WESTERN POWER DISTRIBUTION

Industrial and commercial materials framework appendix to be read in conjunction with:

ENA Engineering Recommendation G81 Part 5 "Framework for materials specification for industrial and commercial underground connected loads up to and including 11kV. Version agreed at Ofgem ECSG on 12th October 2004

INDUSTRIAL AND COMMERCIAL MATERIALS FRAMEWORK DLH SPECIFIC APPENDIX

1.0 INTRODUCTION

1.1 Information contained in this Framework Appendix must be read in conjunction with the National Framework Documents, the Adoption Agreement, and the other two Western Power Distribution (WPD) Industrial and Commercial Framework Appendices relating to Installation and Design and to cable recording techniques. Please see the WPD Housing Development Installation Framework Document Appendix for full details on supplies to Multi-Occupancy buildings.

1.2 This document includes details of the more common arrangements for supplying industrial and commercial underground connected loads at up to and including 11kV. The maximum LV load is 1000kVA. Arrangements for HV connected load are typically via a tee off circuit breaker (equivalent to an fuse switch) or via a ring main unit, with or without HV metering unit, and these are illustrated in this Appendix. There are other HV arrangements which are sometimes used by WPD, involving duplicate supplies, some with "wing" metering, or circuit breaker switchboards, which for the purposes of this document we will term "complex". The availability to employ such complex arrangements may be dependent upon other connection arrangements within the same feeder / ring. Because of this, and since other issues such as protection, ownership and control are also inter-dependent, it is best to discuss such proposed complex arrangements with the WPD Planner at the outset. They can then provide copies of the correct inter-related WPD documents.

1.3 In the event of query please speak to the WPD Planner acting as the focal point of contact for the scheme.

If other than the listed materials or makers are proposed, please pass detailed information to the WPD Planner, who will make contact with the relevant Specifier within WPD to provide a response. Full details of any proposed variation are required, including;

- makers name and place of manufacture
- makers type reference
- rating information
- any applicable COSHH data sheets

2.0 HV SWITCHGEAR

2.1 WPD require non-oil designs of HV switchgear. WPD's current suppliers of HV Ring Main type equipment are Schneider Electric (Ringmaster range) and Lucy (Sabre range). Indoor HV circuit breakers must comply with WPD Engineering Equipment Specification 3, which is based on ENA TS documents. Since these will generally fall under the "complex" heading above, and introduce inter-dependant requirements please discuss such scheme proposals at an early stage with the WPD Planner who can then provide the appropriate correct mix of WPD documents, including battery and charger specifications, CT, VT requirements, and a listing of WPD approved

protection relays. WPD will require to type approve HV switchgear, but this is usually straightforward if the proposed equipment has a Certificate of Conformity issued by the ENA Switchgear Assessment Panel.

2.2 Where HV Metering Units are required, attention is drawn to the requirements of the BSCP for CT and VT accuracy classes to be based on circuit rating and not size of load. Provision of metering CT and VT test certificates and the burden at which these accuracy tests are required to be undertaken, needs to be discussed at an early stage with WPD Planner and the relevant Meter Provider / Operator. Also arrangements for location and housing of meters will need to be settled, whether HV or LV.

3.0 HV/LV TRANSFORMERS

3.1 HV/LV transformers are purchased to WPD specification based on EATS 35-1. WPD specify maximum acceptable losses for the ratings of transformers employed; 315, 500, 800 and 1000kVA as below.

Three phase-rating KVA	315	500	800	1000
No load loss W	609	765	1130	1304
Load loss W	4364	6236	9091	10727

3.2 Limitation of transformer noise is important to WPD; please note that specified noise limits are included in EATS 35-1 and the WPD spec, but are not included in BS EN60076.

3.3 Transformer oil must be certified as being free of PCBs < 2ppm. Transformer oil must comply with BS 148.

4.0 LV FUSE CABINETS, FUSEBOARDS AND FUSE PILLARS

4.1 Shall comply with EATS 37-2 and shall have the following facility to provide for live connection of a standby generator.

4.2 The facility shall be provided to allow the safe connection of generator cables onto live indoor fuseboards, fuse pillars and transformers mounted cabinets. This shall be in the form of connections to the busbars and neutral/earth bar suitable for accepting live connection of a ‘Litton’ connector. The connection shall be rated for 600A. The connections shall be recessed and fitted with individual insulating ‘plugs’ to prevent inadvertent live contact by an operator. The facility shall also be provided to prevent access to these four connections by use of a safety padlock (see clause 4.6).

Evidence of temperature rise tests shall be supplied at the time of tender as detailed in clause 13.2 with the generator cables carrying the full 600A current and the adjacent outgoing ways arranged to obtain current balance.

The cabinet/pillar doors shall be able to be closed and locked with the generator cables connected.

5.0 HV/LV SUBSTATION ENCLOSURES

5.1 HV/LV substations shall be situated indoors; normally within a glass reinforced plastic (g.r.p) enclosure. All g.r.p. enclosures shall meet WPD specification as set out below. Dimensions are for unit type arrangements employing Schneider Ringmaster non extensible ring main or circuit breaker equipments. Please also see extensive information in WPD Framework Appendix 4 relating to the design of indoor substations / switchrooms.

5.2 Introduction

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

5.3 General

This specification details the minimum permissible standard. Suppliers may submit alternative designs for consideration and approval by WPD.

All designs must take into account the often severe, climatic conditions experienced in the South West of England and South Wales and Suppliers shall be able to demonstrate that all equipment supplied will be 'Fit For Purpose'.

All items shall have sufficient protective packaging to prevent any damage in transit.

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 EN60529:1992.

When installed, the interface between the base of the enclosure and the plinth shall be sealed against the ingress of water.

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

5.4 Explosion relief

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. 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.

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. Tests to be recorded on high speed video recorder for consideration.

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.

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

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.

5.5 Materials and stiffening

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 equivalent, 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.

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.

If tests for fire resistance to BS476 Part 20, or equivalent, 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.

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 bevelled edges and be fully encapsulated between layers of GRP.

All plyboard used in the course of manufacture will be 'WPB grade' and have a minimum thickness of 12mm. All plyboard will be fully encapsulated between layers of GRP.

The standard colour of completed assemblies shall be Buff BS4800 08-B-21 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.

The exterior appearance of all panels shall be aesthetically acceptable. Suppliers shall provide detailed proposals with tenders.

5.6 Fittings

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 and door hinges may be suitable grade brass.

All panels, including those provided with enclosures and wicket panels, shall be secured by a hasp and staple arrangement able to accept a lock with a 7mm hasp. Enclosures and double door sets shall have top and bottom internal drop bolts fitted on the door fitted with the staple.

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. Type 1 and Type 2 wicket panels do not require a stay, but a second staple must be provided to secure the door in the 180 degree open position.

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.

5.7 Enclosures

Enclosures shall normally be supplied in the five sizes detailed below. However, there may be a requirement for alternative sizes to be supplied when site conditions so dictate.

(i) 3050mm width, 2225mm depth, 2300mm height, (clear inside dimensions), - Unit Substation Enclosure, - **diagram1.**

(ii) 3050mm width, 1830mm depth, 2300mm height, (clear inside dimensions, - Unit Substation Enclosure, - **diagram1.**

(iii) 2462mm width, 1830mm depth, 2300mm height, (clear inside dimensions), - Unit Substation Enclosure, - **diagram 1.**

A welded steel box frame of cross section at least 40mm x 40mm x 3mm to be fully laminated into the periphery of the front and rear of the enclosure. Timber reinforcing members at least 75mm x 32mm shall be positioned as shown in **diagram 2** to further strengthen the enclosure.

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.

Enclosure roofs shall be 'tight fitting'. With the exception of Mini Switch Covers, roofs shall be constructed of a single section which is double skinned, reinforced, pitched and domed with no joints, and with a steel angle encapsulated inside the bottom edge of the roof to provide fixing points to the side. In order to minimise condensation, the roof shall be polyurethane foam filled with a minimum foam thickness of 18mm. It will be able to withstand a single 100kg load over an area of 300mm x 300mm at any position with no more than a 25mm deflection, and without permanent damage. Threaded sockets shall be provided on the top of the roof to accept lifting eyebolts. The sockets shall be sealed in order to prevent the ingress of moisture and must be fixed such that, when eyebolts are fitted to all sockets, the roof can safely and without damage, be lifted and lowered using only these points. Suitable eyebolts shall be provided where specified. In order to reduce weight, Mini Switch Cover roofs shall be single skin as previously specified and provided **without** threaded sockets for eyebolts.

Suitable eyebolts shall be provided when requested to do so which 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.

The weight of each panel, including the roof, shall be clearly stencilled on the inside panel face and, in addition, where suppliers confirm in writing that the complete enclosure may be lifted by means of eyebolts or lifting brackets, the weight of the complete structure must be clearly stencilled on the inside of the roof.

Ventilation panels, 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. Switchgear enclosures will have ventilation of 0.02 sq. metre net free area shared equally between the top and bottom of the enclosure.

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.

5.8 Vandal Resistant Enclosures. (When Specified)

Except where stated below 'Vandal Resistant Enclosures' shall be constructed to the specification described previously.

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.

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, or equivalent, fire tests, shall be provided and Part 20 tests shall be provided if available.

(vii) List of customers to whom similar enclosures have been provided, with particular respect to UK. Electricity Companies.

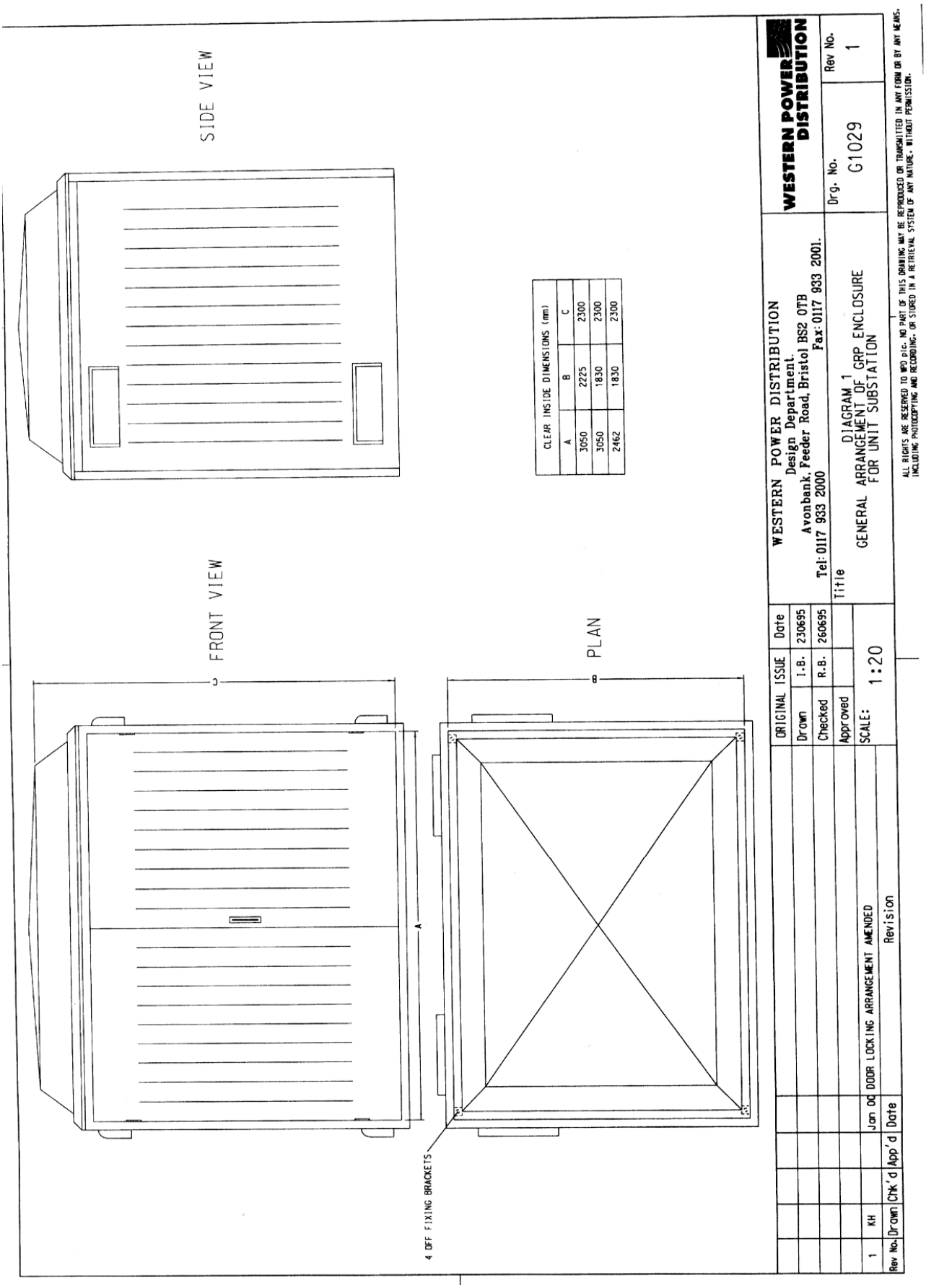
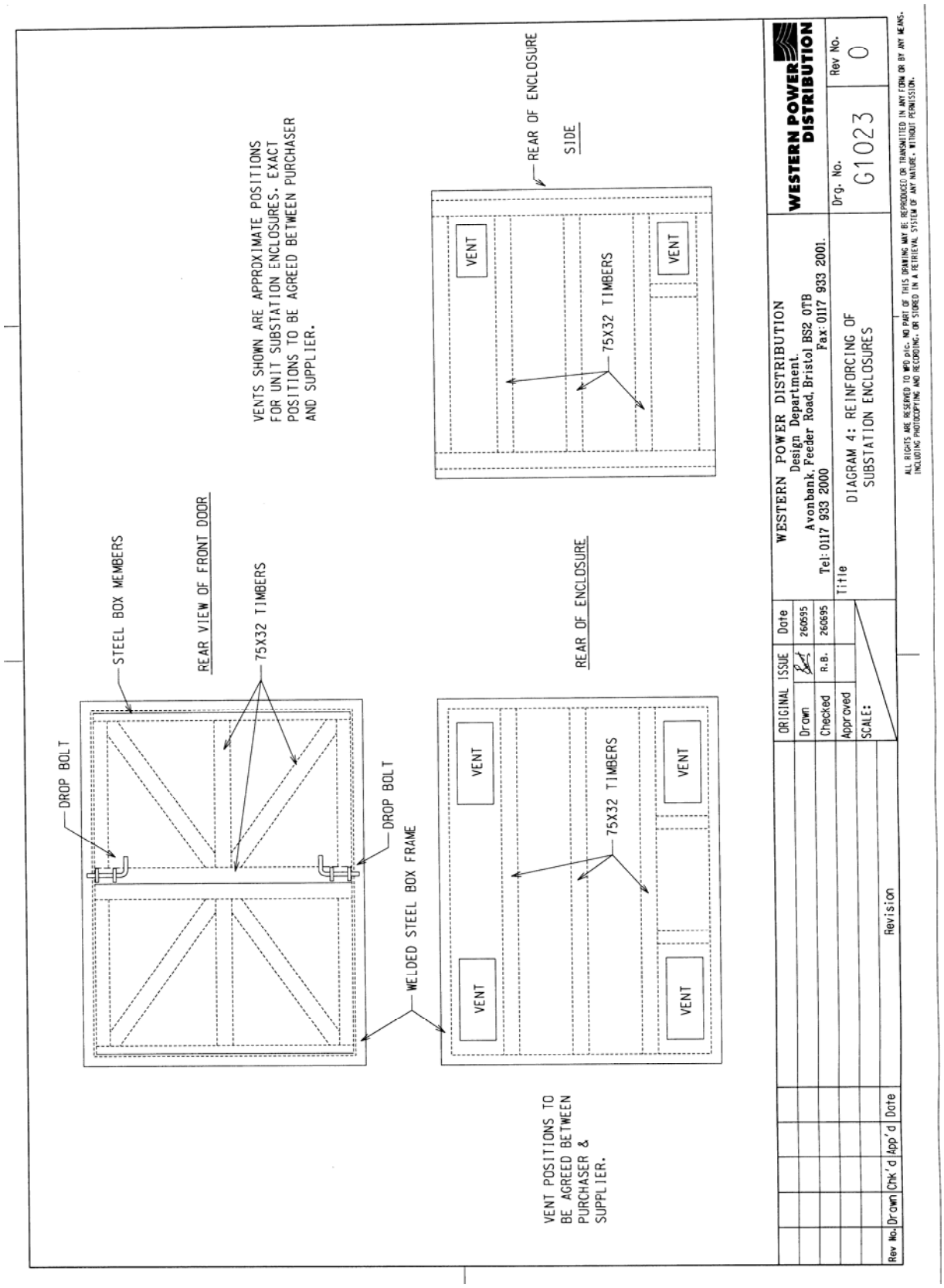

SIDE VIEW
FRONT VIEW
PLAN
CLEAR INSIDE DIMENSIONS (mm)
A B C
3050 2225 2300
3050 1830 2300
2462 1830 2300
4 OFF FIXING BRACKETS
WESTERN POWER DISTRIBUTION
WESTERN POWER DISTRIBUTION
Design Department.
Avonbank, Feeder Road, Bristol BS2 0TB
Tel: 0117 933 2000 Fax: 0117 933 2001.
ORIGINAL ISSUE Date
Drawn I.B. 230695
Checked R.B. 260695
Approved
SCALE: 1:20
Title
DIAGRAM 1
GENERAL ARRANGEMENT OF GRP ENCLOSURE FOR UNIT SUBSTATION
Drg. No. G1029
Rev No. 1
1 KH Jan 06 DOOR LOCKING ARRANGEMENT AMENDED
Rev No. Drawn Chk'd App'd Date Revision
ALL RIGHTS ARE RESERVED TO WPD plc. NO PART OF THIS DRAWING MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, INCLUDING PHOTOCOPYING AND RECORDING, OR STORED IN A RETRIEVAL SYSTEM OF ANY NATURE, WITHOUT PERMISSION.

Diagram 1


STEEL BOX MEMBERS
REAR VIEW OF FRONT DOOR
75X32 TIMBERS
DROP BOLT
DROP BOLT
WELDED STEEL BOX FRAME
VENT POSITIONS TO BE AGREED BETWEEN PURCHASER & SUPPLIER.
VENTS SHOWN ARE APPROXIMATE POSITIONS FOR UNIT SUBSTATION ENCLOSURES. EXACT POSITIONS TO BE AGREED BETWEEN PURCHASER AND SUPPLIER.
REAR OF ENCLOSURE
SIDE
VENT
VENT
75X32 TIMBERS
REAR OF ENCLOSURE
VENT
VENT
VENT
VENT
75X32 TIMBERS
WESTERN POWER DISTRIBUTION
WESTERN POWER DISTRIBUTION
Design Department.
Avonbank, Feeder Road, Bristol BS2 0TB
Tel: 0117 933 2000
Fax: 0117 933 2001.
Title
DIAGRAM 4: REINFORCING OF SUBSTATION ENCLOSURES
Drg. No.
G1023
Rev No.
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ORIGINAL ISSUE
Drawn
Checked
Approved
SCALE:
Date
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R.B.
260695
Rev No. Drawn Chk'd App'd Date
Revision
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Diagram 2

6.0 WPD list of materials and suppliers.

Component	WPD Specification	National Specification	Manufacturer	Size / Type
Earth Rods		ENATS 43-94	W Furse - Nottingham CBS Products – Oakham ERICO (GB)	
Hockey Stick (Bend)			Polypipe Civils	38mmx90inch
Alkathene Tubing		ENATS 12-24	Polypipe Civils	
Marker Tape		ENATS 12-23	Boddingtons Ltd - Essex	150mm x 0.1mm x 365m
Fuses (LV)		BS88 Part 5	Cooper UK Ltd - Bourton On Wold, Leics GEC Alsthom - Liverpool MEM - Tyseley, Birmingham	100A Slot 82mm 160A Slot 82mm 200A Slot 82mm 250A Slot 82mm 315A Slot 82mm 350A Slot 82mm 400A Slot 82mm 500A Slot 82mm 160A Slot 92mm 200A Slot 92mm 250A Slot 92mm 315A Slot 92mm 350A Slot 92mm
Transformer Fuse LV Cabinet	WPD EE SPEC 16	ENATS 37-2	Schneider - Scarborough W Lucy & Co - Thame WT – Henley	Type V 800A, 4 Way Type VII 1600A, 4 Way Type XIV 1600A, 2 Way + 1250A MCCB Type XII 800A, 2 Way + 800A MCCB Type XIII 1600A, 2 Way + 800A MCCB Type IX 1600A, 5 Way
LV MCCB Metering intake panel	WPD EE SPEC 28 (see WPD Framework Appendix 4)		Schneider – Scarborough	
Transformers 11/0.433kV Ground Mounted	SPEC EE SP5	ENATS 35-01	ABB – Waterford GEC Alsthom - Stafford Merlin Gerin - Leeds Pauwels - Cavan	315kVA Cable 315kVA Unit 500kVA Cable 500kVA Unit 800kVA Cable 800kVA Unit 1000kVA Cable 1000kVA Unit
12kV circuit breaker (fuse switch equiv) SF6	WPD EE SPEC 2	ENATS 41-36	Schneider – Leeds W Lucy & Co – Oxford	TXF Mounted SF6 Free Standing SF6

Component	WPD Specification	National Specification	Manufacturer	Size / Type
12kV circuit breaker (fuse switch equiv) SF6	WPD EE SPEC 2	ENATS 41-36	Schneider – Leeds W Lucy & Co – Thame	TXF Mounted SF6 Free Standing SF6
12kV circuit breaker Ring Main Unit SF6	WPD EE SPEC 2	ENATS 41-36	Schneider – Leeds W Lucy & Co – Thame	TXF Mounted RMU Free ST RMU
12kV circuit breaker vacuum or SF6	WPD EE SPEC 3	ENATS 41-36	Areva – Stafford FKI – Blackwood Siemens – Manchester	
Insulating oil (for transformer)		BS148 + PCB<2PPM	EOS	
GRP Enclosure with internal arc pressure relief	WPD EE SPEC 19		Envico - Swansea Morgan Marine	V Resistant 3050x2225x2300mm 3050x1830x2300mm Unit S/S Enc 3050x1830x2300mm 3050x2225x2300mm
Link Disconnection Boxes			Prysmian (2 or 4 way)	Insulated Type/Resin Filled
Cut-Out		BS 7657	WT Henley - Gravesend	Single Phase 100A Three Phase 100A SNE Link/Earth Terminal BL
Street Lighting Cut-Out			W Lucy	SLF 25A
Cut-Out Fuse		BS88 Sec 3 BS1361	Cooper UK Ltd - Bourton On Wold, Leics GEC Alsthom - Liverpool MEM - Tyseley, Birmingham W Lucy – Thame	100AType 11B250V 80A Type 11B 250V 60A Type 11B 250V 30A Type 11B 250V
Meter Cupboard		ENATS 12-03	Matris Composites UK Ltd - Stoke on Trent Ritherdon & Co - Darwen, Lancs Autopress Composites – Stoke on Trent	Small Gas Com EA12-3 Modified Large Meter Box Surface Mounted Standard Large Meter Box Fire Resistant Small
Meter Boards			Wootton & Co Shaw Timber - Huddersfield	490x490 to SWEB G4008 300x300 Wall Mounting 575mmx375mm Medium 650x460mm Large 490x330 Autopress 500x340 Hampton Small Box

Component	WPD Specification	National Specification	Manufacturer	Size / Type
Underground Service Cable		ENATS 09-07 Plain Conc BS 7870 Part 3.11 BS 7870 Part 3.21 Split	General Cables - Spain	16mm 1PH CU Conc 25mm 1PH CU Conc 16mm 1PH Split CU Conc 25mm 1PH Split CU Conc 25mm Hybrid Single Phase 35mm Hybrid Single Phase 16mm 3PH CU Conc 25mm 3PH CU Conc 25mm 3Core Hybrid 35mm 3Core Hybrid
Joint Resin		HD 631.2	Prysmian	3 Pt Poly 1.3L 3 Pt Poly 5L 3 Pt Poly 6.5L 3 Pt Poly 3.2L
Connectors LV Mains joints		IEC 61238-1	Tyco (B&H)	MSIP – service UST – straight USBT1 – straight +service UBR – branch UBRD – cut main branch BCNE-3UTB – neutrals TAI, TA II & TAIII – consac neutral VETA-33P-UTB
Connectors LV service		IEC 61238-1	Tyco (B&H)	BTC – straight BTCL 6-130W – straight & branch neutrals SSIPC
Connectors LV terminations		IEC 61238-1	Tyco (B&H)	LVET lugs BET lugs ML lugs
Mains Cable (LV) 3 & 4 Core (Normal)		BS 7870 Part 3	Prysmian	300mm^2 Wavecon 185mm^2 Wavecon 95mm^2 Wavecon
Mains Cable (LV) 3 & 4 Core (LSF)		BS 7870 Part 3	Copper Cable Co	300mm^2 Wavecon 185mm^2 Wavecon 95mm^2 Wavecon

Component	WPD Specification	National Specification	Manufacturer	Size / Type
LV Cable Joints (Complete)		Nat ER C81/3 or BS6910 Pt 1	Tyco (B&H)	Various depending on cable being jointed
Jointing Compound		HD 628 & 629	Lovink	Lovisil
11kV epr Single Core Cable Cu		BS 7870 Section 4.10	Prysmain Cables	630 mm^2 300 mm^2
HV Earthing (U/G)		ENATS 41-24	Johnson - Wakefield	
11kV epr single core cable solid Al conductor		BS 7870 Section 4.10	Prysmian Cables	95 mm^2
11kV epr Triplex solid Al conductor		BS 7870 Section 4.10	Prysmain Cables	95 mm^2 185 mm^2 300 mm^2
11kV Terminations Indoor & Outdoor		HD 628 & HD 629	3M QT3	95 to 300 mm^2 QT 111 Indoor & QT111 Outdoor
11kV Straight Joints		HD 628 & HD 629	Lovink	K85 - 95 to 185 mm^2 K95 - 185 to 300 mm^2
11kV Stop Ends		HD 628 & HD 629	Lovink	K85 - 95 to 185 mm^2 K95 - 185 to 300 mm^2
11kV Live Break Elbows		HD 628	Coopers (Langley Eng)	95 mm^2
11kV Branch Joints		HD 628 & HD 629	Lovink	95 to 185 mm^2 185 to 300 mm^2
11kV Loop Joints		HD 628 & HD 629	Lovink	95 to 185 mm^2 185 to 300mm^2
11kV Separate Connectors		HD 629.1 S1	Nexans (Euromold) for 630mm^2	K440 TB/G-32-272 GA01C 400-630
		HD 629.1 S1	Nexans (Euromold) for Lucy Sabre Mk2 RMU	K430TB