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## **ENGINEERING RECOMMENDATION G81**

Framework for materials specification for Greenfield low voltage housing estate underground network installations, associated new HV/LV distribution substations, industrial and commercial underground connected loads up to 20 kV.

**Part 2: Materials Specification**

**Appendix A - CE Electric specific**

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## 1 High Voltage Cable

Item	National Specification	Agreed Supplier(s)	Comment
11,000 Volt XLPE 95mm <sup>2</sup> Cable Triplex formation	ENA TS 09-12 Issue 2 1990	Copper Cable Co	95mm <sup>2</sup> mainly used for local switchgear to transformer loop 95mm <sup>2</sup> used in NEDL area only
11,000 Volt XLPE 185mm <sup>2</sup> Cable Triplex formation			
11,000 Volt XLPE 300mm <sup>2</sup> Cable Triplex formation			
22,000 Volt XLPE 95mm <sup>2</sup> Cable Triplex formation	BS 7870- 4.10:1999 & ENA TS 09-17 Issue 2 1995		95mm <sup>2</sup> mainly used for local switchgear to transformer loop 95mm <sup>2</sup> used in NEDL area only
22,000 Volt XLPE 185mm <sup>2</sup> Cable Triplex formation			
11,000 Volt PICAS three core cable 185mm <sup>2</sup>	ENA TS 09-12 Issue 2 1990		Pirelli
11,000 Volt PICAS three core cable 300mm <sup>2</sup>			

## 2 High Voltage Cable Accessories

### 2.1 Non Compound Filled Terminations

Item	National Specification	Agreed Supplier(s)	Comment
11,000 Volt mechanical / compression fittings	ER C.79	Tyco B&H	
22,000 Volt mechanical / compression fittings	ER C.79	Tyco B&H	
11,000 Volt termination	ER C.89	Tyco Raychem	
11,000 Volt 250-Amp Non-load Break Elbow Termination	ER C.89	Tyco Raychem	Complete termination including mechanical connector for cable size up to 185mm
22,000 Volt 250-Amp Non-load Break Elbow Termination	ER C.89	Tyco Raychem	Complete termination including mechanical connector for cable size up to 95mm
22,000 Volt 630Amp Disconnectable Elbow		Tyco	Currently only used on ABB switchgear. Termination including mechanical connector for cable size 95mm
11,000 Volts Indoor Cold Applied Termination		3M	See Table 2: For manufactures part numbers and cable range
22,000 Volts Indoor Cold Applied Termination		3M	See Table 2: For manufactures part numbers and cable range
11,000 Volts Outdoor Cold Applied Termination		3M	See Table 2: For manufactures part numbers and cable range
22,000 Volts Outdoor Cold Applied Termination		3M	See Table 2: For manufactures part numbers and cable range

**2.2 Joints**

Item	National Specification	Agreed Supplier(s)	Comment
11,000 Volt three core Straight Joint	ER C90/1	Tyco (Raychem)	Heat shrink joints with Tyco B&H connectors included within kit
11,000 Volt Transition Straight Joint ( 3-core to Single core XLPE)			
11,000 Volt three-core Stop end			
11,000 Volt Branch Joint ( 3-core Main - S/ core XLPE Branch)			
22,000 Volt three core Straight Joint			
22,000 Volt Transition Straight Joint ( 3-core to Single core XLPE)			
22,000 Volt three-core Stop end			
11,000 Volt Single Core XLPE Straight Joint	ER C90/1	Pirelli	Cold Applied Joints with Pirelli connectors (Connectors included within joint kit) See Table 3: For manufactures reference numbers
11,000 Volt Single Core XLPE Branch Joint			
11,000 Volt Single Core XLPE Stop End			
22,000 Volt Single Core XLPE Straight Joint			
22,000 Volt Single Core XLPE Branch Joint			
22,000 Volt Single Core XLPE Stop End			

### 2.3 Duct and Cable Warning Tape

Item	National Specification	Agreed Supplier(s)	Comment
Black corrugated smooth internal diameter 125mm	ENA TS 12-24	Jewson	
Plastic cable cover tape	ENA TS 12-23	Hepworth	
Black Rigiduct, internal diameter 100mm, 150mm	ENA TS 12-24	Jewson	
Plastic cable tile tape	ENA TS 12-23	Boddingtons Centraforce	

## 3 Substation Buildings, Plant and Equipment

### 3.1 Substation Buildings

Item	NEDL Specification	National Specification	Agreed Supplier(s)	Comment
11,000 Volt Type I	NEDL Drwg 1.02.107.0018 *		Freedom	
11,000 Volt Type II	NEDL Drwg 1.02.107.0013 *			
11,000 Volt Type III	NEDL Drwg 1.02.107.0019 *			
22,000 Volt Type I	NEDL Drwg 1.02.107.0018 *			
22,000 Volt Type II	NEDL Drwg 1.02.107.0013 *			
22,000 Volt Type III	NEDL Drwg 1.02.107.0019 *			
Item	YEDL Specification	National Specification	Agreed Supplier(s)	Comment
11,000 Volt Standard UDE Enclosure	Drawings will be provided on request			

\* Drawings provided on request

### 3.2 Switchgear

Item	National Specification	Agreed Supplier(s)	Comment
11,000 Volt non extensible RMU	ENA TS 41-36	Schneider Merlin Gerin 11kV Type RN2c	21kA rating with: (a) Arc deflection chute (b) Talus CTs on LHS Switch (c) Motorisation auxiliary switch & terminal kit on LHS Switch (d) 3 hole, split, aluminium gland plate (e) Circuit name labels on feeder switch cable box covers  Also if HV customer supply involved: (f) 30V DC Shunt Trip coil (g) VPIS phasing neons
11,000 Volt extensible RMU		Schneider Merlin Gerin 11kV Type RE2c	
11,000 Volt extensible Switchgear		Schneider Merlin Gerin Ringmaster Extensible Range	21kA rating with: (a) Arc relief panel in lid, where unit is to be less than 1m from side wall/obstacle
11,000 Volt Metering Unit		Schneider Merlin Gerin MU2	To be fitted with 2A fuses
22,000 Volt non extensible RMU (NEDL Only)		ABB Safering	With full remote control/motorisation wiring on LHS switch.
22,000 Volt extensible switchgear (NEDL Only)		ABB Safering Plus	None
22,000 Volt Metering Unit (NEDL Only)		ABB Safering Plus	None
Fault Passage Indicator (YEDL Only)	ENA TS 48-2	Nortech SPi-OCEF 110V Version	One fitted as standard, on LHS feeder switch, at all S/S.  Requires 110V supply  Uses Talus CTs.
Fault Passage Indicator (NEDL 11kV Only)		Bowdens EEFI/NB2-LV	One fitted as standard on LHS feeder switch at all S/S.  Requires special CT which uses the passage of fault current to charge the power capacitor in the relay.
Fault Passage Indicator (NEDL 20kV Only)		Nortech SPi-OCEF/2 240V Version	One fitted as standard on LHS feeder switch at all S/S.

### 3.3 Transformers

Item	National Specification	Agreed Supplier(s)	Comment
<p>11,000/433 Volt Cable Connected and 20,000/433 Volt Cable Connected (NEDL only)</p>	<p>ENA TS 35-1</p>	<p>NEDL only: EFACEC</p> <p>YEDL only: Schneider</p>	<p>315KVA, 500KVA, 800KVA, 1.0MVA and 1.6MVA ratings</p> <p>Ground mounted</p> <p>Transformers in substations located within the fabric of residential premises shall be MIDEL filled and clearly labelled as being MIDEL filled.</p>
<p>11,000/433 Volt Close Coupled and 20,000/433 Volt Close Coupled (NEDL only)</p>		<p>NEDL only: Alstom</p> <p>YEDL only: Schneider</p>	<p>315KVA, 500KVA, 800KVA, 1.0MVA and 1.6MVA ratings</p> <p>Ground mounted</p> <p>The preferred option for 11kV is a UDE with close coupled HV &amp; LV switchgear</p> <p>Transformers in substations located within the fabric of residential premises shall be MIDEL filled and clearly labelled as being MIDEL filled.</p>

### 3.4 LV Fuseboards, Cabinets & Pillars

Item	National Specification	Agreed Supplier(s)	Comment
Close coupled fuseboard/cabinet	ENA TS 37-2	Schneider (EMMCO)	Outdoor spec, shrouded LV board/pillar/cabinet with: (a) Tx links & 3, 5 or 7 feeder ways (b) Fixed generator Litton Veam type connections (c) Fused voltage test points, 4mm banana plug, two sets - one on Tx side & one on busbar side of Tx disconnecter
Wall mounted, cable connected, fuseboard/cabinet			On 20kV system (NEDL only) needs busbar phase reversal to suit local phasing.
Free standing, cable connected, fusepillar			

### 3.5 LV ACBs and MCCBs

Item	National Specification	Agreed Supplier(s)	Comment
LV ACB 2500A Outgoing distributor unit	ENA TS 37-2	Schneider Electric (EMMCO)	Used in conjunction with 1.6MVA 11,000/433volt transformer supply to single customer. Close coupled to LV terminals of transformer with metering CT's in cabinet and customers cables connected to outgoing side.
LV ACB 500A Outgoing distributor unit	ENA TS 37-2	Schneider Electric (EMMCO) Masterpact LV ACB with Masterpact 5.0A control unit	In close coupled LV fuse cabinet, with 2 feeder ways. 800A, 1,200A or 1,600A

### 3.6 Fuses

Item	National Specification	Agreed Supplier(s)	Comment
200A, 315A, 400A, 500A or 630A	ENA TS 37-2 Clause 7.1.1 BS 88 Parts 1 and 5	Coopers, Alstom, Lawson Fuses or Brush.	HRC fuses

### 3.7 Earthing

Item	National Specification	Agreed Supplier(s)	Comment
Earth plate	ENA TS 43-94	W J Furse	
Copper Bonded Steel Earth Rod (Extensible Type)			
Earth Rod Coupling			
Steel Driving Stud			
Earth Rod Connector Saddle Clamp Type or "U" bolted (Bulldog Grip) Type			
95mm <sup>2</sup> PVC covered Copper conductor.	BS6360 BS6004 BS6346	BICC, AEI, Pirelli	
Mechanical Cable Lug		Sicame	

### 3.8 Substation Ancillary Equipment

Rubber Mat	BS 921	Rayflex rubber, MacLellan Rubber.	
<b>Item</b>	<b>National Specification</b>	<b>Agreed Supplier(s)</b>	<b>Comment</b>
Electric Shock Treatment Notice			All Substation Locks and Labels will be supplied by NEDL/YEDL and will be included in the non-contestable costs.
Substation Diagram			
Substation Name and Property plate			
Internal Substation Name Plate			
Safety Sign			
Danger Notice			
Caution Notice			
Safety Padlock			
Fire Instruction Notice			
Door Padlock			
Cylinder Rim Lock			
Circuit Name Plates			
Rubber Mat	BS 921	Rayflex Rubber, MacLellan Rubber.	

## 4 Low Voltage Underground Distribution Networks

### 4.1 Cables

Item	National Specification	Agreed Supplier(s)	Comment
95mm <sup>2</sup> Waveform 3-Core Al/Cu	BS 7870: Section 3.4 :1996 & ENA TS 09-9	Pirelli	
185mm <sup>2</sup> Waveform 3-Core Al/Cu			
300mm <sup>2</sup> Waveform 3-Core Al/Cu			
480mm <sup>2</sup> XLPE single core			
800mm <sup>2</sup> XLPE Single Core	BS. 5467	Pirelli	

Item	National Specification	Agreed Supplier(s)	Comment
185mm <sup>2</sup> XLPE LSF		Copper Cable Co	All rising mains in buildings shall be LSF cables.

#### 4.2 LV Joints

Item	National Specification	Agreed Supplier(s)	Comment
Straight Joint	ER C81 & C79	SICAME	Only combinations of connectors, joint shells, etc as defined in our standard kits are acceptable.
Breeches Joint		See Table 4: For List Of Kits Common To YEDL and NEDL	
Stop Ends			
Pole Terminations			
Joint Resin	ER C81	Pirelli Two Part Resin	

#### 4.3 Link Boxes

Item	National Specification	Agreed Supplier(s)	Comment
2-Way Link Box		Tyco	
4-Way Link Box			

## 5 Low Voltage Underground Services

### 5.1 Cables

Item	National Specification	Agreed Supplier(s)	Comment
25mm <sup>2</sup> 1 Core CNE	BS 7870: Section 3.1 :1996 & ENA TS 09-7	Wessel	
35mm <sup>2</sup> 1 Core CNE			
35mm <sup>2</sup> 3 Core CNE			
25mm <sup>2</sup> 1 Core SNE		ABB Cables Ltd	
35mm <sup>2</sup> 1 Core SNE			

## 5.2 Joints and Terminations

Item	National Specification	Agreed Supplier(s)	Comment
Mains/Service Breeches Joints (up to 4 - Services)	ER C8 1/3 ER C79 BS 4579	SICAME	Only combinations of connectors, joint shells, etc as defined in our standard kits are acceptable.
Service Straight Joints	BS5378:1980 BS6910:1988	See Table 4: for separate list of kit lists – common to YEDL and NEDL	
Service Pot End	ENA TS 09-11		
100A Single Phase Service Cut-out	BS 7657:1993 ENA TS 12-10 BS 7654	W Lucy, Henley	
100A Three Phase Service Cut-out			
100A Single Phase Service Cut-out with Integral Sealing Chamber			
100A Three Phase Service Cut-out With Integral Sealing Chamber			
25Amp Street Lighting Cut-out (Double Pole)		W Lucy & Tofco Ltd	
Industrial Service Unit		Schneider (EMMCO)	Used for LV supplies above 65KVA (Minimum cable size to be 95 mm <sup>2</sup> Wf Al/Cu)
200Amp Heavy Duty Cut-out	ENA TS 12-10 BS 7654	W Lucy	Used for LV supplies (Maximum cable size 95 mm <sup>2</sup> WNE Al/Cu)
300Amp Heavy Duty Cut-out			Used for LV supplies (for cable size up to 185 mm <sup>2</sup> WNE Al/Cu)
500Amp Heavy Duty Cut-out			Used for LV supplies (for cable size up to 300 mm <sup>2</sup> WNE Al/Cu)
Multi-way Service Distribution Unit		Bemco	Number of fuseways as required for development

**5.3 Ducts, Service Tubes and Cabinets**

Item	National Specification	Agreed Supplier(s)	Comment
38mm Service Duct (5m length)	ENA TS 12-24	Jewsons	Manufactured by Polypipe Civils Ltd
38mm Duct Bend			
50mm Service Duct (1.5m length)	ENA TS 12-24 BS 3506		
50mm Duct Bend			
38/50mm Duct Adapter			
125mm Duct (3m length)	ENA TS 12-24		
125mm Duct Bend			
38mm Int. Dia. UPVC Flexi-Duct	ENA TS 12-24		
Entry Pipe (Hockey Stick) 38mm Int. Dia.			
External Meter Cabinet	ENA TS 12-3		
Meterboard Class 'O' Fire Retardant Chipboard	BS 476, Part 6	Wootton & Co. Ltd	Required for Internal Meter Positions 575mm x 375mm Normal Domestic Supplies 650mm x 460mm Poly-Phase Supplies

## 6 Terminations and Joint Part Numbers

### 6.1 Table 2: HV Terminations

Supplier ref. number	Description
92EP621-1-NY43	95mm 11kV Indoor Termination
92EP631-1-NY44	185-300mm 11kV Indoor Termination
92EP641-1-NY45	400mm 11kV Indoor Termination
92EP641-1-NY52	630mm (Copper) 11kV Indoor Termination
92EP621-2-NY46	95mm 11kV Outdoor Termination
92EP631-2-NY47	185 - 300mm Outdoor Termination
93EP620-1-NY74	95 - 185mm 22kV Indoor Termination
93EP620-1-NY75	300mm 22kV Indoor Termination
93EP620-2-NY83	95mm 22kV Outdoor Termination
93EP620-2-NY84	185-300mm 22kV Outdoor Termination
92EE717-1-NY57	11kV Cold Applied Boot Kit

**6.2 Table 3: HV Joints (Cold Applied)**

Supplier ref. number	Description	Voltage	Range
EJ-SXU-12-A-NY	Single Core Polymeric Straight Joint	11kV	95mm & 185mm Solid Aluminium Core
EJ-SXU-12/24-B-NY	Single Core Polymeric Straight Joint	11kV or 20kV	185mm & 300mm Solid Aluminium Core or 185mm Solid Aluminium Core or 150mm Stranded Aluminium.
EJ-SXUB-12-A-NY	Single Core Polymeric Branch Joint	11kV	95mm & 185mm Solid Aluminium Core
EJ-SXUB-12/24-B-NY	Single Core Polymeric Branch Joint	11kV or 20kV	185mm & 300mm Solid Aluminium Core or 185mm Solid Aluminium Core or 150mm Stranded Aluminium.
EJ-SXUSE-12/24-NY	Single Core Polymeric Stop-End Module Kit	11kV or 20kV	Used in conjunction with EJ-SXU-12-A-NY & EJ-SXU-12/24-B-NY
EJ-SXUL-12/24-NY	Single Core Loop Joint Module Kit	11kV or 20kV	Used in conjunction with EJ-SXUB-12-A-NY or EJ-SXUB-12/24-B-NY
EJ-SXUBK-12/24-B-NY	95mm Single Core Polymeric Build-up Module Kit	11kV or 20kV	Used in conjunction with EJ-SXU-12/24-B-NY

6.3 Table 4: LV Service Joints Heatshrink and Resin Filled

Supplier ref. number	Description
SJ1/A/NY	Single Phase CNE PVC/PVC Straight Joint Kit (Shells)
PPT1/NY	25sqmm PILC Pole Termination.
PPT2/NY	95sqmm PILC Pole Termination.
PPT3/NY	185sqmm PILC Pole Termination
WPT1/NY	120-185sqmm Waveform Pole Termination.
WPT2/NY	300sqmm Waveform Pole Termination.
WPT3/NY	Pole Termination: 3-Phase CNE Up To 35mm.
SE1/NY	Pot End: Service: Heatshrink: Single Phase CNE/SNE Up to 35mm.
SE2/NY	Pot End: Service: Heatshrink: Single Phase PILC.
SE3/NY	Pot End: Service: Heatshrink: 3 Phase CNE up to 35mm.
SE4/NY	Pot End: Service: Heatshrink: 3 Phase PILC.
SE5/NY	Pot End: Heatshrink: 70 - 185mm Waveform.
SE6/NY	Pot End: Heatshrink: 300mm Waveform.
SE7/NY	Pot End: Mains: Heatshrink: 50 - 95mm (.06 - .15in) PILC.
SE8/NY	Pot End: Mains: Heatshrink: 120 - 300mm (.2 - .5in) PILC.
SE9/NY	Pot End: Mains: Heatshrink: 70 - 120mm CONSAC.
SE10/NY	Pot End: Mains: Heatshrink: 150 - 300mm CONSAC.
SJ1/NY	Straight Joint: Heatshrink: Single Phase CNE - CNE Up to 35mm.
SJ2/NY	Straight Joint: Heatshrink: Single Phase SNE - SNE Up to 35mm.
SJ3/NY	Straight Joint: Heatshrink: Three Phase CNE - CNE Up To 35mm.
SJ4/NY	Straight Joint: Heatshrink: Single Phase Up To 35mm CNE - PILC (up to 0.06in).
SJ5/NY	Straight Joint: Heatshrink: Single Phase SNE - PILC up to 35mm.
SJ6/NY	Straight Joint: Heatshrink: Three Phase Up To 35mm CNE - PILC (0.06in).
SJ7/NY	Branch Joint: Single Phase CNE Main - CNE Branch up to 35mm.
SJ8/NY	Branch Joint: Single Phase SNE Main - SNE Branch up to 35mm.
SJ9/NY	Branch Joint: Three Phase CNE Main - Three Phase CNE Branch: Up to 35mm.
SJ10/NY	Branch Joint: Single Phase: PILC Main - CNE Branch: up to 35mm.
SJ12/NY	Branch Joint: Three Phase PILC Main - 3 Phase CNE Branch: Up To 35mm.
SMJ95W/NY	Straight Joint Waveform/Waveform up to 95mm
SMJ185W/NY	Straight joint Waveform/Waveform up to 185mm
SMJ300W/NY	Straight Joint Waveform/Waveform up to 300mm
SMJ95T/NY	Transition Straight Joint Waveform/PILC up to 95mm
SMJ185T/NY	Transition Straight Joint Waveform/PILC up to 185mm
SMJ300T/NY	Transition Straight Joint Waveform/PILC up to 300mm
SMJ95CT/NY	Transition Straight Joint Waveform/CONSAC up to 95mm
SMJ185CT/NY	Transition Straight Joint Waveform/CONSAC up to 185mm
SMJ300CT/NY	Transition Straight Joint Waveform/CONSAC up to 300mm
BMJ95W/NY	Mains Branch Joint Waveform/Waveform up to 95mm
BMJ185W/NY	Mains Branch Joint Waveform/Waveform up to 185mm
BMJ300AW/NY	Mains Branch Joint Waveform/Waveform up to 300mm
BMJ300W/NY	Mains Branch Joint Waveform/Waveform 300mm / 300mm
BMJ95T/NY	Transition Branch Joint Waveform/PILC up to 95mm
BMJ185T/NY	Transition Branch Joint Waveform/PILC up to 185mm
BMJ300T/NY	Transition Branch Joint Waveform/PILC up to 300mm
BMJ185CT/NY	Transition Straight Joint Waveform 95-185mm / CONSAC up to 185mm
BMJ300CT/NY	Transition Straight Joint Waveform 95-300mm / CONSAC up to 1300mm
SMJ300CT/NY	Transition Straight Joint Waveform/CONSAC up to 300mm
MSJ95W/NY	Mains Service Branch Jt.95mm Waveform With up to 4 x 1 Ph Services 35mm
MSJ185W/NY	Mains Service Branch Jt.185mm Waveform With up to 4 x 1 Ph Services 35mm
MSJ300W/NY	Mains Service Branch Jt.300mm Waveform With up to 4 x 1 Ph Services 35mm

**Engineering Recommendation G81:Part 2**  
**APPENDIX A**

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	Pole Termination: 3-Phase CNE up to 35mm.
168358	Transitional Connector
171647	Stop Connector 35mm
174490	Single Phase SNE - SNE Breeches Joint for cables up to 35mm
174505	Straight Joint: Heatshrink: Single Phase CNE-CNE/SNE Up to 35mm