

WESTERN POWER DISTRIBUTION

Housing development materials framework appendix to be read in conjunction with:

ENA Engineering Recommendation G81 “Framework for Design and Planning, Materials Specification and Installation and Record for Greenfield Low Voltage Housing Development Installations and Associated, New, HV/LV Distribution Substations” – Part 2 Materials Specification. Version agreed at Ofgem ECSG on 12th October 2004

Please note that this version (G) now includes additional information, in section 7, which is only applicable to the former Central Networks East and West Midlands licence areas due to legacy design / equipment issues. Unless otherwise stated the document applies across all 4 WPD licence areas.

WESTERN POWER DISTRIBUTION

HOUSING DEVELOPMENT 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, the other two Western Power Distribution (WPD) Housing Development Framework Appendices relating to Installation and Design and the WPD Framework Appendix on cable recording techniques.

1.2 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).

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 ENATS 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 ENATS 37-2.

4.2 Provision for connecting a generator as detailed in Clause 7.1.1.f of ENATS 37-2 shall be provided.

The connection from the transformer side to the synchronising reference fuses shall be double insulated and of not less than 16mm².

Female 'Litton' connectors (or equivalent) shall be provided on each busbar and the neutral/earth bar to allow the safe connection of generator cables onto live SCDB's.

The connections shall be rated at 600A.

Evidence of temperature rise tests shall be supplied at the time of tender, 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.

5.2 Introduction

This specification covers the sizes, material and physical design of GRP enclosures, roofs, doors and panels suitable for the 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, South Wales and coastal areas of East Midlands 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, - **diagram 1**.
- (ii) 3050mm width, 1830mm depth, 2300mm height, (clear inside dimensions), - Unit Substation Enclosure, - **diagram 1**.
- (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.

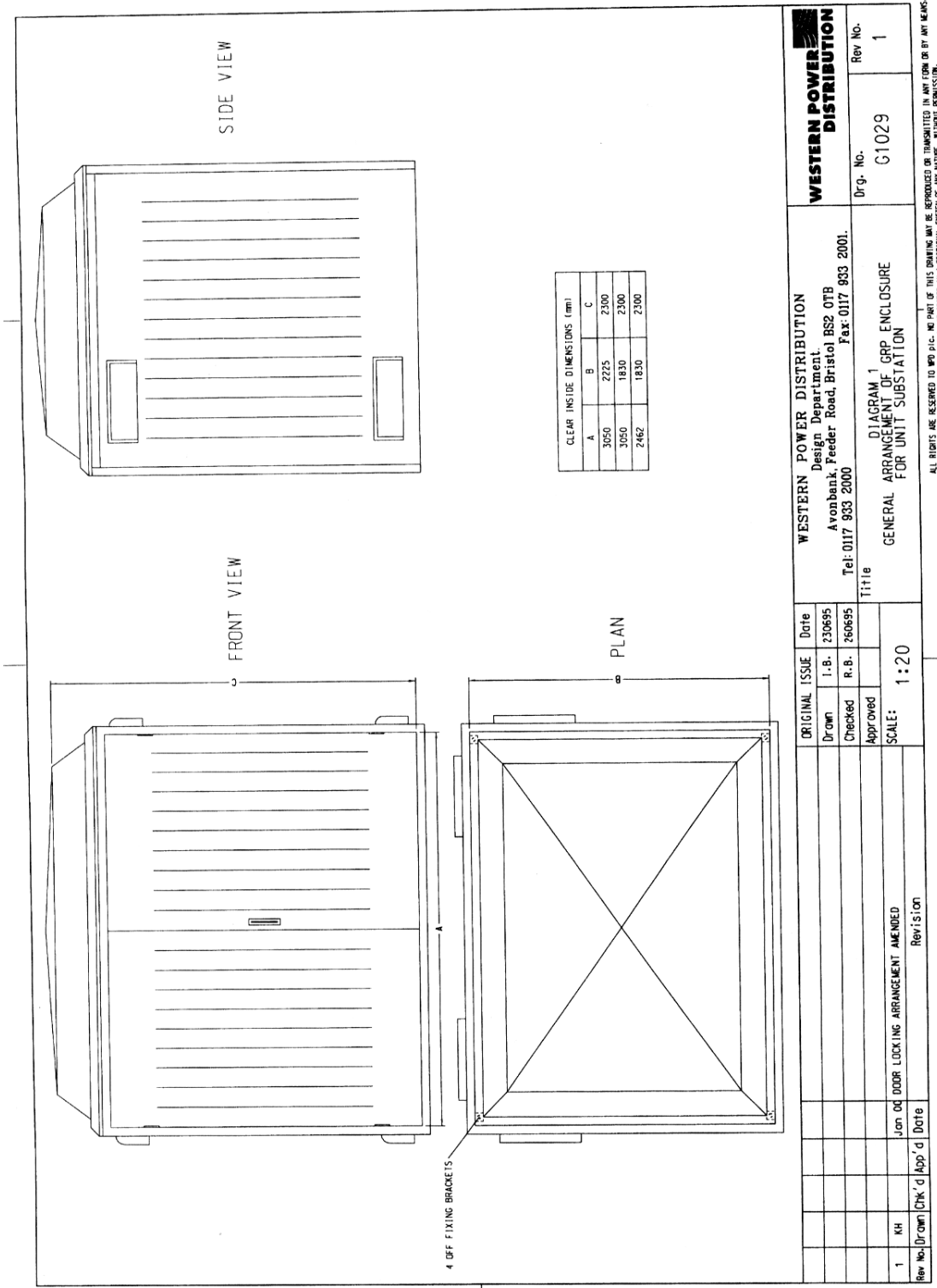


Diagram 1

| | | | | |
|--|--------------------------|--|--|-----------------------------|
| | | WESTERN POWER DISTRIBUTION Design Department Avonbank, Feeder Road, Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001. | | Dwg. No. G1029 Rev No. 1 |
| WESTERN POWER DISTRIBUTION Design Department Avonbank, Feeder Road, Bristol BS2 0TB Tel: 0117 933 2000 Fax: 0117 933 2001. | | Title DIAGRAM 1 GENERAL ARRANGEMENT OF GRP ENCLOSURE FOR UNIT SUBSTATION | | |
| ORIGINAL ISSUE Drawn I.B. 230695 Checked R.B. 260695 Approved | Date 230695 260695 | SCALE: 1:20 | | |
| Rev No. 1 Drawn KH Chk'd App'd | Date 1/1/00 | Description DOOR LOCKING ARRANGEMENT AMENDED Revision | | |

ALL RIGHTS ARE RESERVED IN THIS DRAWING AND 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.

6.0 WPD list of materials and suppliers.

(see clause 1.2 in relation to proposal of alternatives)

| 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 | –Fiberweb Geosynthetics Ltd - Maldon | 150mm x 0.1mm x 365m |
| Fuses (LV) | | BS88 Part 5 | Cooper Bussmann UK Ltd - Bourton On Wold, Leics Lawson Fuses Ltd, Ponteland, Newcastle Upon Tyne | 100A Slot 92mm 160A Slot 92mm 200A Slot 92mm 250A Slot 92mm 315A Slot 92mm 355A Slot 92mm 400A Slot 92mm 500A Slot 92mm 630A Slot 92mm |
| Transformer Fuse LV Cabinet | WPD EE SPEC 16/5 | ENATS 37-2 | Schneider – Scarborough W Lucy & Co – Thame | 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 28/5 (see WPD Framework Appendix 4) | | Schneider – Scarborough | |
| Transformers 11/0.433kV Ground Mounted | WPD EE SPEC 5/3 | ENATS 35-01 | CG – Cavan Efasec - Portugal | 315kVA Cable 315kVA Unit 500kVA Cable 500kVA Unit 800kVA Cable 800kVA Unit 1000kVA Cable 1000kVA Unit |
| Transformers 11/0.433kV | WPD EE SPEC 5/3 | ANSI C57-12-26, ANSI C57 – 12-25 | Cooper/Langley Engineering, Theale | |

| Component | WPD Specification | National Specification | Manufacturer | Size / Type |
|---|--------------------------|-------------------------------|---|--|
| 12kV circuit breaker (fuse switch equiv) SF6 | WPD EE SPEC 2/5 | ENATS 41-36 | Schneider – Leeds W Lucy & Co – Oxford | TXF Mounted SF6 Free Standing SF6 |
| 12kV circuit breaker (fuse switch equiv) SF6 | WPD EE SPEC 2/5 | 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 2/5 | ENATS 41-36 | Schneider – Leeds W Lucy & Co – Thame | TXF Mounted RMU Free ST RMU |
| 12kV circuit breaker vacuum or SF6 | WPD EE SPEC 3/3 | ENATS 41-36 | Schneider – Stafford FKI – Blackwood Siemens – Manchester | |
| Insulating oil (for transformer) | | BS148 + PCB<2PPM | EOS | |
| GRP Enclosure with internal arc pressure relief | WPD EE SPEC 19/6 | | Morgan Marine - Swansea | V Resistant 3050x2225x2300mm 3050x1830x2300mm Unit S/S Enc 3050x1830x2300mm 3050x2225x2300mm |
| Link Disconnection Boxes | | | Prysmian (2 or 4 way) (Note - former CN areas – see section 7) | Insulated Type/Resin Filled |
| Cut-Out | | BS 7657 | Cooper Bussman – Burton on the Wolds WT Henley - Gravesend | Single Phase 100A Three Phase 100A SNE Link/Earth Terminal BL |
| Street Lighting Cut-Out | | | W T Henley - Gravesend W Lucy & Co – Thame | SLF 25A |
| Cut-Out Fuse | | BS88 Sec 3 BS1361 | Cooper Bussman – Bourton On Wold, Leics Lawson Fuses Ltd, Ponteland, Newcastle Upon Tyne | 5A Type IIA 15A Type IIA 30A Type IIA 45A Type IIA 60A Type IIA 80A Type IIA 20A Type IIB 60A Type IIB 80A Type IIB 100A Type IIB |
| Street Lighting Cut-Out Fuse | | BS7654 | Cooper Bussman – Bourton On Wold, Leics Lawson Fuses Ltd, Ponteland, Newcastle Upon Tyne | 6A 10A 16A 20A 25A |

| Component | WPD Specification | National Specification | Manufacturer | Size / Type |
|----------------------------------|--------------------------|---|--|--|
| 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 |
| Multi-service Distribution Board | U/GD 12 ver 1 | | Ryefield Engineering Co Ltd, Cheshunt | 9 Way 12 Way 18 Way 24 Way 35 Way |
| Underground Service Cable | | ENATS 09-07 Plain Conc BS 7870 Part 3.11 BS 7870 Part 3.21 Split | Tratos Cables | 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 |
| Underground Service Cable LSF | | BS 7870 Part 3 | Waskonig & Walter | 25mm 1PH Split CU Conc 25mm 3PH CU Split Conc |
| Joint Resin | | HD 631.2 | Tyco | 3 Pt Poly 1.3L 3 Pt Poly 5L 3 Pt Poly 6.5L 3 Pt Poly 3.2L |

| Component | WPD Specification | National Specification | Manufacturer | Size / Type |
|---|-------------------|-------------------------------|--|---|
| Connectors LV Mains joints | | IEC 61238-1 | Tyco (B&H) (Note - former CN areas – see section 7) | 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) (Note - former CN areas – see section 7) | BTC – straight BTCL 6-130W – straight & branch neutrals SSIPC |
| Connectors LV terminations | | IEC 61238-1 | Tyco (B&H) (Note - former CN areas – see section 7) | LVET lugs BET lugs ML lugs |
| LV Mains Cable 3 & 4 Core (Normal) | | BS 7870 Part 3-40 | Prysmian Tratos cables | 300mm ² Wavecon 185mm ² Wavecon 95mm ² Wavecon |
| LV Mains Cable 3 & 4 Core (LSF) | | BS 7870 Part 3-50 | Waskonig & Walter | 300mm ² Wavecon 185mm ² Wavecon 95mm ² Wavecon |
| LV Cable Joints (Complete) | | Nat ER C81/3 or BS EN50393 | Tyco (B&H) (Note - former CN areas – see section 7) | Various depending on cable being jointed |
| 11kV Compound - Jointing Compound | | HD 628 & 629 | Lovink (Note - former CN areas – see section 7) | Lovisil |
| 11kV EPR Single Core Cable Cu | | BS 7870 Part 4.10 | Prysmian Cables (Note - former CN areas – see section 7) | 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 Part 4.10 | Prysmian Cables (Note - former CN areas – see section 7) | 95 mm ² |

| Component | WPD Specification | National Specification | Manufacturer | Size / Type |
|-------------------------------------|-------------------|------------------------|--|---|
| 11kV EPR Triplex solid Al conductor | | BS 7870 Part 4.10 | Prysmain Cables (Note - former CN areas – see section 7) | 95 mm ² 185 mm ² 300 mm ² |
| Connectors 11kV terminations | | IEC 61238-1 | Tyco (B&H) (Note - former CN areas – see section 7) | BAH-02-403-0127 BAH-02-403-0100 BAH-02-403-0128 BAH-02-403-0129 VETB33-12UTB VETC330HUTB VETB28-12/16 UTB VETB28-OHUTB BET lugs |
| Connectors 11kV | | IEC 61238-1 | Tyco (B&H) (Note - former CN areas – see section 7) | MSFE-0009-0035/0185 MSFE-0010-0035/0300 BAH-02-211-0098 VTPC36UTB HVBRM18SPUTC HVBRM22SPUTC HVBRM18SOUTC HVBRM22SOUTC |
| 11kV Terminations Indoor & Outdoor | | HD 628 & HD 629 | 3M QT3(Note - former CN areas – see section 7) | 95 to 300 mm ² QT 111 Indoor & QT111 Outdoor |
| 11kV Straight Joints | | HD 628 & HD 629 | Lovink (Note - former CN areas – see section 7) | K85 - 95 to 185 mm ² K95 - 185 to 300 mm ² |
| 11kV Stop Ends | | HD 628 & HD 629 | Lovink (Note - former CN areas – see section 7) | K85 - 95 to 185 mm ² K95 - 185 to 300 mm ² |
| 11kV Live Break Elbows | | HD 628 | Nexans (Euromold) | 95 mm ² |
| 11kV Branch Joints | | HD 628 & HD 629 | Lovink(Note - former CN areas – see section 7) | 95 to 185 mm ² 185 to 300 mm ² |
| 11kV Loop Joints | | HD 628 & HD 629 | Lovink (Note - former CN areas – see section 7) | 95 to 185 mm ² 185 to 300mm ² |
| 11kV Separable 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 |

7.0 Variations applicable to former Central Network East & West Midlands only

LV & HV Jointing

The CN Jointing Manual contains general requirements which must be read in conjunction with the jointing instructions provided in the jointing packs supplied to the former Central Networks by Tyco and Sicame.

<http://www.eon-uk.com/distribution/cabledocs.aspx>

LV joints and terminations shall normally be made 'colour true'.

Much of the former Central Networks' LV network runs at National Standard phasing. However, some isolated parts of the LV network may have non-standard phase rotation or may be 30 degrees displaced from National Standard due to historical crosses on the local HV system. There are also many instances of HV & LV cores being crossed and/or rolled between switchgear, transformer and LV feeder pillar in existing substations.

Where the project requires LV interconnection it may be necessary to cross the LV connections in the substation LV feeder pillar. Where a local 30 degree displacement exists the HV busbars of the substation may have to be commissioned non-standard. The Applicant should seek advice from WPD (Midlands) in these cases.

Most HV projects will require that a National Standard reference be established at an adjacent substation prior to jointing in the new substation. The Applicant should seek advice from WPD (Midlands) in all cases.

HV cable terminations shall not be physically crossed inside cable boxes under any circumstances. The correct phasing of the busbars shall be established by crossing cores in joints where necessary.

The colour conventions commonly encountered in the former Central Networks include, but are not limited to:

| National Standard | Plant | | | New cables | | | Examples of local historical colours | |
|-------------------|-------|----|----------|-------------|------------------|------------------------------|--------------------------------------|-----------------------------|
| | HV | LV | HV or LV | Core Number | British Standard | Harmonised European Standard | PILSTA PILSWA | Leicester plain lead cables |
| L1 | A | a | U | 1 | Red | Brown | Red | Brown |
| L3 | B | b | V | 2 | Yellow | Black | Yellow or White | Green |
| L3 | C | c | W | 3 | Blue | Grey | Blue | Red |
| N | | n | N | 0 | Black | Blue | Green or Black | Blue |

The Applicant must not assume that any marking on cables or plant represent National Standard phases. *Significant parts of Central Networks system has non-standard phasing as a legacy of individual electric power undertaking's local standards inherited at nationalisation in 1947.*

| Materials & Suppliers – former Central Networks areas | | |
|--|----------------------|--|
| Item | Specification | Manufacturer |
| HV Cable | HD 620 IEC 60502 | Prysmian, Wrexham Copper Cable Company, Coalville, Leics Tratos, Italy General Cable, Spain |
| LV Cable | BS 7870 Part 3.4 | Prysmian, Wrexham Copper Cable Company, Coalville, Leics Tratos, Italy |
| Service cable | ENATS 09-07 | Prysmian, Wrexham Copper Cable Company, Coalville, Leics |
| HV Cable Joints | BS 7888 | Tyco, Swindon |
| LV Cable Joints | BS 7888 | Service joints - Sicame Electrical Developments, Holmfirth, West Yorks LV Mains joints - Tyco, Swindon |
| Link Disconnection Boxes | | Tyco (2 or 4 way) Insulated Type/Resin Filled |