

Code of Practice 625

Issue 6 June 2024

Network Diagrams



Amendment Summary

ISSUE NO. DATE	DESCRIPTION
Issue 5 July 2021	New Template applied and minor change in Appendix D to cover where a Load Break Switch with Sectionalising function is being used in Non-Automatic mode to create an alternative to an ABSD N/A to be applied to the diagrams. Prepared by: Matthew Kayes Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, Engineering and Technical Director
Issue 6 June 2024	Changed Central Engineering Services Manager to Head of Asset Management and Policy and Implementation Manager to Head of Policy and Standards in Section 2. Addition of new symbology in Appendix E for ReLink linkbox. Reformatting of Appendices A to E into tables, with no changes. Prepared by: Paul Ward Approved by: Policy Approval Panel and signed on its behalf by Paul Turner, PAP Chairperson

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1 Scope

This Code of Practice (CP) defines responsibilities for the preparation and maintenance of and the symbols and information to be recorded on all network diagrams representing circuits owned and operated by Electricity North West Limited and applies to all voltages up to 132kV.

Non-standard symbols are included to aid the understanding of existing diagrams.

2 General

The Head of Asset Management shall be responsible for the maintenance of accurate network diagrams. In practice, this work is carried out by Data Management.

Additional symbols may be added only with the written agreement of the Head of Policy & Standards.

LV Operational Diagrams shall be semi-geographic. Appropriate parts of the 11 and 6.6kV overhead distribution networks may also be semi-geographic. Otherwise, straight-line busbar to busbar operational diagrams shall be used for all voltages.

All diagrams, unless specified otherwise, shall utilise black drawings on a white background.

132/33/11/6.6kV network operational diagrams and 132kV planning diagrams shall be amended only following the receipt of a correctly completed System Amendment Request form. This requirement is described in CP606, Procedure G18.

All network diagrams shall be allocated a unique drawing reference.

All network diagrams shall identify the latest revision date and 132/33kV diagrams shall describe the revisions made.

Non-standard symbols, which may be found on existing operational diagrams, are shown in [Appendix F](#). Non-standard symbols shall not be used for the creation of new, or the updating of existing, diagrams.

The sample diagrams contained in the Appendices are extracts of existing diagrams and do not necessarily use the correct symbols as described in this CP or numbering and nomenclature as described in CP615. They are provided to give the general layout of each diagram type.

3 Diagram Types

3.1 Control 2000 Diagrams

These are used within the Control Room Management System. The symbols used are described in [Appendix S](#). These symbols are designed for use on display screens, where the black symbols shown in this CP appear in colour on a black background.

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3.2 132kV Diagrams

The following types of diagram shall be maintained and kept up to-date:

- Operational Diagram
- 'Y' Diagrams
- Protection Diagram
- Intertripping Diagram
- Auto-Reclose Diagram
- Tower Line Circuit Colour Diagram
- 132kV Planning Diagram

3.3 33kV Diagrams

The following types of diagram shall be maintained and kept up to-date:

- Operational Diagram
- Intertripping Diagram
- Tower Line Circuit Colour Diagram

3.4 11/6.6kV Diagrams

The following types of diagram shall be maintained and kept up to-date:

- Operational Diagram

3.5 LV Network Operation Diagram

A diagram shall be maintained and kept up to-date that shows the LV network arrangement including substations, link boxes, feeder pillars and the interconnecting lines and cables.

3.6 Phasing Diagram

A phasing diagram shall be maintained and kept up to-date showing phasing arrangements.

3.7 Final Metering Scheme (FMS) Diagram

A diagram shall be maintained and kept up to-date that shows FMS locations within the Electricity North West Limited Distribution Services Area.

3.8 Diagrams for Planning Purposes

For planning purposes geographical data shall be extracted from IPSA (132kV), DiNIS (33/11/6.6kV) or the GIS records and shall be used in conjunction with the various relevant diagrams described in this CP.

4 Network Diagram Conventions

4.1 132kV Diagrams

4.1.1 Operational Diagrams

132kV operational diagrams shall show the electrical connectivity between 132kV cables, lines, plant and busbars, including connections with equipment at other voltages.

The approved symbols are as shown in [Appendix A](#).

The following colours, on a white background, shall be used:

- Green - 132kV assets owned by ENW
- Blue - Assets owned by private generators
- Red - Other 132kV assets

The following information shall be recorded on the diagrams:

Lines & cables	Numbering of all plant
Line numbers	Voltage of busbars
Feeder numbers	Busbar isolators
Tower line names eg AB Line	Circuit breakers
Key towers and their Nos.	Line & transformer isolators (manual/motor)
River crossings	Earth switches
Substation names	Fault throwers
Supergrid & Bulk Supply Point transformers	Normally open points
Transformer ratings	Operational limitations
Reactors	Network boundaries
Earthing transformers	Third-party incoming switchgear
Earthing resistors	COMA Sites
Voltage transformers (wound & capacitor types)	

A sample 132kV diagram is shown in [Appendix G](#).

4.1.2 'Y' Diagrams

'Y' diagrams shall show the physical electrical plant layout at each Grid Supply Point (GSP) and each Bulk Supply Point (BSP) and may include 400, 275, 132, 33, 25, 11 and 6.6kV plant as appropriate.

'Y' diagrams shall utilise the symbols shown in [Appendix B](#).

A sample 'Y' Diagram is shown in [Appendix H](#).

4.1.3 Protection Diagrams

Protection diagrams shall identify the type of protection used on transformers and feeders and show the numbers of the controlling circuit breakers.

A sample protection diagram is shown in [Appendix I](#).

4.1.4 Intertripping Diagrams

Intertripping diagrams shall identify the following:

- Substation names
- Feeders and controlling feeder circuit breaker numbers
- Type of intertripping applied to each feeder
- Direction of intertripping

A database shall be maintained to show all rented pilot numbers.

The diagram shall use the following colours and line types:

- | | | | | |
|---|----------------------------------|--------|---|---|
| • | Hard-wired intertripping | Yellow | { |  |
| • | Plain intertripping | Blue | |  |
| • | Pilot wires crossed for security | Green | |  |
| • | | Red | |  |

A sample intertripping diagram is shown in [Appendix J](#).

4.1.5 Auto-Reclose Diagram

The auto-reclose diagram shall identify the following:

- Substation names
- Feeders and controlling feeder circuit breaker numbers
- Auto-reclose times
- Direction of 'dead line' charging reversion where fitted

A sample auto-reclose diagram is shown in [Appendix K](#).

4.1.6 Tower Line Circuit Colours

Tower-line circuit identification colour diagrams shall identify:

- All 132kV tower lines
- All substations and feeder numbers
- Circuit colours against each circuit
- A table showing:
 - Line and tower numbers
 - Circuit colours
 - Tower 'Flag Key' code

The circuit colours shall be denoted by:

R	=	Red
B	=	Blue
G	=	Green
Y	=	Yellow
V	=	Violet
BK	=	Black
W	=	White
O	=	Orange

A sample of a 132kV tower line circuit identification colour diagram is shown in [Appendix L](#).

4.1.7 132kV Planning Diagram

4.1.7.2 132kV Planning Diagrams shall show the Electrical Connectivity between 132kV Cables, Lines, Plant and Busbars

Planning diagrams shall identify the following:

- Substation names;
- Circuit and transformer numbering;
- Significant tower numbers;
- Circuit lengths, including breakdown by conductor or cable size and type.
- Transformer ratings

A sample of a 132kV planning diagram is shown in [Appendix M](#).

- Colour coding of the 132kV planning diagrams is as per [4.1.1](#)

4.2 33kV Diagrams

4.2.1 Operational Diagrams

33kV operational diagrams shall show the electrical connectivity between 33kV cables, lines, plant and busbars, including connections with equipment at other voltages.

The approved symbols are as shown in [Appendix C](#).

The following information shall be recorded on the diagram:

Lines & cables	Circuit breakers
Circuit summer and winter rating	Isolators (manual/motor/spring)
Feeder numbers	Earth switches
Key pole Nos.	Fault throwers
Substation names	Normally open points
Primary transformers	Auto-reclose
Transformer ratings & voltage	Auto-changeover
Reactors	Network boundaries
Earthing transformers	Operational limitations
Earthing resistors	Third-party incoming switchgear
Voltage transformers	COMA Sites

A sample 33kV Operation diagram is shown in [Appendix N](#).

4.2.2 Intertripping Diagram

Intertripping diagrams shall identify the following:

- Substation names
- Feeders and controlling feeder circuit breaker numbers
- Type of intertripping applied to each feeder
- Direction of intertripping

A database shall be maintained to show all rented pilot numbers.

The 33kV diagram shall be similar to the example 132kV Intertripping Diagram shown in [Appendix J](#).

4.2.3 Tower Line Circuit Colours

Tower line circuit identification colour diagrams shall identify:

- All 33kV tower lines
- All substations and feeder numbers
- Circuit colours against each feeder
- A table showing:
 - Line and Tower numbers
 - Circuit colours
 - Tower 'Flag Key' code

The circuit colours shall be denoted by:

R	=	Red
B	=	Blue
G	=	Green
Y	=	Yellow
V	=	Violet
BK	=	Black
W	=	White
O	=	Orange

The 33kV diagram shall be similar to the example 132kV tower line circuit identification colour diagram shown in [Appendix L](#).

4.3 11/6.6kV Diagrams

11/6.6kV operational diagrams shall show the electrical connectivity between 11/6.6kV cables, lines, plant and busbars, including connections with equipment at other voltages.

The approved symbols are as shown in [Appendix D](#). Where non-standard symbols have been used, approved symbols shall be substituted whenever diagram amendments are made.

The following information shall be recorded on the diagram:

Lines & cables	Pole-mounted transformers with ratings
Line & cable conductor sizes	Pole-mounted fuses
Feeder numbers	Pole-mounted auto-sectionalising links
Key pole Nos.	Pole-mounted links
Primary transformers & secondary voltage (11kV or 6.6kV)	Normally open points
Substation names	Network boundaries
Substation plant references	Operational limitations
Distribution transformers & ratings	SF6
Earthing transformers	Earth-fault indicators
Earthing resistors	SEF protection
Reactors	Live-line protection
Circuit breakers	Auto-reclose
Isolators	Remote Control
Earth switches	Automatic restoration schemes
Fault throwers	Third-party's incoming switchgear
Pole-mounted switch ratings	COMA sites

A sample 11/6.6kV operational diagram is shown in [Appendix O](#).

4.4 LV Operational Diagram

A semi-geographical style of diagram shall be used at a normal viewing scale of 1/2500.

Only the symbols described in [Appendix E](#) may be used.

Services shall not be shown on the diagram; only mains. For this purpose, the following definitions apply to underground cables, overhead lines and mural wiring:

A main:

- (a) Connects more than 4 customers; or
- (b) Connects 1 customer or a multiple occupancy building directly to a substation; or
- (c) Is laid in a street, public thoroughfare or public land and connects (4 or fewer) customers, those customers being connected to that main via branch connections (e.g. breeches or tee joints or overhead), which are in the street, public thoroughfare or public land.

A service:

Connects up to 4 customers in adjacent properties to a main, any branch connection within such service (e.g., looped cut-out, buried joint, service pole or wall-mounted box or connector) being within the curtilage of one those customers' properties.

NOTE:

- (a) A connection to a multiple occupancy building with more than 4 customers shall be treated as a main and shown on the diagram.
- (b) Street electrical fixtures shall not be regarded as being separate customers and their connections shall not be shown on the diagram.

The following information shall be recorded on the diagram:

Lines and cables	Substation way numbers
Number of cores/wires and conductor sizes	Feeder pillars and way numbers
Transition joints (changes in cable size)	Link boxes and way letters
Key pole Nos.	Normally open points
Street names	Operational limitations
Substations and substation names	Connections to Independent Distribution Network Operators (IDNO).
Pole-mounted transformers	Small-Scale Embedded Generation (SSEG).

At each location where an IDNO network is connected there shall be a note: "IDNO CONNECTED AT THIS LOCATION" and a leader line indicating where the service is connected to an LV distributor.

The symbols used for non-standard pillars and link boxes are shown in [Appendix E](#). Any non-standard link boxes and pillars shall be jointed out or replaced in accordance with EPD283.

Non-standard link boxes and pillars shall be identified on the diagram.

Circuit numbers shall be shown in substations and feeder pillars but to simplify the diagram by the avoidance of crossovers, the circuits may be drawn on the diagram in a different order from the physical arrangement.

Provision of large capacity LV connections requires two or three LV Ways to be ganged together. The relevant Ways and their circuit numbers will be shown as in [Appendix E](#).

Sample Operation Diagrams are shown in [Appendix P](#)

4.5 Distributed Generation (Connected by any Voltage)

Generation shall be indicated on operational diagrams according to the table below.

SITUATION	LV DIAGRAM	HV DIAGRAM	EXAMPLE	AFFECTED NOPS
SSEG	Yes	No		No
Embedded on LV >16A / phase	Yes	Yes	 50 kW GP 12 – NA	No
Embedded on LV >16A / phase multiple connections	Yes	Yes	50 kW GP M – NA	No
Embedded on LV >16A / phase multiple connections	Yes	Yes	 50 kW GP 08 – NA (List GP number that causes restriction)	
Directly connected to S/S	No	Yes	3.5MVA GP 12 – NA Or GP 07	

Embedded on private HV network	No	Yes	 3.5MVA GP 12– NA Or GP 07	 GP 07
--------------------------------	----	-----	--	--

Where Generation is embedded in a customer's system that is incorporated into a diagram, the Generation shall be shown at its actual Point of Supply. Where the customer's system is not shown, the generation symbol shall be shown adjacent to the appropriate busbar with an arrow to the busbar and an appropriate note.

Generation connected to customers' systems that cannot be paralleled with the Network may be shown on Network system diagrams if required. In such cases the symbol above shall be used with the letters SO inside the circle to indicate Standby Only.

The unique reference number shall be marked next to the generator symbol on the diagram.

Where a Generator Procedure describes the restricted operating conditions of a generator, all affected normally open points shall be marked with a purple triangle and the Generator Procedure number.

Where the generator has unrestricted operation, the diagram shall be marked "GP-NA" to indicate no action is required under abnormal network conditions.

4.6 Phasing Diagrams

Samples of phasing diagrams are shown in [Appendix Q](#).

4.7 Final Metering Scheme (FMS)

The FMS diagram shall show the metering locations of all FMS meters, the voltage at which the metering is fitted and indicate relevant plant numbers.

Third party generation shall be clearly identified.

A sample FMS Diagram is shown in [Appendix R](#).

4.8 Diagrams for Planning Purposes

Planning diagrams are intended to provide planners with the geographical relationship of plant and substations.

The primary source of planning diagrams (except for LV networks) shall be IPSA and DiNIS and therefore the symbols used will be based on the tool used.

The symbols used by various design tools are outside of the scope of this document.

5 Documents Referenced

DOCUMENTS REFERENCED	
Distribution Safety Rules	
EPD283	Distribution System Design – 400/230V Network
CP012	GIS
CP606	Operations Manual
CP615	Substation, Circuit & Plant Identification

6 Keywords

System; Diagram; Network; Operation; Record

Appendix A – 132kV Operational Diagram Symbols

Circuit Breakers		Transformers	
Circuit Breaker (CB) (general)		Transformer (3ph)	
Withdrawable CB		Transformer (1ph)	
Withdrawable CB with Transfer Circuit Earthing		Three-winding transformer	
Withdrawable CB with Transfer Circuit & Busbar Earthing		Auto-transformer	
CB Internal Isolation and Earthing		Earthing Transformer with Liquid Earthing Resistor	
Disconnectors		Earthing Transformer with Isolatable Liquid Earthing Resistor	
Manually Operated Disconnector		Shunt Reactor	
Motor Operated Disconnector		Series Reactor	
SF6 Switching Disconnector		Wound Voltage Transformer (VT) 3ph	
SF6 Switching Disconnector with Auto Trip		Wound VT 1ph	
Power Operated Disconnector		Capacitor VT 3ph	
Disconnector (centre break)		Capacitor VT 1ph	
Earthing		Metalclad VT 3ph	
Manually operated earth switch		Withdrawable VT	
Fault thrower		Isolatable VT	
Spark gap		Miscellaneous	
Solid earth		Busbar	
Power operated earth switch		Overhead Line	
Surge diveter		Cable	
Overhead		Cable Sealing End	
Double circuit tower		Through-wall Bushing	
Single circuit tower		Bolted Link	
Junction tower		Metering Point	
Tower with auxiliary arm		Operational Restriction	
Double circuit tower		Normally Open Point	
Wood pole		Free-standing Current Transformer	
		The order of switchgear is shown from the front. If reversed on the diagram, the front is indicated by:	
		Alternator	
		High Accuracy Metering (HAM)	

Appendix B – ‘Y’ Diagram Symbols

Circuit Breakers	
Electrically Closed Oil or Air CB without/with Auto-reclose	
Pneumatically Closed Oil or Air CB without/with Auto-reclose	
Air-blast CB without/with Auto-reclose	
Gas CB without/with Auto-reclose	
Vacuum CB without/with Auto-reclose	
Withdrawable CB	
Withdrawable CB with Transfer Circuit Earthing	
Withdrawable CB with Transfer Circuit & Busbar Earthing	
CB Internal Isolation and Earthing	
SVCB with Integral VT, Busbar Isolation and Circuit Earthing	
Disconnectors	
Manually Operated Disconnector	
Motor Operated Disconnector	
Auto-trip Disconnector	
SF ₆ Switching Disconnector	
SF ₆ Switching Disconnector with Auto Trip	
Earthing	
Manually Operated Earth Switch	
Fault Thrower	
Spark Gap	
Solid Earth	
Earthing Resistor (liquid type)	
Earthing Resistor (metallic grid type)	
Surge diverter	

Transformers	
Bulk Supply Transformer (eg GT1)	
Auto-transformer (eg SGT2)	
Earthing Transformer and liquid NER	
Earthing Transformer and NER with NER Disconnector	
Single-phase Transformer	
Shunt Reactor	
Series Reactor	
Wound Voltage Transformer (VT) 3ph	
Wound VT 1ph	
Capacitor VT 3ph	
Capacitor VT 1ph	
Metalclad VT 3ph	
Withdrawable VT	
Isolatable VT	
Miscellaneous	
Busbar	
Overhead Line or Connection	
Cable	
Cable Sealing End	
Double Circuit Tower	
Single Circuit Tower	
Through-wall Bushing	
Bolted Link	
Metering Point	
Operational Restriction	
Normally Open Point	
Free-standing Current Transformer	
The order of switchgear is shown from the front. If reversed on the diagram, the front is indicated by:	
Alternator	
High Accuracy Metering (HAM)	

Appendix C – 33kV Operational Diagram Symbols

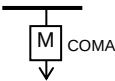
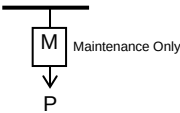
Circuit Breakers	
Circuit Breaker	
Circuit Breaker with Auto-reclose	R
Vacuum Circuit Breaker	V
Gas Circuit Breaker	G
OCB with In-tank Oil Switches (On/Off/Earth)	
Other Switchgear	
Oil switch (On/Off/Earth)	
Oil switch (On/Off/Earth) (Fault-making On/Earth)	
Air-break switch with Earthing Facility	
Manually Operated Disconnecter	
Motor Operated Disconnecter	
Auto-trip Disconnecter	
Spring-opening Disconnecter	
Earthing	
Solid Earth	
Manually Operated Earth Switch	
Rotary Earth Switch	
Fault Thrower	
Spark Gap	
Surge diverter	
Indicates Circuit Breaker Isolated and Closed in Circuit Earth	
Earthing Resistor (liquid type)	
Earthing Resistor (metallic grid type)	

Transformers	
Bulk Supply Transformer	GT1 132/33kV 60MVA
Primary Transformer	T12 33/11kV 11.5/23
Shunt Reactor	
Series Reactor	
Wound Voltage Transformer (VT) 3ph	
Wound VT 1ph	
Metalclad VT 3ph	
Withdrawable Metalclad VT 3ph	
Miscellaneous	
Busbar	
Overhead Line/Cable	
Circuits at Voltages other than 33kV	
Control Boundary	
Sealing End	
Tower	
Pole	
Bolted Link	
Operational Restriction	
Normally Open Point	
Normally Open Point - Auto-close	AC
Normally Open Point - BSP Parallel	G
Normally Open Point - Primary S/S Parallel	P
Air-break Switch Duty Rating	
Operational Restriction (See Distribution Safety Rules EN7)	
Fault Current Indicator	FCI
Alternator	

Appendix D – 11/6.6kV Operational Diagram Symbols

Circuit Breaker			
Circuit Breaker		Travelling Wave System (arrow shows direction)	
Circuit Breaker Description			
Interruption Medium	V	= Vacuum	
	G	= Gas	
Protection	SEF	= Sensitive Earth Fault	
Auto-Reclose and Number of Shots	R	= Single-Shot Auto-Reclose	
	2R	= 2-Shot Auto-Reclose	
	3R	= 3-Shot Auto-Reclose, etc	
Other	NA	= Non-Automatic	
	INT	= Non-Standard Intertripping	
	E	= Integral Earthing	
	ACD	= Control cabinet above ACD	
Automation/Remote Control	RC	= Remote Control	
	A	= Automation	
The number of boxes shall be varied (up or down) to accommodate each relevant item in a single box. No other descriptions or symbols may be used.			
Examples :			
Switch Fuses		Transformers	
Switch Fuse		Primary Transformer	T11 33/11kV 11.5/23
GF3D Switch Fuse		Distribution Transformer	315kVA
Air-Break		Pole-Mtd Transfr -3ph-rating in kVA	100
Oil-Immersed (appropriate parts of symbol to be within the box)		Pole-Mtd Transfr -1ph-rating in kVA	25
Fuse Switches		Pole-Mtd Transfr - Split ph - rating in kVA	50/2
Air-Break		Ground-Mounted Transformer (not associated with switchgear)	GM 100
Oil-Immersed		Pad-Mounted Transformer	PAD 100
		Auto-Transformer	

Switches		Miscellaneous	
Air-Break		Bus-bar 11kV	
Oil-Immersed		Bus-bar 6.6kV	
Oil-Immersed (rated to make faults in On and Earth)		Overhead Line or Cable - 3ph	
Oil-Immersed Auto-Sectionaliser		Overhead Line or Cable - 1ph	
Load Break Switch (LBS) combined with auto-sectionaliser (n = number of shots or if used as an LBS without sectionalising active N/A will be used instead of n)		Cable Sealing End or Termination	
Reactor		Live Line Connection	
Reactor		Fuse(s)	
Regulators and Boosters		Solid "Drop out" Links	
Induction Regulator		Auto-Sectionalising Links	
Booster (Series)		Operational Restriction (See CP606.)	
Booster (Quadrature)		Normally Open Point	
Earthing		Normally Open Point - Primary Parallel	
Solid Earth		Normally Open Point - BSP Parallel	
Earth switch (Air)		Air-Break Switch Duty Rating	
Earth switch (Oil-Immersed)		Operational Restriction (See Distribution safety rules EN7.)	
Spark Gap		Fault Passage Indicator - Overhead	
Surge Diverter		Fault Current Indicator – Switchgear Manual Reset	
Indicates Circuit Breaker Isolated and Closed in Circuit Earth		Fault Current Indicator - Self-Reset	
Earthing Point Location on CCC Line		Fault Passage Indicator – Switchgear Remote Indication	
		Unit Protection	
		11/6.6kV Metering Unit	
		Alternator	
		Power Fail Monitor or Power Outage Device	
		Recreational Site	
		Wood Pole	

Customer Connections			
COMA Site		Kidney Dialysis Machine	
COMA - Maintenance Only		Oxygen Concentrator	
Non COMA Site			

Appendix E – LV Operational Diagrams Symbols

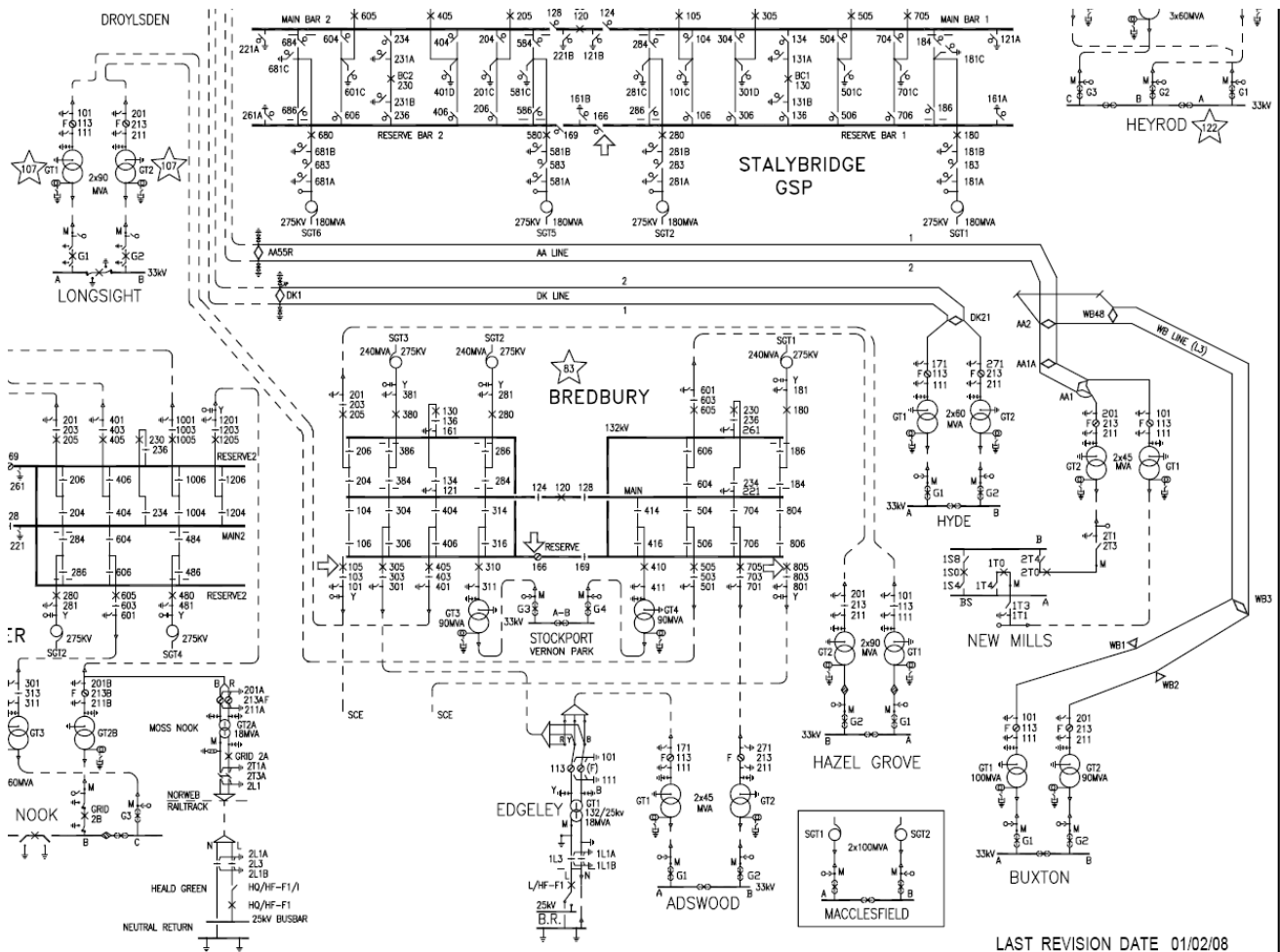
Ground-Mounted Distribution Substation	
Ground-Mounted Distribution Substation showing 2 ganged ways	
Ground-Mounted Distribution Substation showing 3 ganged ways	
Larger Ground-Mounted Distribution Substation - typically with two transformers	
Underground Cable Link-Box (4-way shown) with Link-Box Number	
ReLink in 2 Way Prysmian Link Box	
Free-Standing Feeder Pillar with Feeder Pillar Number	
Three-Phase Underground Cable with changes of x-section	
Single-Phase Underground Cable	
Three-Phase Overhead Line	
Single-Phase Overhead Line	
Cable Termination on Overhead Line	
Pole-Mounted Transformer (3ph) - rating in kVA	
Pole-Mounted Transformer (1ph and Split-ph)- ratings in kVA	
Ground-Mounted Transformer	
Pad-Mounted Transformer	
Normally Open Point	
Fuse	
Alternator	
Small-Scale Embedded Generation (SSEG)	

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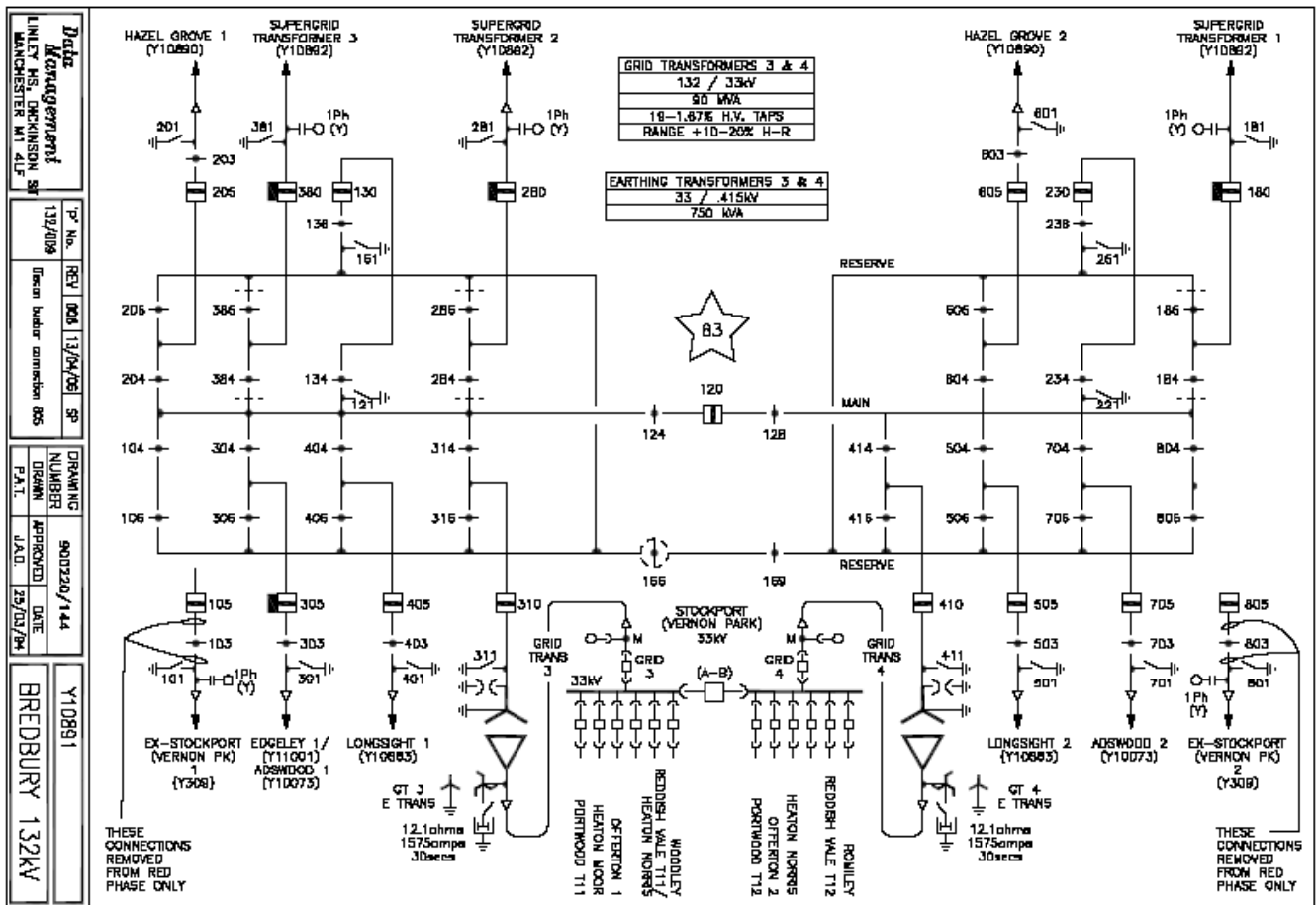
Appendix F – Non-Standard Operation Diagram Symbols

Carlisle		Preston	
Oxygen Concentrator		Normally open point	
LV Link Box		Normally open point between Primary Substations	
Kendal		Normally open point between Grid Substations	
SEF		Backfeed	
Grid Parallel		Automation	
Private Switchgear connected to an extension of ENW busbar		LV Link Box - Enfield (Modified)	
Remote Control (by telecontrol)			
LV Link Box			
Manchester			
SEF In/Out		Directional Protection	
Surge Diverter		Peak District Operation Notes	
CB with CT's		OCB with arrow to private network	
Permanent Earth		Auto Gas Recloser	
Backfeed			
LV Link Boxes			
LV Overground Distribution Pillars			
LV Underground Pillar			

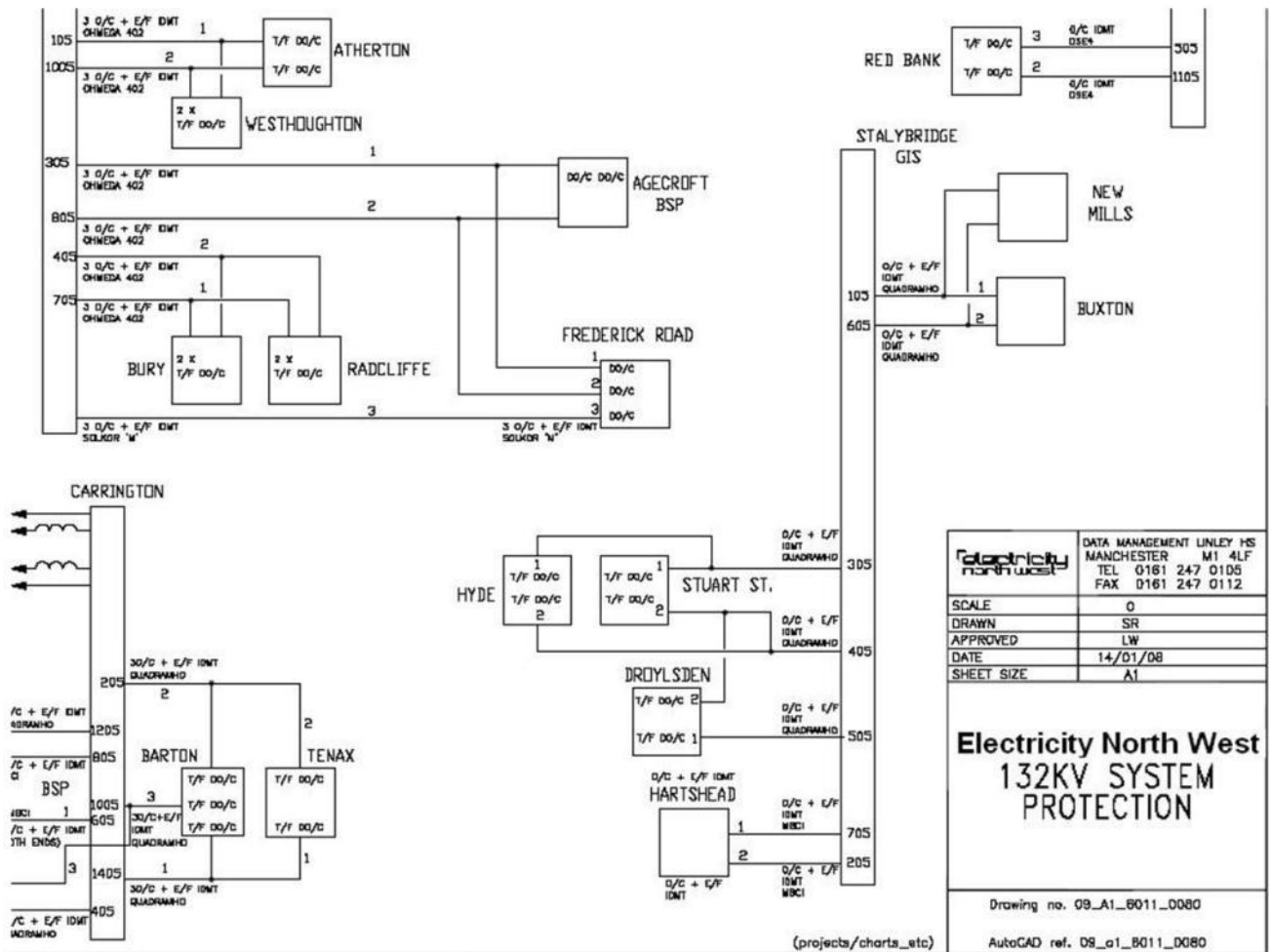
Appendix G – Sample 132kV Operational Diagram



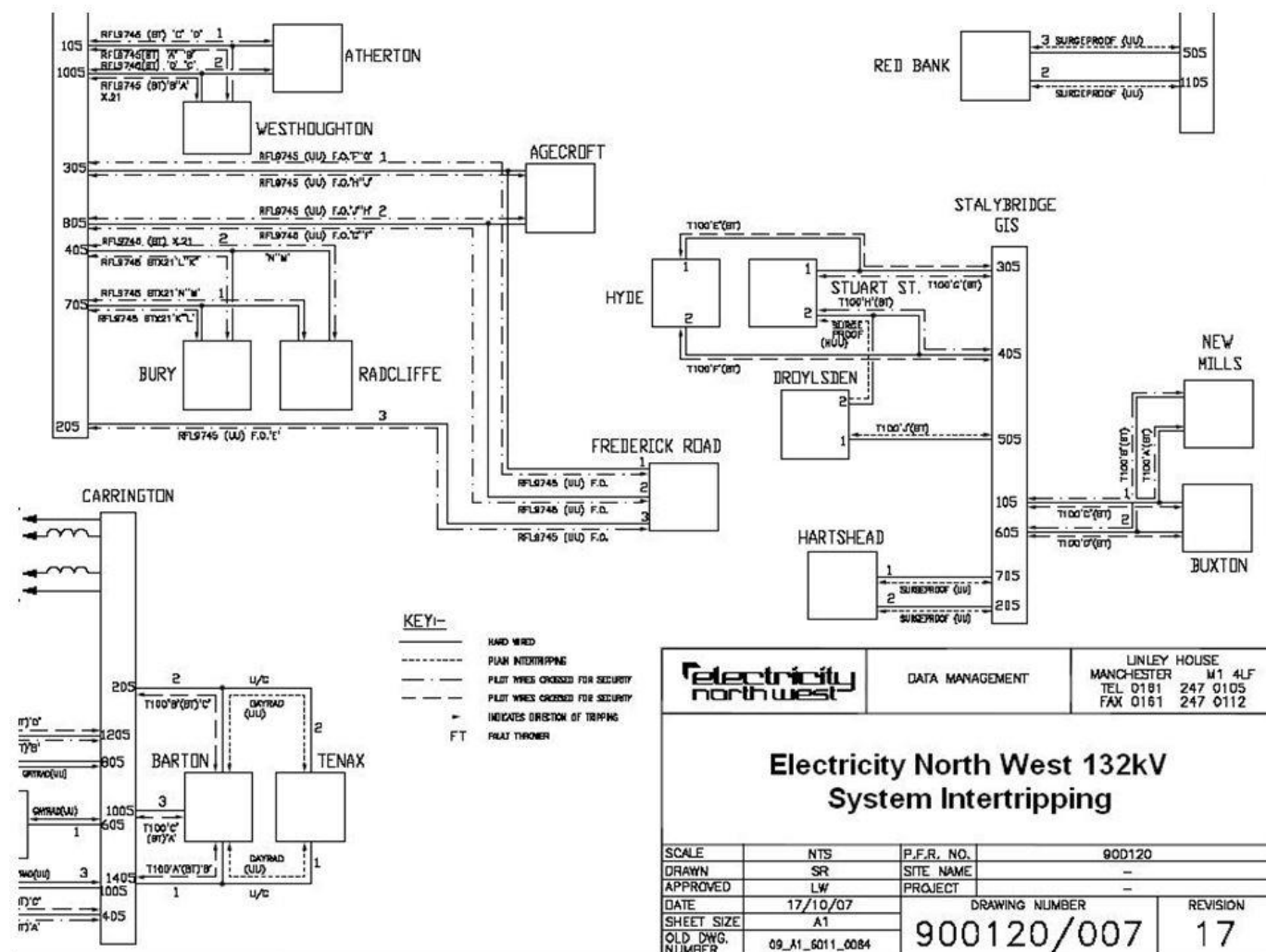
Appendix H – Sample ‘Y’ Diagram



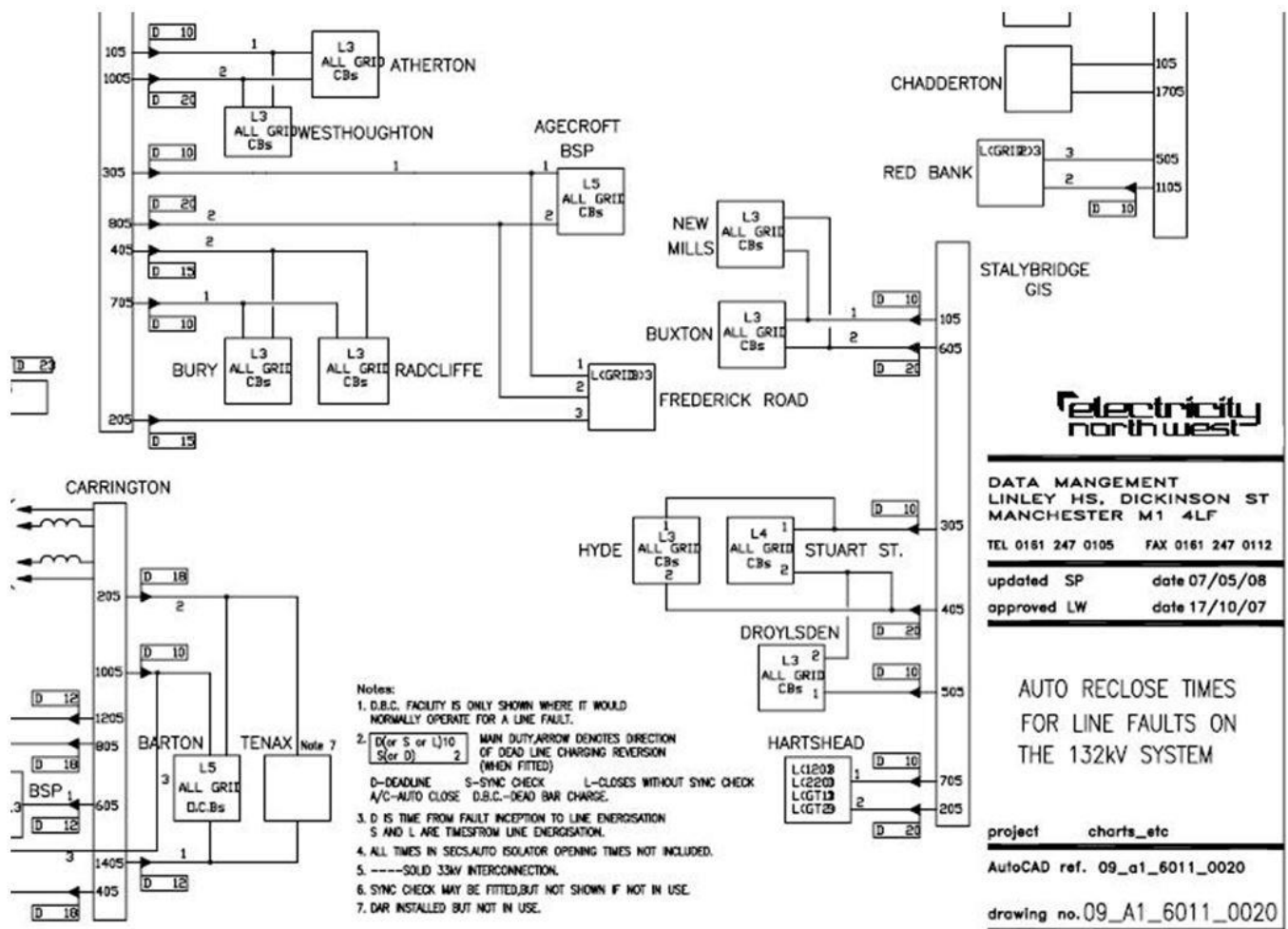
Appendix I – Sample 132kV Protective Diagram



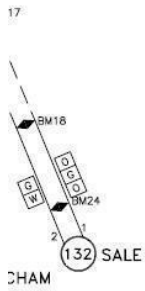
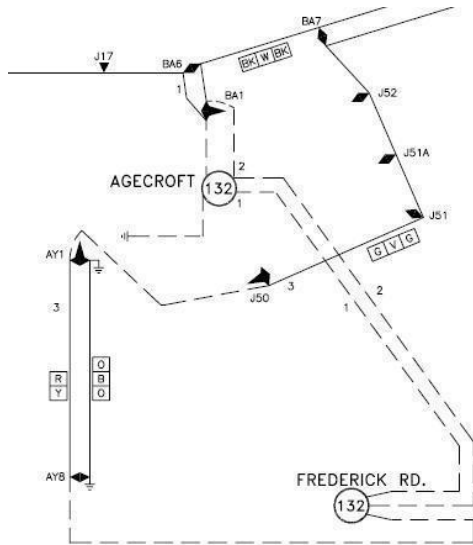
Appendix J – Sample 132kV Intertripping Diagram



Appendix K – Sample 132kV Auto-Reclose Diagram



Appendix L – Sample Circuit Colour Identification Diagram

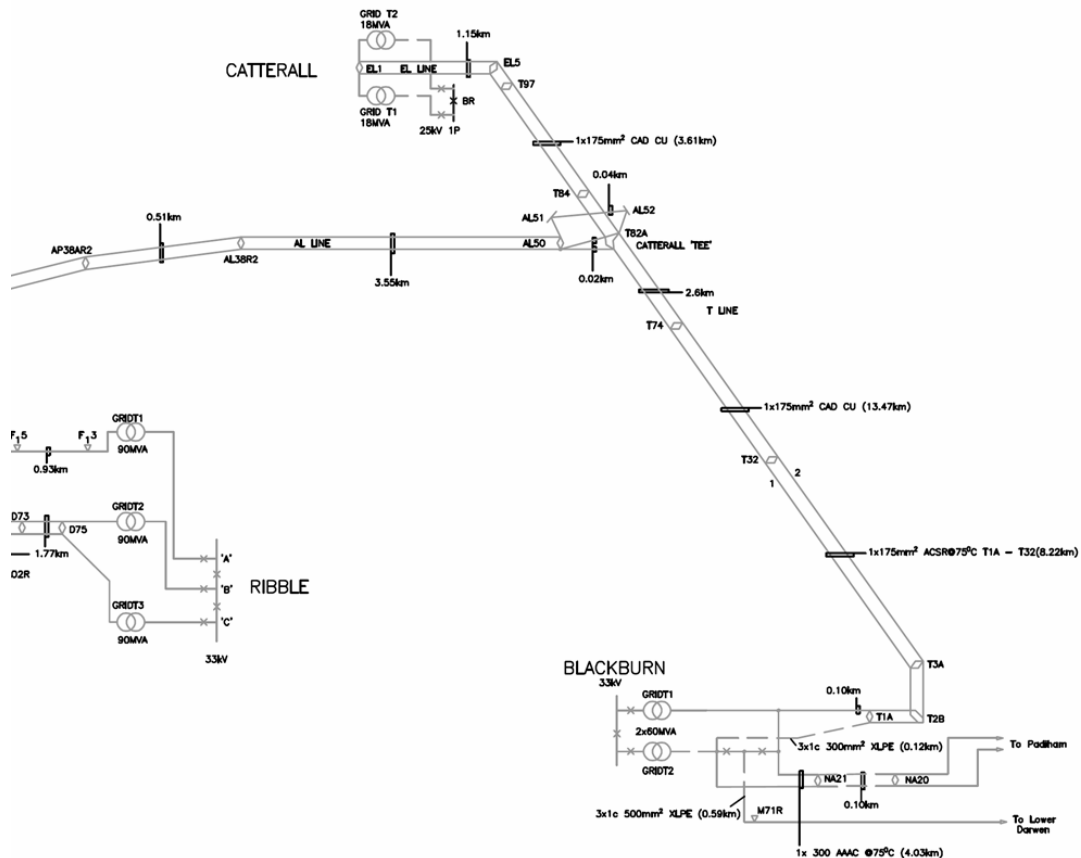


KEARSLEY – RADCLIFFE TEED BURY No.2		
VA1 – VA5	BLUE–WHITE–VIOLET	CE8
VA6	YELLOW	AB5
BP5A – BP8 – RADCLIFFE	RED–BLACK–RED	AE5
VA7 – BURY	GREEN–RED–GREEN	AE9
KEARSLEY – AGE CROFT GT1 – FREDERICK RD GT1		
J1 – J17	BLUE – WHITE	AC8
BA1 – BA6	BLUE – WHITE	AC8
KEARSLEY – AGE CROFT GT2 – FREDERICK RD GT2		
BA1 – BA15R	BLACK–WHITE–BLACK	BE3
KEARSLEY – FREDERICK RD GT3		
BA7 – BA15R	GREEN–VIOLET–GREEN	AD2
J50–J52	GREEN–VIOLET–GREEN	AD2
AY1 – AY8	RED–YELLOW	AB12
WARRINGTON–RISLEY–DALLAM–FIDDLERS FERRY		
GC1 – GC17	RED–BLUE	AB9
CH1 – CH39	GREEN–RED–GREEN	AE9
FC11 – FC8	ORANGE	AB4
FCB – FH32	ORANGE	AB4
FH32 – FS3	YELLOW–RED–YELLOW	AE11
FH1 – FC8	YELLOW–RED–YELLOW	AE11
FCB – DALLAM	RED–WHITE	AE2
FCB – CH2BR	GREEN–RED–GREEN	AE9
CH2BR – CH1	GREEN–RED–GREEN	AE9

25. Agedcroft 1/Fred 1 transferred to Kearsley GSP.
Amendment No. 132KV/23 08/06/06
26. Atherton/Westhoughton 2 transferred to Kearsley GSP.
Amendment No. 132KV/33 10/08/06
27. Bolton 2 transferred to Kearsley GSP.
Amendment No. 132KV/34 10/08/06
28. Atherton/Westh. 1 transferred to Kearsley GSP.
Amendment No. 132KV/39 21/08/06
29. Remove YA1 & YA2
Amendment No. 132KV/49 13/10/06
30. Transfer Bolton 1
Amendment No. 132KV/59 30/10/06
31. Remove interconnect
Amendment No. 132KV/54 08/11/06
32. Remove Kearsley 132 old
Amendment No. 132KV/60 13/11/06
33. Amend circuit colours 132/67 19/12/06

Electricity north west		DATA MANGEMENT	LINLEY HS. DICKINSON ST MANCHESTER M1 4LF TEL 0161 247 0105 FAX 0161 247 0112
132kV TOWER LINE CIRCUIT IDENTIFICATION COLOURS MANCHESTER AREA (1) SOUTH LANCs AREA (2)			
SCALE	NTS	P.F.R. NO.	900220
DRAWN	LW	SITE NAME	SYSTEM OPERATIONS DIAGRAMS
APPROVED	SP	PROJECT	
DATE	1/12/05	DRAWING NUMBER	900220/205
SHEET SIZE	A1	REVISION	33
OLD DWG. NUMBER	09_A1_5119_0116		

Appendix M – Sample 132kV Planning Diagram



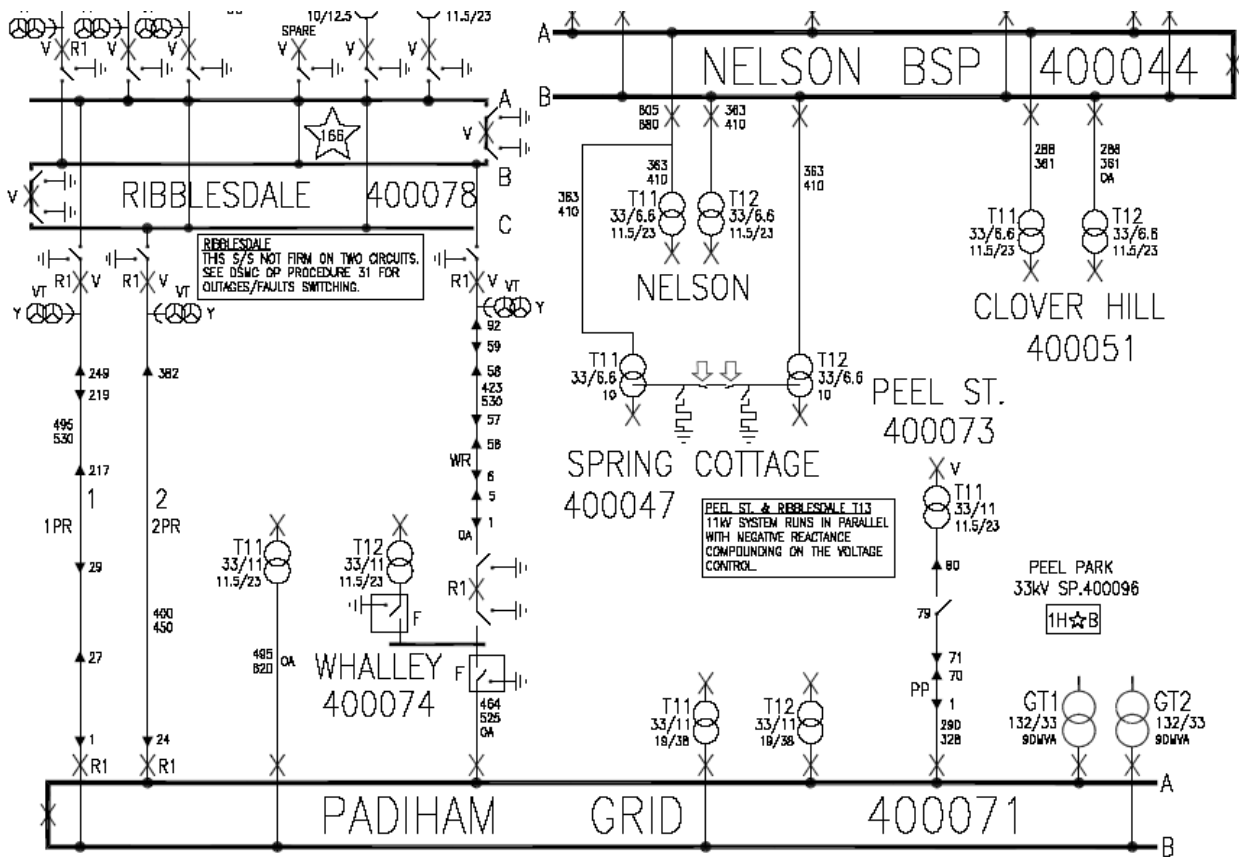
132kV PLANNING DIAGRAM HEYSHAM & PENWORTHAM EAST

NOT FOR OPERATIONAL USE

Drawing number: 41/18579
Amended by: SP
Date of amendment: 10/11/08

SCALE:- NTS

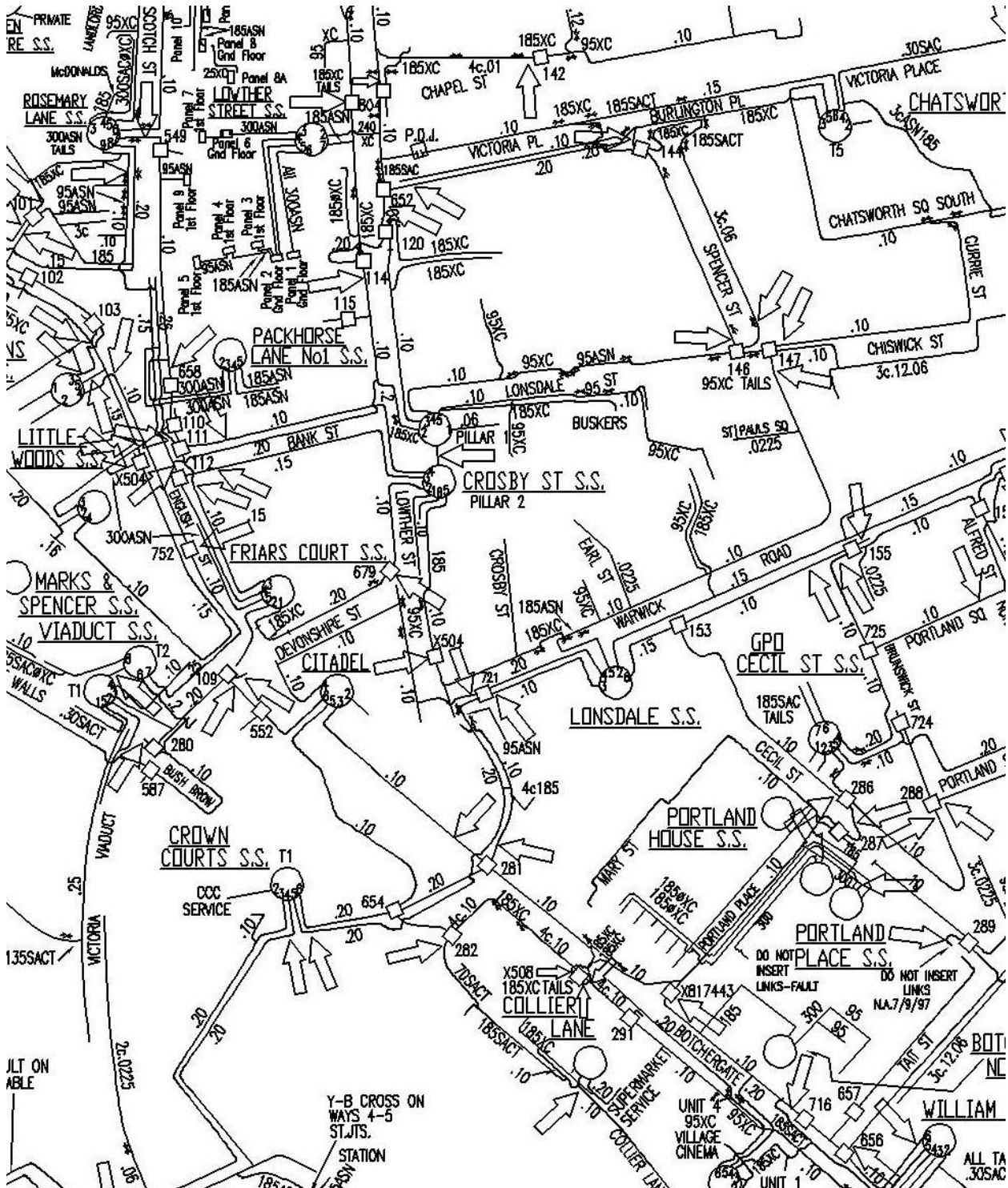
Appendix N – Sample 33kV Operational Diagram



Appendix P – Sample LV Operational Diagram

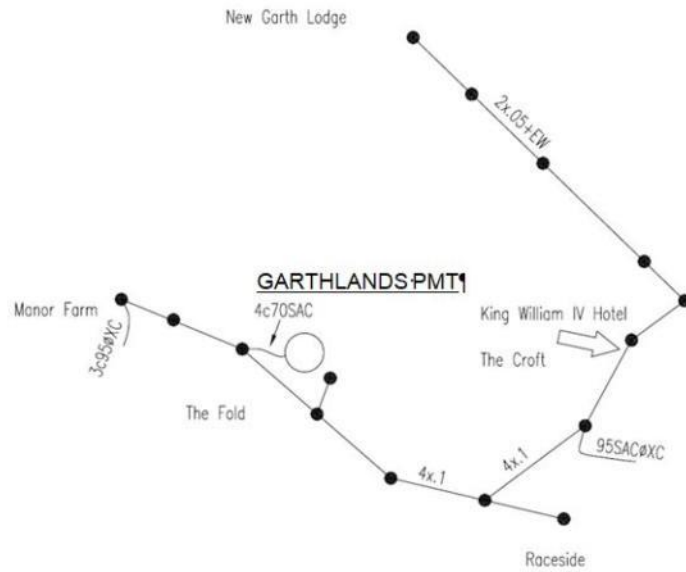
Page P1 - Typical underground network

Page P2 - Typical overhead network

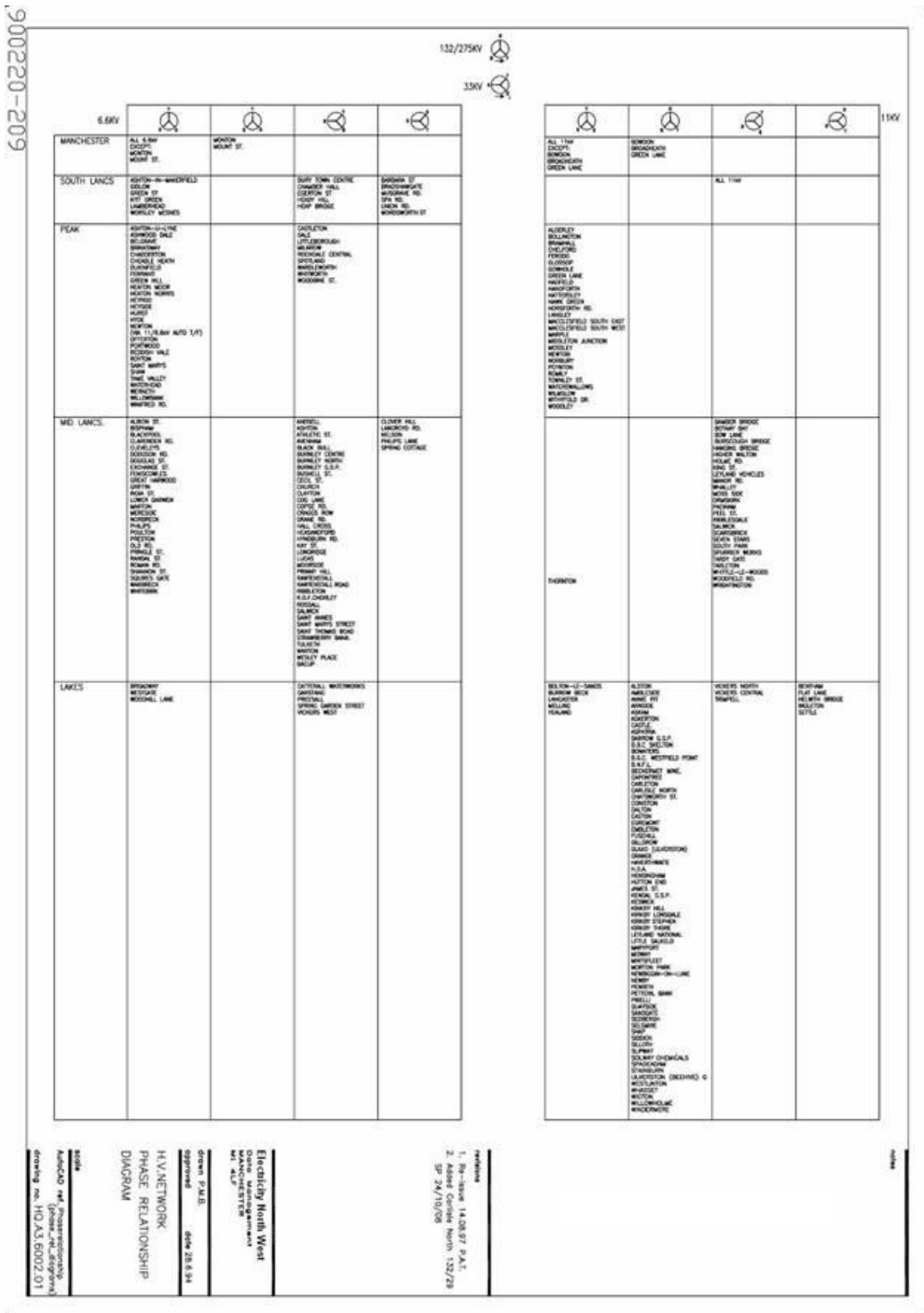


Standing Stones

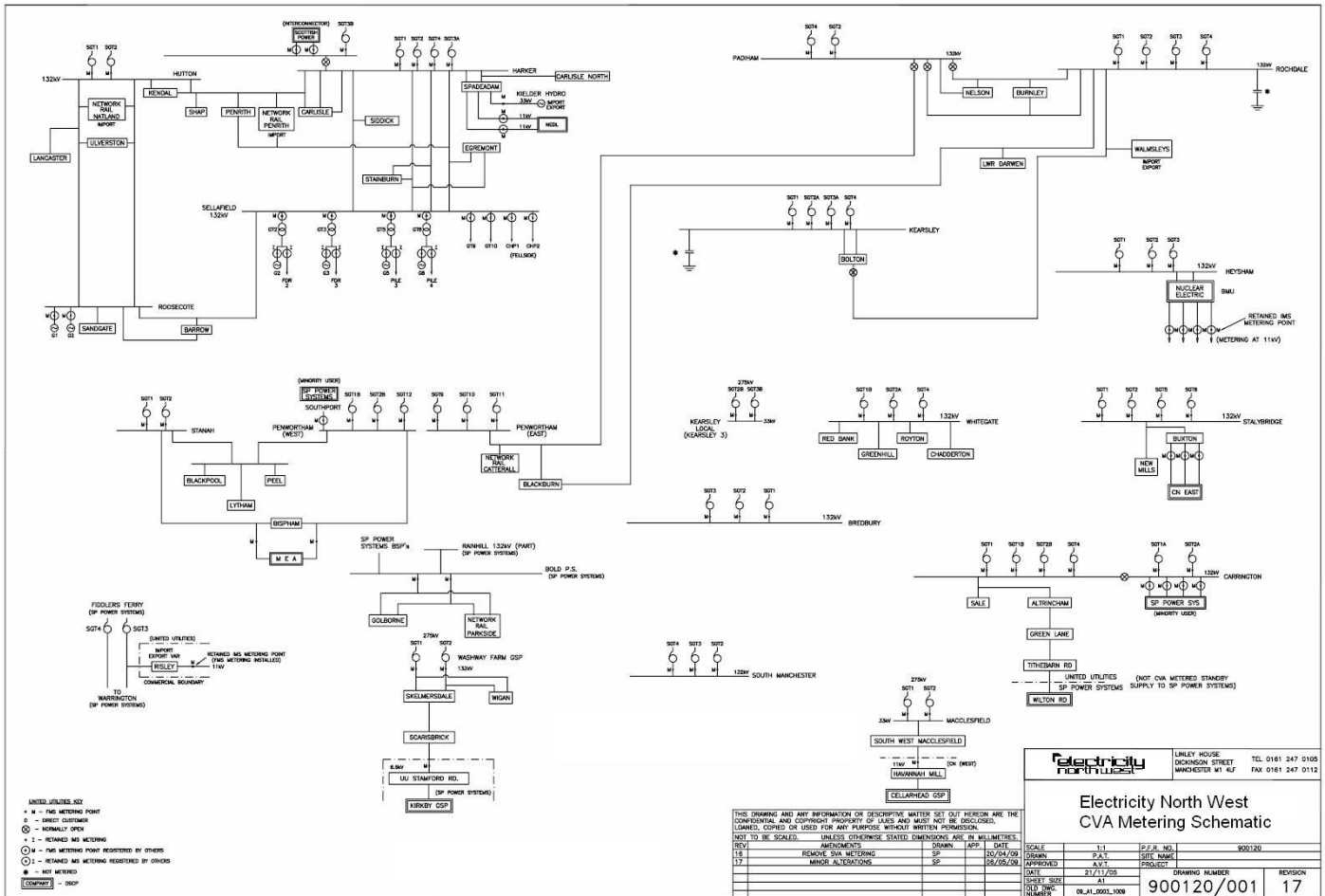
STANDING STONES PMT



Appendix Q – Sample Phasing Diagram



Appendix R – Sample Final Metering Scheme (FMS) Drawing



Appendix S - Control 2000 Symbols

Contents

Symbol Elements Specification – 6.6/11kV Non-Controllable Symbols

Busbar and Connection	R2
Circuit Breaker	R2
Switch	R3
Earth Fault Indicator	R3
Disconnecter	R3
Fuse	R4
Fuse Switch	R4
Switch Fuse	R4
Link	R4
Protection	R4
Transformer	R5
Cable	R5
Overhead Line	R6
Indication	R6
Operational Features	R7
Composite Switchgear Symbols	R8

Symbol Elements Specification – 33/132kV Controllable Symbols

Circuit and Busbar	R10
Circuit Breaker	R10
Earth Switch	R10
Switch	R11
Reactor	R11
Transformer	R11
Voltage Transformer	R11
Alternator	R12
Indication	R12
Auxiliary Control	R13

CONTROL 2000 6.6/11kV SYMBOLS

Busbar and Connection

substation (5 times standard line thickness)



end box



overhead tee



underground tee



Circuit Breaker (fault make/break)

oil



gas



vacuum



auto-reclose



non-automatic



sensitive earth fault protection



no integral earth



withdrawable



number of fault trips



telecontrolled



telecontrolled - withdrawable



Note that all symbols have a selection box at higher zoom levels



Note that switchgear cable boxes are *not* to be shown.

Switch (load make/break) (fault make)

air	
oil	
gas	GAS 
not fault making	NF 
no integral earth	NE 
withdrawable	
telecontrolled (blade and box colour indicate state)	
Load Break Switch combined with auto-sectionaliser (n = number of shots)	GAS Sn 

Earth fault indicator

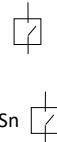
manual reset	MR 
self reset (240V)	SR 
with remote indication	RI 

Disconnecter (*not* load make/break)

air



auto-sectionaliser (n = number of shots)



telecontrolled



Fuse

air



oil



gas



Fuse Switch

air



oil



Switch Fuse

air



oil



Link

link



auto-sectionalising



Protection

directional



Translay



Transformer

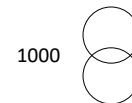
ground mounted



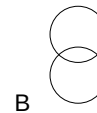
pad mounted



rating (kVA)



backfeedable



pole mounted

three phase



single phase



power fail monitor



Cable

three phase



single phase



junction with ohl

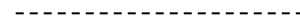


Overhead Line

three phase



single phase



jumper



fault passage indicator
with remote indication



Indication

closed

opened



isolated



I

busbar earthed



E

feeder earthed



E

normal closed point opened



normal open point closed



C

Operational Features

Safety Documents are indicated by a yellow circle and distinguished by the appropriate letters as listed below, e.g.

permit to work



PTW

sanction for test

SFT

limitation of access

LOA

operational restriction



field control

FC

transmission control

TC

local control



Composite Switchgear Symbols

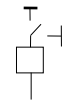
Circuit Breakers

Example

BVP17



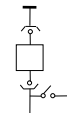
W&B cV



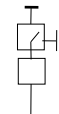
*/P



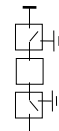
W&B dV



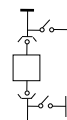
RAO50/RAO4/RAO6



RAO4/RAO6



HWX 2e



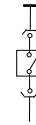
hsar



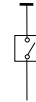
Switches

Example

withdrawable



non-withdrawable



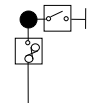
GF3D earth switch



Fuse Switches and Switch Fuses

Example

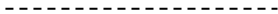
GF3D



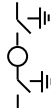
Control 2000

33/132kV Symbols

Circuit and Busbar

132kV cable	
132kV overhead line	
overhead tee	
underground tee	
substation busbar (five times standard line thickness)	

Circuit Breaker

non-withdrawable	
withdrawable	
integral isolation and earthing	
number of fault interruptions	

Earth Switch

FED	
fault thrower	

Switch

plain ABSD



air



gas



oil switch



Reactor



Transformer

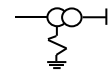
auxiliary transformer



neutral earthing resistor



earthing transformer



system transformer

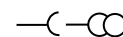


super grid transformer

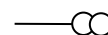


Voltage transformer

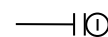
withdrawable



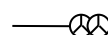
non-withdrawable



capacitor (non withdrawable)



wound (non withdrawable)



Alternator



Indication

closed



opened



isolated



busbar earthed



feeder earthed



normal closed point opened



normal open point closed



telecontrolled



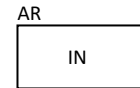
telemetred



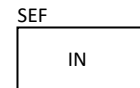
Auxiliary controls

(Background colour and text indicates state)

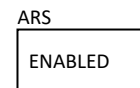
auto reclose



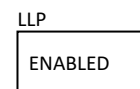
sensitive earth fault



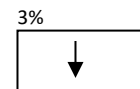
auto restoration scheme



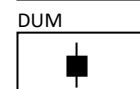
live line protection



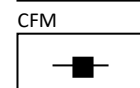
voltage reduction



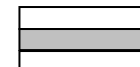
dummy circuit breaker



current flow monitor



132kV tower colours



ALRS, Ops or Generation Procedure



C₂C enabled circuit or open point

