WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Company Directive

STANDARD TECHNIQUE: SD4O/1

Standard HV Connection Arrangements

Policy Summary

This document specifies the standard arrangements for HV metered connections.

Author: **Andy Hood**

Implementation Date: **September 2015**

Approved by

Policy Manager

Date: 16 September 2015

Implementation Plan

Introduction
This document specifies the standard arrangements for HV metered connections.

Main Changes
The acceptable customer / IDNO owned cable construction and termination type which can be connected to WPD owned switch gear have been specified.

Impact of Changes
None, this brings the document in line with ST:TP21D.

Implementation Actions
Team managers are to make planners and technicians aware of this requirement.

Implementation Timetable
This policy can be implemented with immediate effect.

Document Revision & Review Table		
Date	**Comments**	**Author**
November 2016	• Clause 3.3 added for confirmation of acceptable cable types connected to outgoing way of HV switch/s.	Seth Treasure
September 2015	• Company logo updated. • Section 10 has been amended. • The Customer must ensure that LV and HV earthing is segregated unless it can be shown that the combined resistance is less than 20 ohms and the potential rise under earth fault conditions is less than 430V in accordance with ST:TP21D. • General typographical errors amended	Stephen Davies
June 2013	• A maximum cable length of 100m between the exit point and customers switchgear has been specified (section 3.1) • Arrangements 1, 2 and 3 may be used for loads up to 7600 kVA.	A. Hood

1.0 INTRODUCTION

1.1 This document specifies standard switchgear, protection and metering arrangements used for HV connections to Western Power Distribution's electricity system.

1.2 All arrangements listed within this document assume that the load is balanced over three phases.

1.3 11kV switchgear and protection requirements are specified in EE:SPEC2 and EE:SPEC3 (as amended). Advice should be sought from the author of ST:SD40 for connection arrangements which are not included in EE:SPEC2 and EE:SPEC3.

1.4 Metering CTs and VTs must be specified and tested in accordance with EE:SPEC2 and EE:SPEC3 (as amended). Three copies of the test certificates shall be provided in advance of switchboard delivery.

1.5 Indoor accommodation for Western Power Distribution's equipment is normally provided by the customer, free of charge. The Customer shall provide a 230V AC supply, suitable power points, lighting and heating with the substation. The Customer is responsible for the maintenance of the building and providing 24 hour access. All pertinent details regarding the building shall be included in the Connection Agreement.

1.6 A Connection Agreement, Responsibility Schedule, Supply Contract and Meter Operator Agreement must be in place and a Notice of Completion received by Western Power Distribution before an HV connection can be energised.

1.7 It is normal practice to only provide a single connection to a Customer at any given location. If the Customer requires additional supply security or their site is split into discrete areas with no electrical interconnection, an additional connection may be needed. Requirements for multiple connections are described in Section 11.0.

2.0 LEGAL REQUIREMENTS

2.1 The Electricity Supply Regulations 1988 (as amended) and the Electricity at Work Regulations 1989 place requirements on the design of HV connections.

2.2 In order to meet the requirements of the above legislation and also to provide the Customer with a means of disconnecting the electricity supply, each standard arrangement includes:

- an isolatable fuse switch or automatic circuit breaker as close as reasonably practicable to the exit point
- an emergency, break glass, tripping system

2.3 The term 'Exit Point' has the same definition as 'supply terminals' included in the Electricity Supply Regulations 1988 (as amended).

3.0 STANDARD ARRANGEMENTS

3.1 The maximum length of cable between an exit point and the customer's switchgear or transformer is 100m. WPD equipment may be used to protect this cable and a single customer owned transformer, as applicable.

3.2 For simplicity, circuit breakers shown on the standard diagrams are displayed as SF6 filled circuit breakers. Other types of circuit breaker, approved for use on Western Power Distribution's system, can also be used.

3.3 The Customer / IDNO cable/s, which are connected to the WPD Owned HV metering unit/s, shall conform to BS 7870: Part 4.10 2011 and all terminations shall be type tested to the latest HD 628 or HD 629 and shall be cold shrink complete with cold applied boots.

3.4 Arrangement No 1 - Ring Main Unit (RMU) + Metering Unit

3.4.1 Arrangement No 1 is suitable for loads up to 400A (7600kVA at 11kV or 4500kVA at 6.6kVA). The ring switches are rated at 630A and the tee off circuit breaker 200A or 630A as required.

3.4.2 11kV loads up to 1900kVA and 6.6kV loads up to 1100kVA will normally be protected by a Time Lag Fuse (TLF) operated circuit breaker. For higher loads, an approved, self-powered relay, for example the VIP300, shall be installed.

3.4.3 Where the metering circuit breaker is connected directly to a single transformer, it can provide the transformer HV protection. The maximum size of transformer which can be protected by TLFs is 1500kVA at 11kV and 1000kVA at 6.6kV.

3.4.4 The metering circuit breaker cannot provide transformer protection where the Customer has more than one transformer. In such cases the Customer shall install additional HV switchgear and protection.

3.4.5 Supplies provided to mines or quarries may require sensitive earth fault (SEF) protection to be included (see Section 7). Arrangement 1 (M&Q) can be used where SEF is required.

3.4.6 If the customer operates embedded generation in parallel with Western Power Distribution's system, neutral voltage displacement (NVD) protection may be required (see Section 8). NVD protection requires a 3 phase, 5 limb VT (or three, single phase VT'S), with an open delta winding. Arrangement 1(G) can be used where NVD is required.

3.5 Arrangement No 2 - Extensible Switchgear, Single Bus bar Connection

3.5.1 Arrangement No 2 is suitable for loads up to 400A (7600kVA at 11kV or 4500kVA at 6.6kVA). The ring switches shall be rated at 630A and the busbar metering circuit breaker at either 200A or 630A as required.

3.5.2 Physical segregation between Western Power Distribution and Customer owned equipment is normally achieved by the installation of a wire mesh screen. Where necessary a busbar extension can be installed to allow the wire mesh screen to be fitted. Alternatively the wire mesh screen may include a removable panel which can be taken out / opened by Western Power Distribution (but not by the Customer) to allow access to the metering circuit breaker.

Page revised November 2016

3.5.3 Only one version is provided in the Standard Arrangements. It is assumed that where extensible switchgear is required this will connect to a Customer owned HV switchboard. An approved protection relay, rather than TLFs is provided on the metering circuit breaker to grade with the customer's protection. It is also assumed that the Customer will provide NVD or SEF protection where needed.

3.6 Arrangement No 3 - Free-standing 200A Circuit Breaker, Single Circuit Connection

3.6.1 This arrangement can supply load up to 200A (3800kVA at 11kV and 2200kVA at 6.6kVA).

3.6.2 Loads up to 100A (1900kVA at 11kV and 1100kVA at 6.6kV) will normally be protected by a Time Lag Fuse (TLF) operated circuit breaker. For higher loads, an approved self-powered relay, for example the VIP300, shall be installed.

3.6.3 Where the metering circuit breaker is connected directly to a single transformer, it can provide the transformer HV protection. The maximum size of transformer which can be protected by TLFs is 1500kVA at 11kV and 1000kVA at 6.6kV.

3.6.4 The metering circuit breaker cannot provide transformer protection where the Customer has more than one transformer. In such cases the Customer shall install additional HV switchgear and protection.

3.6.5 Supplies provided to mines or quarries may require sensitive earth fault (SEF) protection to be included (see Section 7). Arrangement 3(M&Q) can be used where SEF protection is required.

3.6.6 If the Customer operates embedded generation in parallel with Western Power's Distribution system, neutral voltage displacement (NVD) protection may be required (See Section 8). NVD protection requires a 3 phase, 5 limb VT (or three, single phase VTs), with an open delta winding. Arrangement 1(G) can be used where NVD is required.

3.7 Arrangement No 4 - Firm Duplicate Supply, Single Bus bar Connection

3.7.1 Arrangement 4 is applicable for supplies fed from parallel circuits where a single busbar connection is required. Loads as high as 600A can be provided using this arrangement, as long as all protection and metering requirements are satisfied.

3.7.2 Before this arrangement is specified the protection implications shall be assessed to ensure that adequate clearance times can be maintained.

3.7.3 If the equipment is capable of providing the Customer with 10MW or higher, irrespective of the load actually used by the Customer, the metering CT and VT specifications are enhanced. Further details are provided in Section 4 and in EE:SPEC3 (as amended).

3.8 Arrangement No 5 - Firm Duplicate Supply, Double Bus bar Connection

3.8.1 Arrangement 5 is applicable for supplies fed from parallel circuits where a duplicate busbar connection is required. Loads as high as 600A can be provided using this arrangement, as long as all protection and metering requirements are satisfied.

3.8.2 Before this arrangement is specified the protection implications shall be assessed to ensure that adequate clearance times can be maintained.

3.8.3 If the equipment is capable of providing the Customer with 10MW or higher, irrespective of the load actually used by the Customer, the metering CT and VT specifications are enhanced. Further details are provided in Section 4 and in EE:SPEC3 (as amended).

3.8.4 If dedicated cables and pilots are installed between the primary substation and the Customer's installation then unit protection (e.g. Translay or Solkor) can be used instead of directional relays. The feeder VTs shall be omitted and class X CTs added where unit protection is used.

4.0 METERING

4.1 The ownership, operating and maintenance responsibilities for metering equipment are split between the Meter Operator and WPD's distribution business. The Customer may appoint Western Power Distribution as the Meter Operator. Section 5.0 provides further information.

4.2 The Meter Operator owns, operates and maintains the

- meters
- meter control equipment
- test terminal block, if the safe access terminal block (SATB) is not suitable for test purposes
- fuses and links within the meter panel beyond the multicore termination
- communication equipment, if required

4.3 WPD's distribution business owns, operates and maintains the

- CTs and VTs
- metering unit
- switchgear
- multicores
- fuses and links outside the meter panel
- multicore termination block, SATB or fuses and links
- the cubicle which contains the multicore termination block, SATB and/or fuses and links. This is normally the meter panel itself.

4.4 Multicores are usually terminated within the meter panel. Normally the CT wiring is terminated on an extra SATB and the VT wiring on a set of fuses and/or links. These form the ownership boundary between the Meter Operator and Western Power Distribution.

4.5 Meter panels shall be installed within a 'walk in' building or weatherproof enclosure. A separate panel is installed for each circuit to be metered, each requiring a minimum space of 1m x 1m x 1.5m (depth). Meters shall be mounted at roughly 'eye-level'. To achieve this, the top of each panel should be approximately 1.8m above the floor level.

4.6 Standard Metering CT ratios included in this document are in accordance with Electricity Association Technical Specification 41-5. The specification and testing requirements of metering CTs and CTs are included in EE:SPEC2 and EE:SPEC3 (as amended). Test Certificates shall be provided for all windings in advance of the delivery of the equipment.

4.7 Where the circuit capacity (the rating of the equipment), irrespective of the load requested by the Customer is over 10MVA then the requirements for metering CTs and VTs are enhanced. Above this capacity the accuracy class for both CTs and VTs is increased and specifications for VT check windings changes. Care must be taken to ensure the correct CTs and VTs are purchased. Full details are included in EE:SPEC2 and EE:SPEC3 (as amended).

4.8 PVC insulated multicore cables complying with Electricity Association Technical Specification 09-6 shall be used to connect between the metering panel and switchgear. Where the total multicore length exceeds 10 metres the cores shall be doubled up to reduce impedance. Under no circumstances shall the multicore be longer than 20 metres.

5.0 LIAISON WITH THE METER OPERATOR

5.1 The Customer or Supplier has the right to appoint their own Meter Operator. The Customer must enter into a Meter Operator Agreement.

5.2 Any physical changes to the metering equipment, for example changes to the CT ratios, meters, meter positions, VT's, switchgear etc, must be notified by the planner to the Meter Operator at least three weeks in advance of any change to the metering arrangement.

6.0 EMERGENCY TRIPPING

6.1 All the standard arrangements described in this document provide the Customer with a means of switching off the incoming electricity.

6.2 The emergency tripping system shall be designed to disconnect the incoming source of electricity. If Customer generation is installed this may need to be prevented from operating by the emergency tripping system.

6.3 Western Power Distribution's standard trip unit consists of a push button switch installed within a box fitted with a 'break glass' cover. The switch has two contacts, one normally open and one normally closed. Operation of the trip button will energise the metering circuit breaker trip coil, opening the breaker. The trip coil is either energised from the metering VT or from a DC supply owned and maintained by Western Power Distribution. The normally closed contact may be used to inhibit the operation of customer owned generation. Where this is the case a label shall be fitted stating “More Than One Source Of Supply”.

6.4 Under no circumstances shall the circuit breaker trip coil be connected to more than one auxiliary supply.

6.5 The trip button shall be located in a position which is easily accessible by the Customer. Multicores used to connect between the emergency trip button, switchgear and trip supply shall have a maximum length of 50m. Multicores used for this purpose shall meet the requirements of Electricity Association Technical Specification 09-6.

6.6 A standard emergency trip button is normally provided by Western Power Distribution. As an alternative, the Customer may provide, install and pay for an emergency trip button to their own specification.

6.7 In some cases Customers may wish to trip Western Power Distribution's metering circuit breakers from their protection equipment or from an additional emergency trip button. This can lead to confusion over the ownership of the equipment and increase the length and complexity of trip supply wiring. In order to minimise the risk to Western Power Distribution, Customer owned protection may only trip the metering circuit breaker if all of the following conditions are met:

i) Only circuit breakers shall be tripped by Customer protection.

ii) The circuit breaker shall be tripped from a hand reset trip relay meeting the requirements of IEC 60255, wired in parallel with the emergency trip button. The Customer's trip relay shall be located on a panel close to the emergency trip button and arranged to minimise the chance of damage to the trip supply wiring.

iii) The trip relay and associated panel shall be provided, installed and owned by the Customer.

iv) The operating coil of the trip relay shall be energised from the Customer's supply.

6.8 Standard emergency trip button and trip arrangement diagrams are included in Appendix B.

7.0 MINES AND QUARRIES

7.1 Guidance on the use of electricity at mines and quarries is provided in the two Health and Safety Executive (HSE), Approved Code of Practices (ACOP), listed below.

i) The Use of Electricity at Quarries
ii) The Use of Electricity in Mines

7.2 Responsibility for meeting the requirements of these documents lie with the employer, manager and where appropriate, employees at the mine or quarry.

7.3 The following statements, referring to earth leakage protection for supplies above 650V, appear in both ACOPs.

"For power systems with their reference connected solidly to earth the maximum value of trip settings should not exceed 5 amperes, or 15% of the rated load current, whichever is the greater."

"The settings of leakage fault protection devices in the switchgear controlling the circuit should be selected to ensure effective operation. Leakage fault protection may not be effective if the ratio between the maximum prospective earth fault current and that required to operate the tripping mechanism is less than 3:1 and a value of at least 5:1 is preferable."

7.4 Provision of earth leakage protection to meet the above requirements is the responsibility of the Customer. In most cases the Customer can easily provide this protection but where Western Power Distribution's metering circuit breaker provides the customer's only HV protection then sensitive earth fault (SEF) protection can be provided by Western Power Distribution.

7.5 Arrangements 1(M) and 3(M) should be used for this type of application.

8.0 GENERATION

8.1 The requirements for the connection of embedded generation are specified by National Engineering Recommendation G59/1 and G75 and Engineering Technical Report 113. Interface protection, commonly known as "G59 protection" is required when embedded generation operates in parallel with the distribution system.

8.2 As a minimum, G59 protection includes

- Under Voltage Protection
- Over Voltage Protection
- Under Frequency Protection
- Over Frequency Protection

8.3 Often additional protection equipment is required including

- Loss of Mains (e.g. Rate of Change of Frequency or Vector Shift)
- Neutral Voltage Displacement
- Reverse Power
- Directional Overcurrent

8.4 The Customer usually owns and maintains all G59 protection. The only significant exception is where Neutral Voltage Displacement (NVD) protection is required. NVD protection is used to detect the presence of earth fault conditions where the system earth reference is lost. This can occur when an LV generator feeds back onto the HV system through a distribution transformer under earth fault conditions. NVD protection is fitted on the HV system and derives its voltage input from a suitable HV Voltage Transformer (VT).

8.5 If the Customer has no HV switchgear and hence no HV VT then Western Power Distribution can provide NVD protection. Arrangements 1(G) and 3(G) are suitable for this purpose.

9.0 BATTERY SYSTEMS

9.1 Arrangements 1(M&Q), 1(G), 3(M&Q), 3(G), 4 and 5 all require a DC battery and battery charger to be installed. The battery system is used to power some of the protection relays and to provide circuit breaker tripping facilities. The latest issue of EE:SPEC:24, shall be used to specify the battery system requirements.

9.2 Battery systems which are used to power WPD protection equipment or to trip WPD switchgear shall be owned and maintained by Western Power Distribution.

9.3 In some cases both the Customer and Western Power Distribution will require a DC supply. In practice it may be sensible for the customer to derive their DC supply from the Western Power Distribution battery system. This is only acceptable if the Customer has only a small amount of equipment requiring a DC supply and all the following requirements are met:

i) The Customer's equipment is located in the same or adjacent room to that containing Western Power Distribution's battery system.

ii) The battery system is sized to take account of the Customer's equipment

iii) The Customer's load is fused separately to Western Power Distribution's load. The scheme shall be designed so that faults on the Customer's DC wiring shall not blow fuses supplying Western Power Distribution's equipment.

10.0 EARTHING

10.1 The earthing requirements at HV connections are similar to those at any Western Power Distribution 11kV/415V substation. The HV earth resistance and the thermal requirements of the earthing shall be assessed and designed in the same manner as any distribution transformer.

10.2 Western Power Distribution shall install HV earthing for the incoming switches, bonded to the HV metalwork and arranged to prevent dangerous step, touch and transfer voltages occurring. HV cable sheaths should normally be bonded to the HV metalwork/earthing system.

10.3 The Customer is responsible for designing and providing their own HV and LV earthing systems, although in practice it is normal to bond the Customer and Western Power Distribution HV earths together to reduce the earth resistance. The Customer must ensure that LV and HV earthing is segregated unless it can be shown that the combined resistance is less than 20 ohms and the potential rise under earth fault conditions is less than 430V. Guidance on assessment of earth potential rise is provided in ST:TP21D and by the Primary Design Section. In general, where there is not a continuous metallic path back to the primary substation, the earth potential rise may exceed 430V. This will depend on the relative earth resistances at cable ends and also the cable sheath type.

10.4 Where HV and LV segregation is required, care must be taken to ensure that a minimum distance of 2m above ground is maintained between HV metalwork and any LV bonded metalwork to prevent anyone touching both earth references simultaneously. The standard segregation distance of 9m below ground is also required between the HV and LV earthing electrodes.

10.5 Further guidance on earthing issues is provided in the Manual of Earthing Practices, POL:TP21 and its associated Standard Techniques.

11.0 MULTIPLE CONNECTIONS

11.1 It is normal practice for Western Power Distribution to only provide a single connection for each customer at a given location in order to minimise the cost and complication of the connection and to satisfy metering requirements.

11.2 In some cases the Customer will have good reasons for requiring additional connections at a site. Examples include situations where

- An enhanced supply security is required
- The site is large and fragmented (there is little or no electrical interconnection between parts of the site).

11.3 When multiple connection arrangements are provided there is a danger that if the connections are operated in parallel then current could be imported through one connection and exported out of another. Even if metering systems are in place which record both imported and exported energy, there is no mechanism within the Pooling and Settlement system to account for “through current” passing between the connections.

11.4 Arrangements No 4 and No 5 are designed to overcome the problems associated with the parallel operation of connection points. If these arrangements are not suitable then steps shall be taken to prevent multiple connections being operated in parallel.

11.5 Parallel operation of multiple connections can be prevented either by physical segregation of the two systems or by fitting interlocking, preferably mechanical interlocking. Electrical interlocking is only acceptable if it prevents interconnection even if its AC and/or DC auxiliary supply fails.

11.6 Where an auto-changeover arrangement is required to provide backup supplies, a "break before make" scheme shall be used. The backup supply circuit breaker shall only be capable of being closed once the normal supply circuit breaker has opened. Schemes shall be designed to prevent faults on the customer's system being re-energised more than once by the auto-changeover scheme.

11.7 If generation is installed which runs in parallel with the Western Power Distribution's system, its operation may need to be restricted to allow it to run only when connected to a specific connection point. Where this is the case, the interlocking shall be designed to prevent parallel operation with the other connections. Any such restrictions shall be detailed in the Connection Agreement and Responsibility Schedule.

11.8 Separate emergency trip buttons will normally be provided for each connection point. If the two connections are located in close proximity, it is normal practice to fit two trip buttons adjacent to each other. If the customer requires any other arrangement this shall be designed, provided and paid for by the Customer. Requirements for emergency tripping are included in Section 6.0.

KEY TO STANDARD ARRANGEMENTS

PROTECTION RELAY SYMBOLS USED IN STANDARD ARRANGEMENTS

2OC IT	2 PHASE - INVERSE TIME OVERCURRENT PROTECTION (ALSO USED FOR TIME LAG FUSE OVERCURRENT)
E IT	INVERSE TIME EARTH FAULT PROTECTION (ALSO USED FOR TIME LAG FUSE EARTH FAULT)
SEF	SENSITIVE EARTH FAULT PROTECTION
NVD	NEUTRAL VOLTAGE DISPLACEMENT PROTECTION
TH	HAND RESET TRIP RELAY
2DOC IT	2 PHASE - DIRECTIONAL OVERCURRENT PROTECTION
DE IT	DIRECTIONAL EARTH FAULT PROTECTION

Rev No	Drawn	Chk'd	App'd	Date	Revision
2	RJB			1/00	TITLE BLOCK CHANGE

ORIGINAL ISSUE		DATE
Drawn	RJB	10/99
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Approved		
SCALE N.T.S.		

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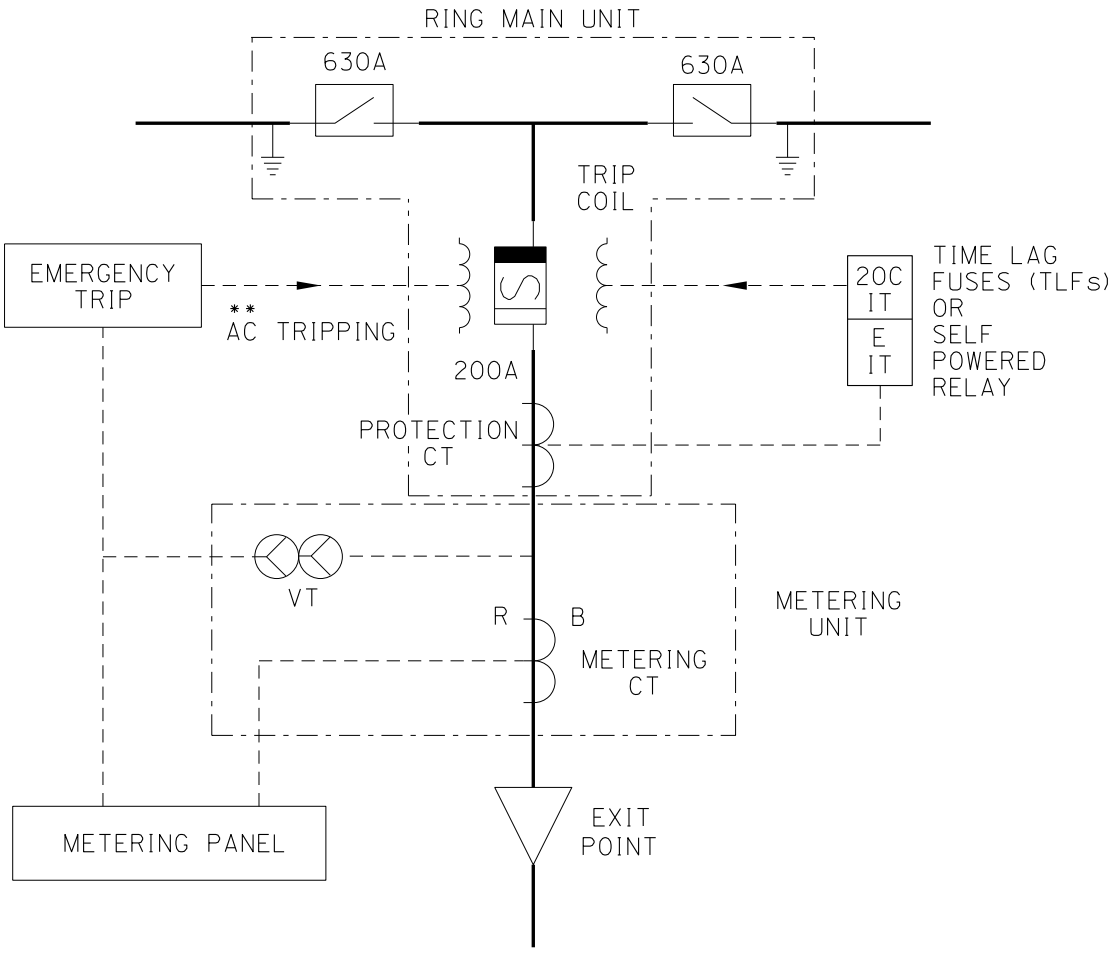
WESTERN POWER DISTRIBUTION

Title: PROTECTION RELAY SYMBOLS

Drg. No. 06/69/2889/0

Rev No 2

ARRANGEMENT No 1



6.6kV LOAD kVA	11kV LOAD kVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	PROTECTION TYPE
100 - 570	100 - 950	100/50/5	100/50/5	TLF
570 - 1100*	950 - 1900*	100/50/5	100/50/5	TLF
1100 - 2200	1900 - 3800	200/100/5	200/1	SELF POWERED RELAY

* SEE SECTION 3 FOR TRANSFORMER PROTECTION RESTRICTIONS

** AC TRIPPING SUPPLY IS DERIVED FROM THE METERING VT

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11	RJB			7/00	TEXT ADDED

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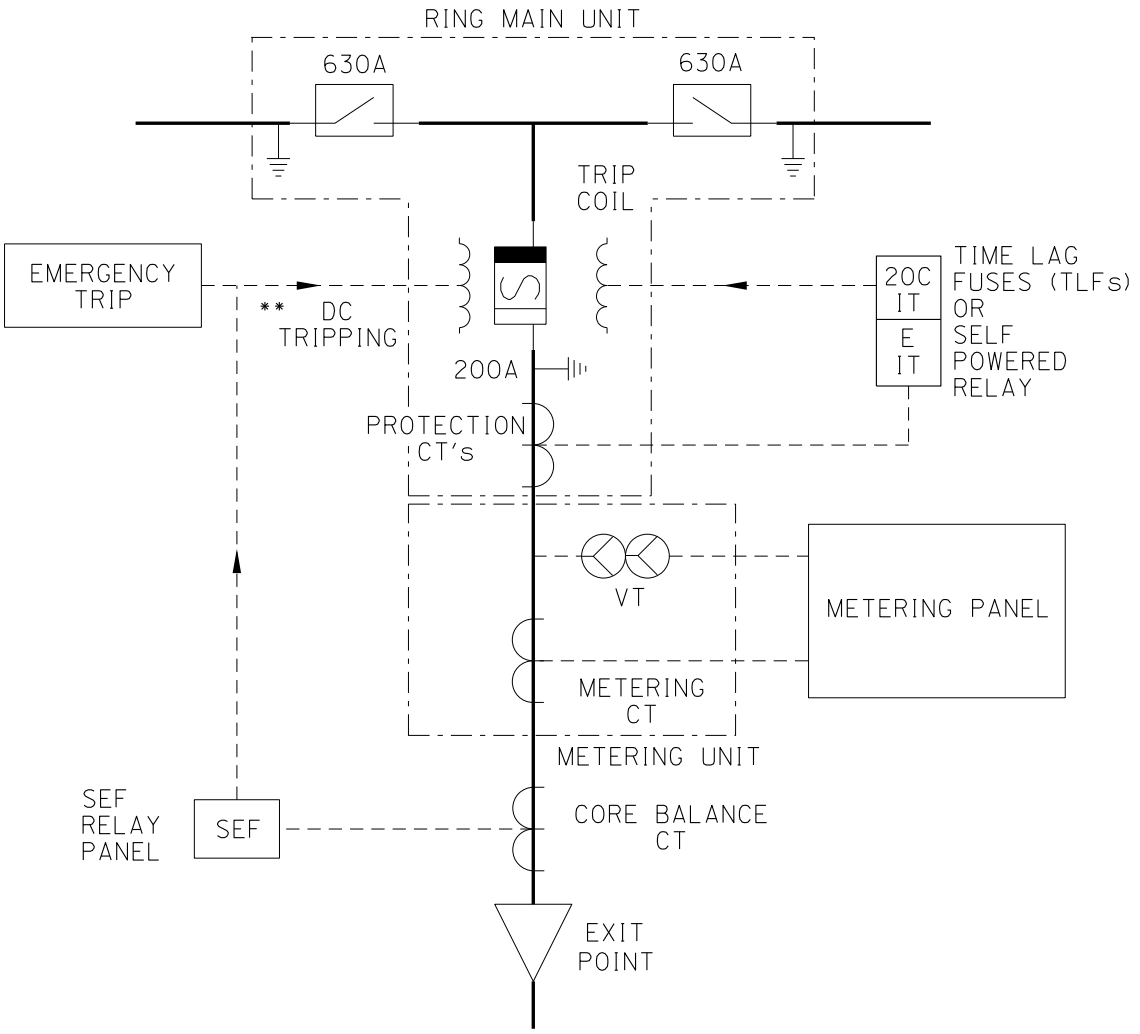
WESTERN POWER DISTRIBUTION

Title: RING MAIN UNIT

Drg. No. 06/69/2889/1

Rev No 11

ARRANGEMENT No 1 (M & Q)



6.6kV LOAD kVA	11kV LOAD kVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	MAIN PROTECTION TYPE
100 - 570	100 - 950	100/50/5	100/50/5	TLF
570 - 1100*	950 - 1900*	100/50/5	100/50/5	TLF
1100 - 2200	1900 - 3800	200/100/5	200/1	SELF POWERED RELAY

* SEE SECTION 3 FOR TRANSFORMER PROTECTION RESTRICTIONS

** 30V DC BATTERY & CHARGER SYSTEM IS REQUIRED FOR SEF RELAY POWER SUPPLY & FOR TRIPPING

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4	RJB			7/00	TEXT ADDED

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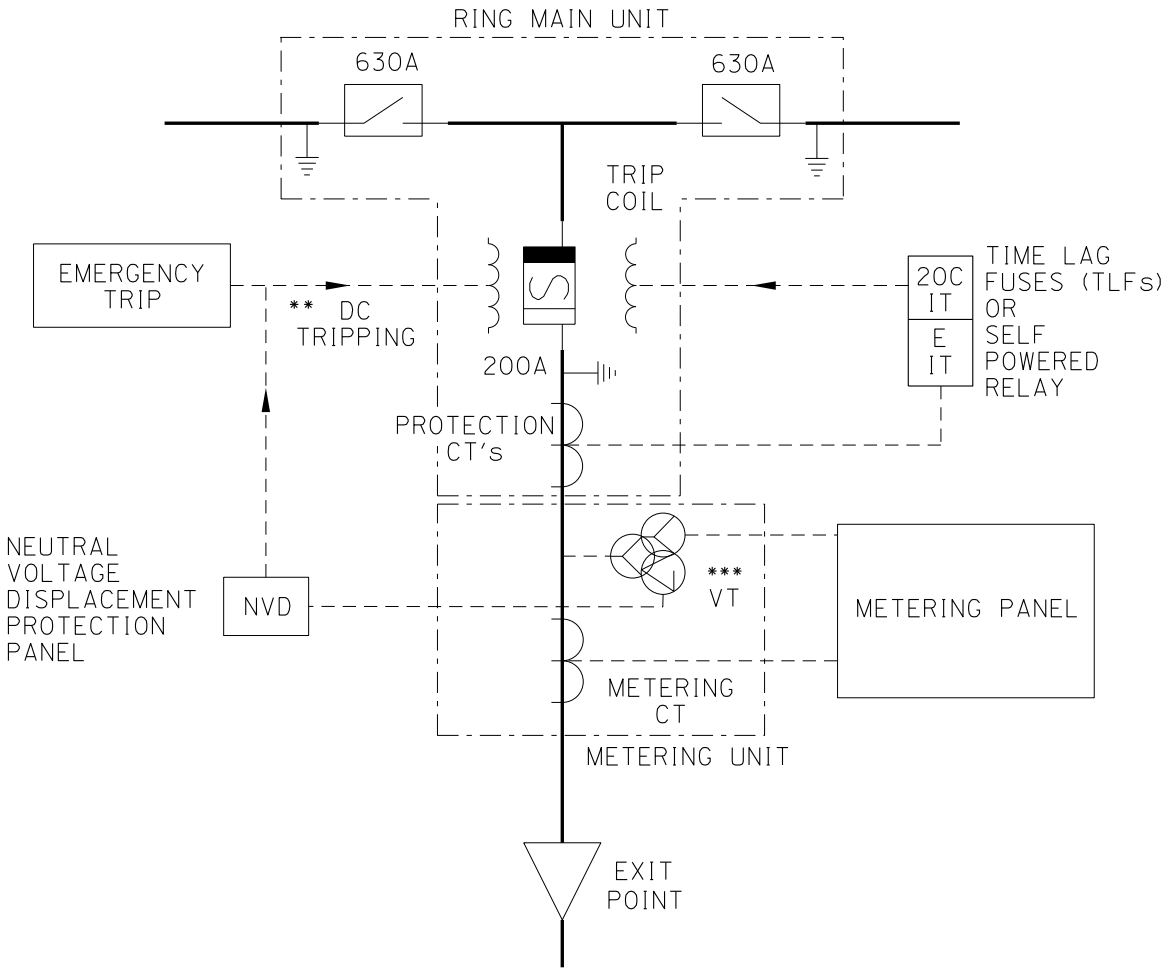
WESTERN POWER DISTRIBUTION

Title: RING MAIN UNIT WITH SEF PROTECTION FOR MINE & QUARRY APPLICATIONS

Drg. No. 06/69/2889/1M

Rev No 4

ARRANGEMENT No 1 (G)



6.6kV LOAD kVA	11kV LOAD kVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	MAIN PROTECTION TYPE
100 - 570	100 - 950	100/50/5	100/50/5	TLF
570 - 1100*	950 - 1900*	100/50/5	100/50/5	TLF
1100 - 2200	1900 - 3800	200/100/5	200/1	SELF POWERED RELAY

* SEE SECTION 3 FOR TRANSFORMER PROTECTION RESTRICTIONS

** 30V DC BATTERY & CHARGER SYSTEM IS REQUIRED FOR NVD RELAY POWER SUPPLY & FOR TRIPPING

*** VT HAS AN ADDITIONAL OPEN DELTA WINDING FOR NVD PROTECTION

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4	RJB			7/00	TEXT ADDED

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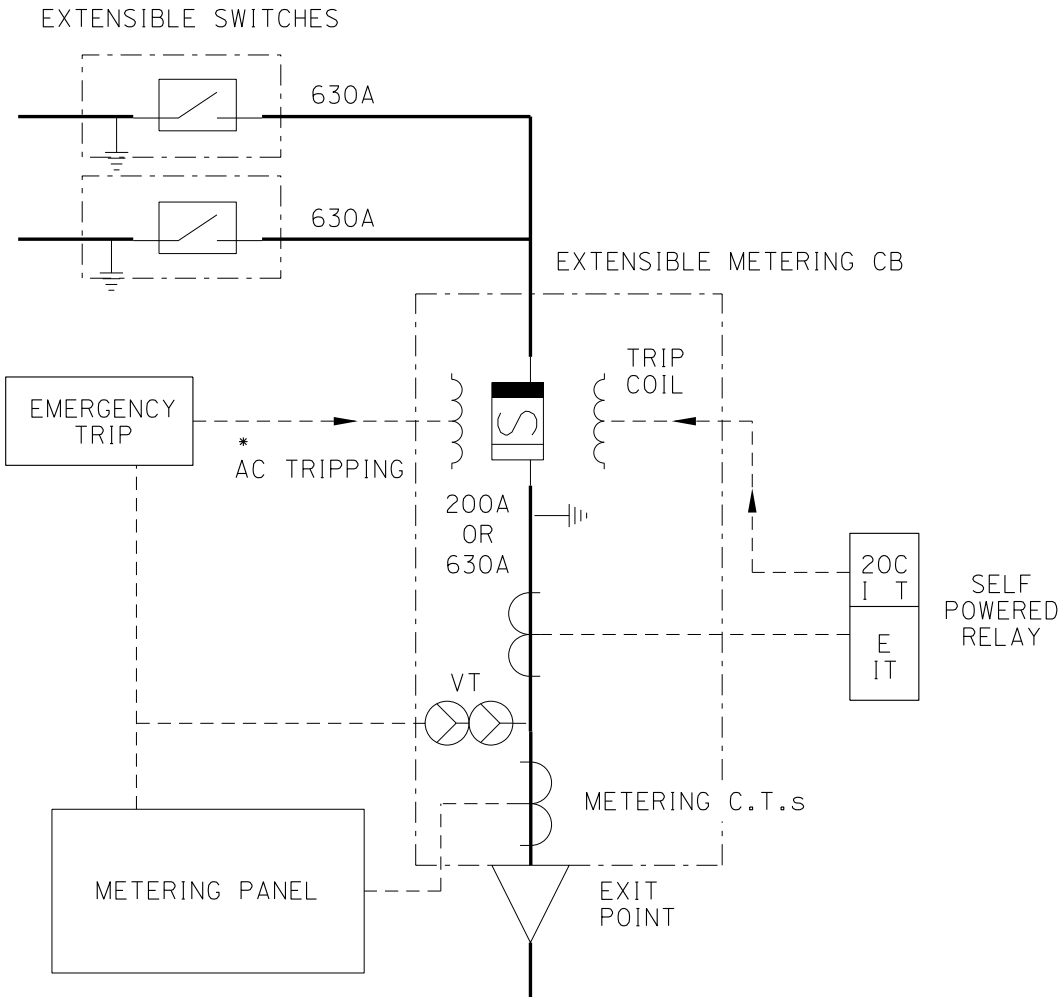
WESTERN POWER DISTRIBUTION

Title: RING MAIN UNIT WITH NVD PROTECTION FOR PARALLEL GENERATION APPLICATIONS

Drg. No. 06/69/2889/1G

Rev No 4

ARRANGEMENT No 2



6.6kV LOAD MVA	11kV LOAD MVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO
100 - 570	100 - 950	100/50/5	200/1
570 - 1100	950 - 1900	100/50/5	200/1
1100 - 2200	1900 - 3800	400/200/5	800/1
2200 - 4500	3800 - 7600	400/200/5	800/1

* AC TRIPPING SUPPLY IS DERIVED FROM METERING VT

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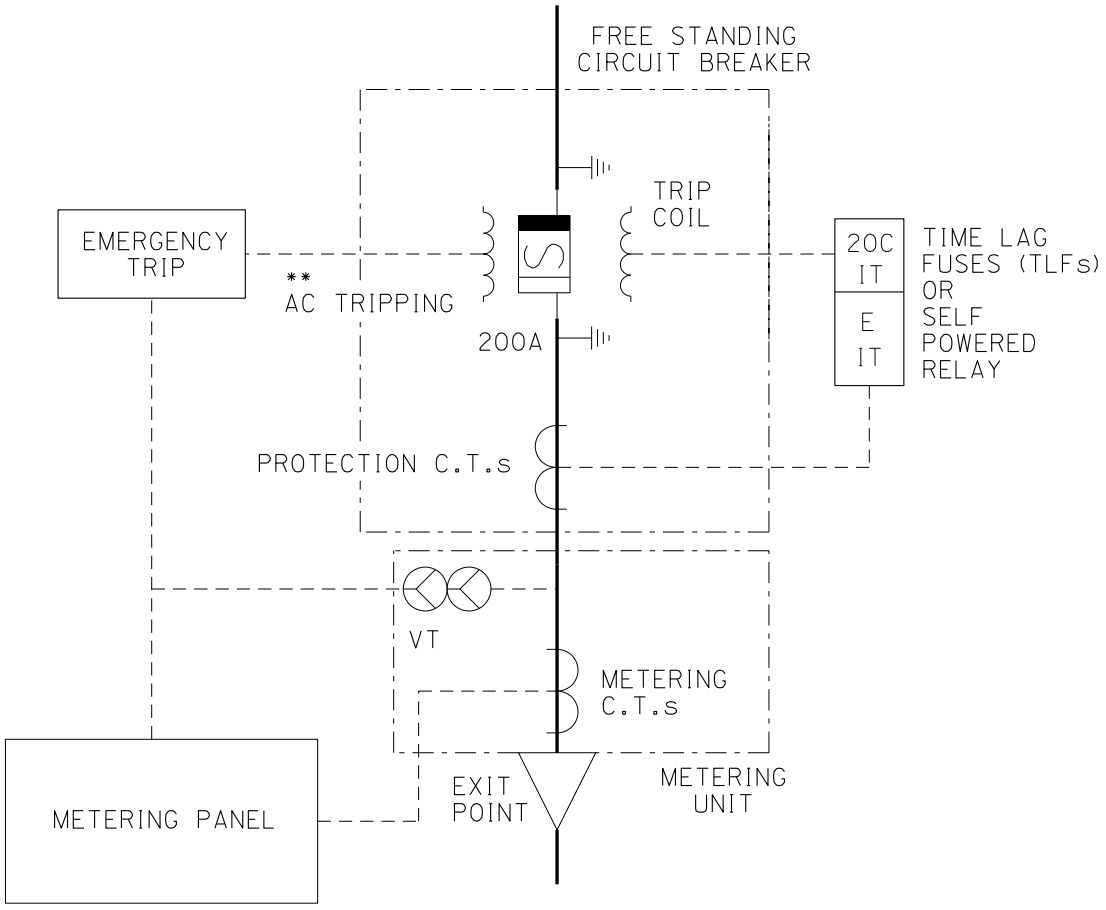
WESTERN POWER DISTRIBUTION

Title
EXTENSIBLE RING MAIN UNIT

Drg. No. 06/69/2892/2

Rev No 11

ARRANGEMENT No 3



6.6kV LOAD KVA	11kV LOAD KVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	PROTECTION TYPE
100 - 570	100 - 950	100/50/5	100/50/5	TLF
570 - 1100*	950 - 1900*	100/50/5	100/50/5	TLF
1100 - 2200	1900 - 3800	200/100/5	200/1	SELF POWERED RELAY

* SEE SECTION 3 FOR TRANSFORMER PROTECTION RESTRICTIONS

** AC TRIPPING SUPPLY IS DERIVED FROM THE METERING VT

Rev No	Drawn	Chk'd	App'd	Date	Revision
5	RJB			7/00	TEXT CHANGED

ORIGINAL ISSUE		DATE
Drawn	RJB	7/98
Checked		
Approved		
SCALE	N.T.S.	

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Design Department.
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Tel: 0117 933 2000 Fax: 0117 933 2001.

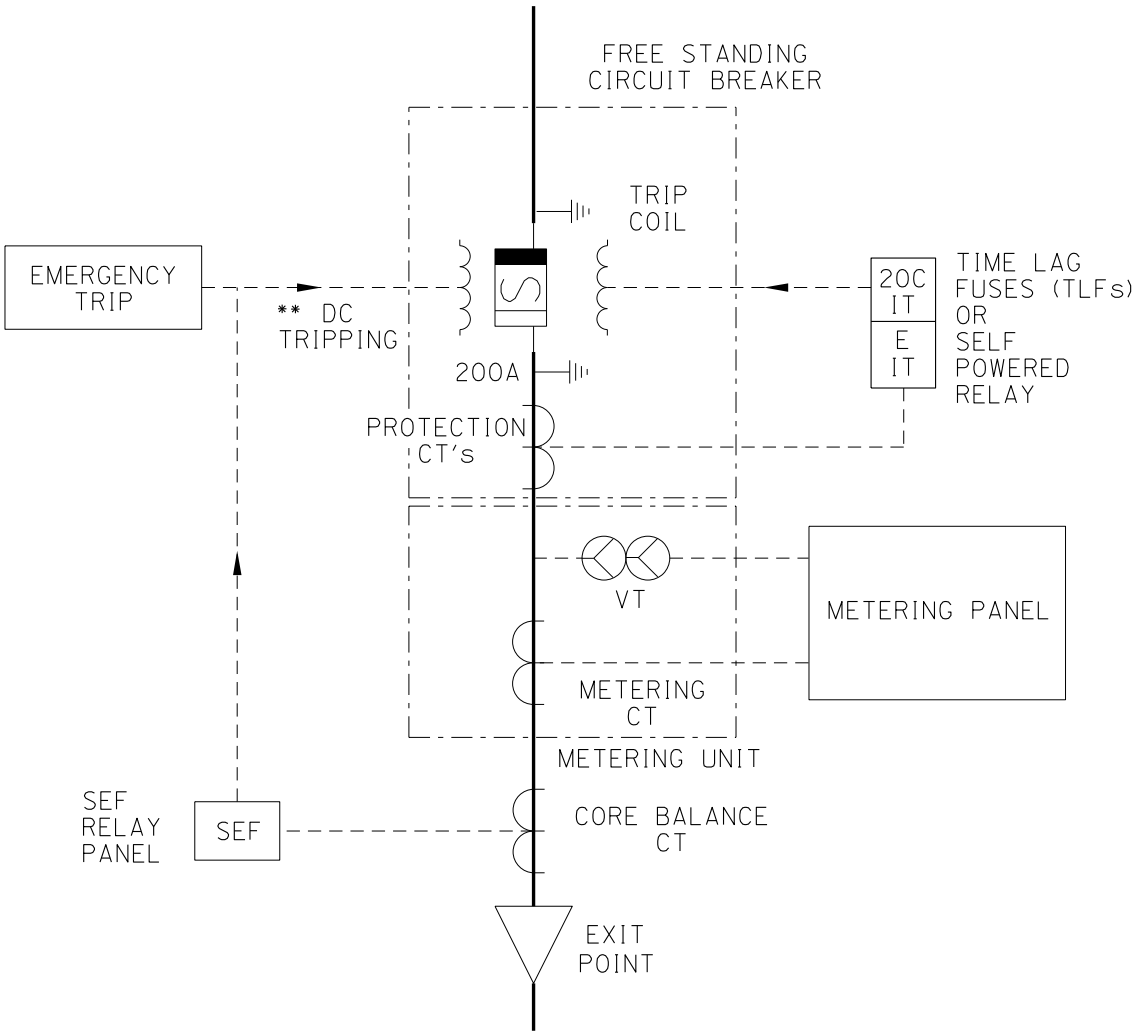
WESTERN POWER DISTRIBUTION

Title: FREE STANDING CIRCUIT BREAKER

Drg. No. 06/69/2891/3

Rev No 5

ARRANGEMENT No 3 (M & Q)



6.6kV LOAD kVA	11kV LOAD kVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	PROTECTION TYPE
100 - 570	100 - 950	100/50/5	100/50/5	TLF
570 - 1100*	950 - 1900*	100/50/5	100/50/5	TLF
1100 - 2200	1900 - 3800	200/100/5	200/1	SELF POWERED RELAY

* SEE SECTION 3 FOR TRANSFORMER PROTECTION RESTRICTIONS

** 30V DC BATTERY & CHARGER SYSTEM IS REQUIRED FOR SEF RELAY POWER SUPPLY & FOR TRIPPING

Rev No	Drawn	Chk'd	App'd	Date	Revision
4	RJB			7/00	TEXT ADDED

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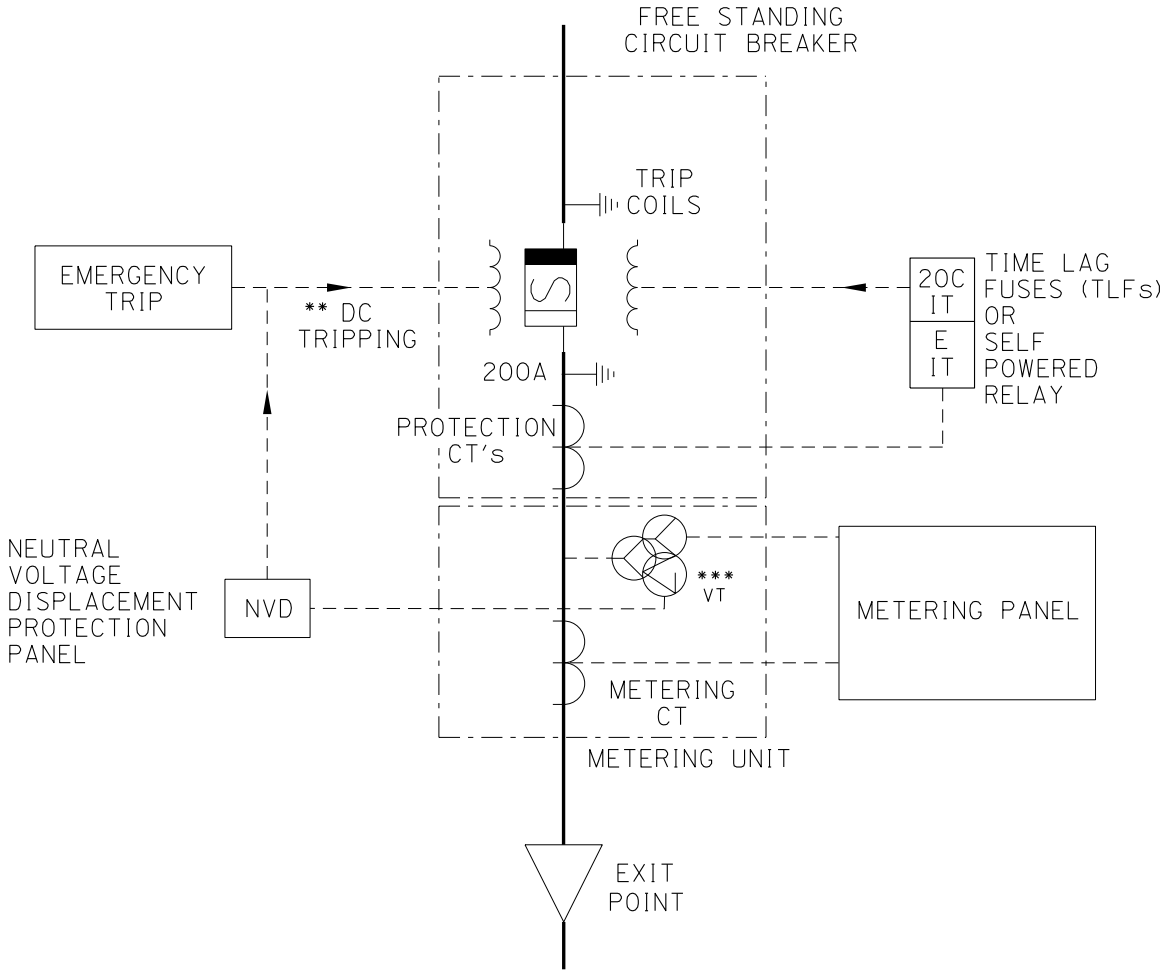
Title: FREE STANDING CIRCUIT BREAKER WITH SEF PROTECTION FOR MINE & QUARRY APPLICATIONS

Drg. No. 06/69/2889/3M

Rev No 4

ARRANGEMENT No 3 (G)



6.6kV LOAD kVA	11kV LOAD kVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	PROTECTION TYPE
100 - 570	100 - 950	100/50/5	100/50/5	TLF
570 - 1100*	950 - 1900*	100/50/5	100/50/5	TLF
1100 - 2200	1900 - 3800	200/100/5	200/1	SELF POWERED RELAY

* SEE SECTION 3 FOR TRANSFORMER PROTECTION RESTRICTIONS

** 30V DC BATTERY & CHARGER SYSTEM IS REQUIRED FOR NVD RELAY POWER SUPPLY & FOR TRIPPING

*** VT HAS AN ADDITIONAL OPEN DELTA WINDING FOR NVD PROTECTION.

Rev No	Drawn	Chk'd	App'd	Date	Revision
4	RJB			7/00	TEXT ADDED

ORIGINAL ISSUE		DATE
Drawn	RJB	7/98
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Approved		
SCALE	N.T.S.	

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Design Department.
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WESTERN POWER DISTRIBUTION

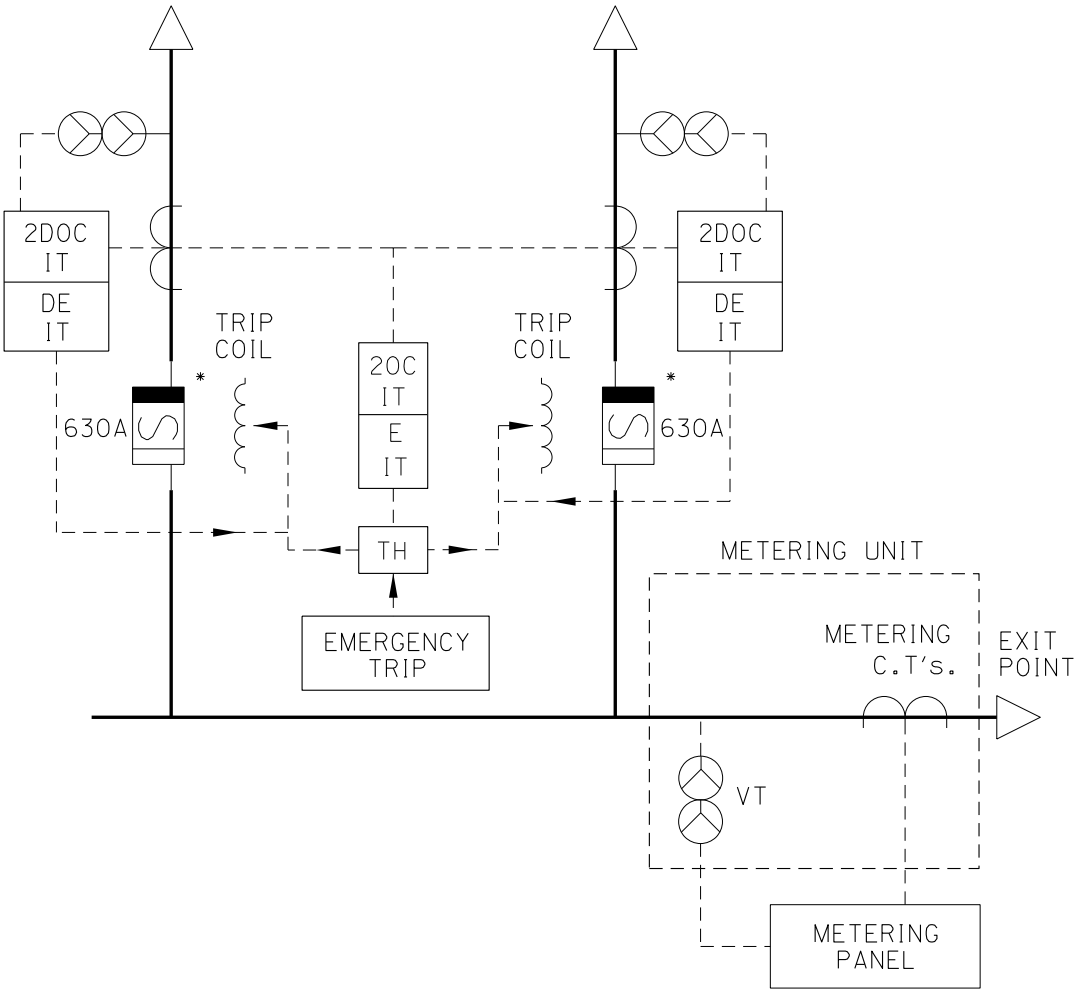
Title **FREE STANDING CIRCUIT BREAKER WITH NVD PROTECTION FOR PARALLEL GENERATION APPLICATIONS**

Drg. No. 06/69/2889/3G

Rev No 4

ARRANGEMENT No 4

TO BE USED FOR PARALLEL FEEDERS



* CATAGORY A SF6 OR VACUUM CIRCUIT BREAKERS

** SEE SECTION 4 FOR ENHANCED METERING CT & VT REQUIREMENTS

6.6kV LOAD KVA	11kV LOAD KVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO	
100 - 570	100 - 950	100/50/5	400/5	
570 - 1100	950 - 1900	100/50/5	400/5	
1100 - 2200	1900 - 3800	400/200/5	400/5	
2200 - 4500	3800 - 7600	400/200/5	400/5	
4500 - 6850	7600 - 11430	800/5	600/5	**

Rev No	Drawn	Chk'd	App'd	Date	Revision
12	RJB			7/00	800/5 ADDED

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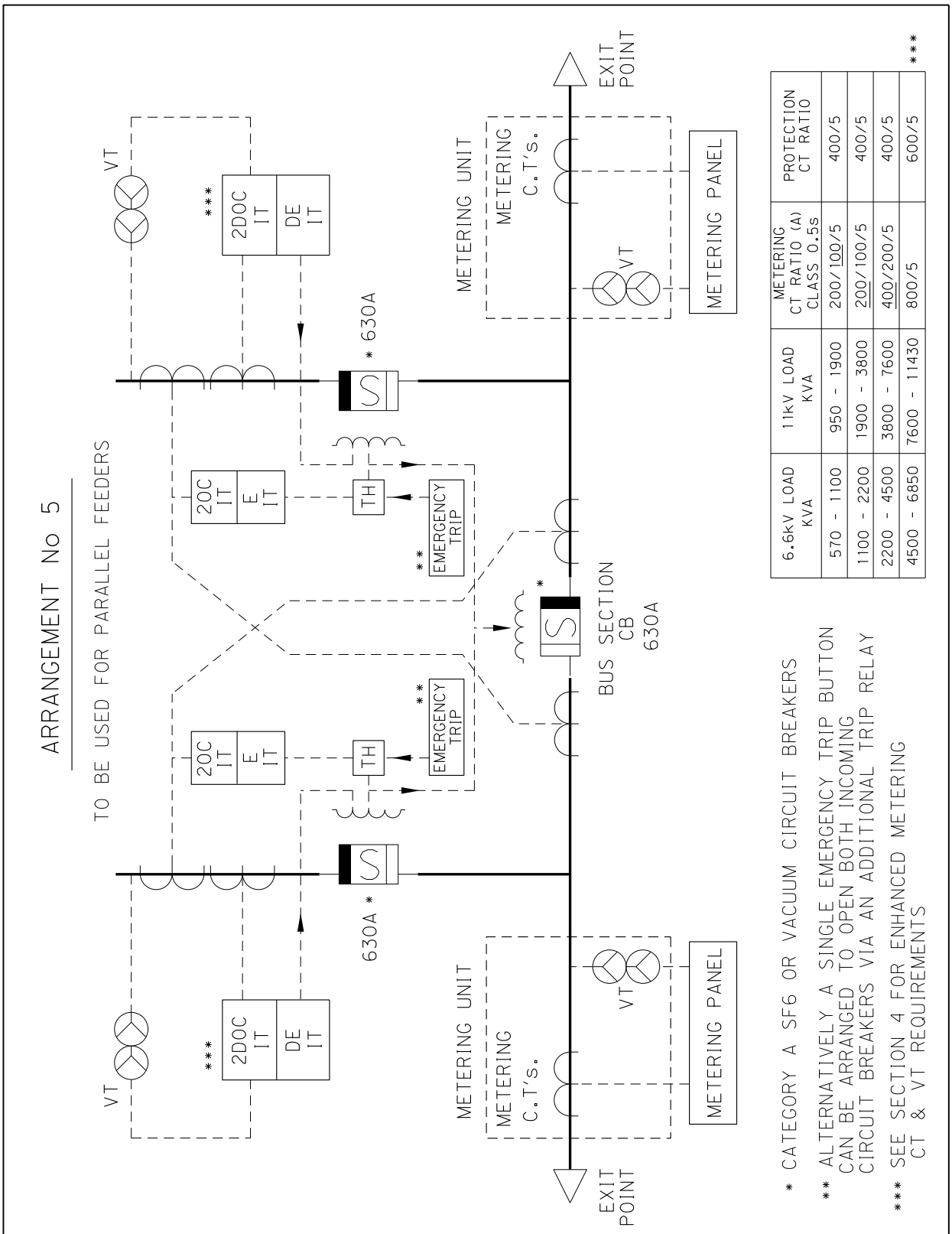
Title

FIRM DUPLICATE SUPPLY WITH SINGLE EXIT POINT

Drg. No.	Rev No
06/69/2894	12



6.6kV LOAD KVA	11kV LOAD KVA	METERING CT RATIO (A) CLASS 0.5s	PROTECTION CT RATIO
570 - 1100	950 - 1900	200/100/5	400/5
1100 - 2200	1900 - 3800	200/100/5	400/5
2200 - 4500	3800 - 7600	400/200/5	400/5
4500 - 6850	7600 - 11430	800/5	600/5

Rev No	Drawn	Chk'd	App'd	Date	Revision
11	RJB			7/00	NOTE MODIFICATION

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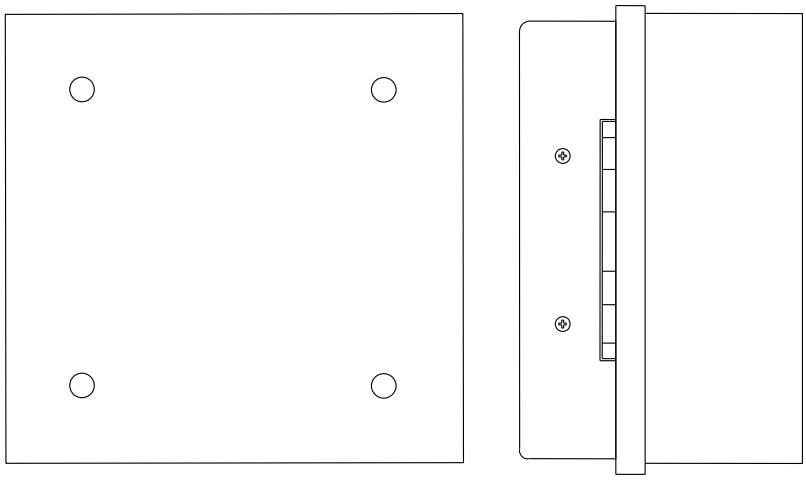
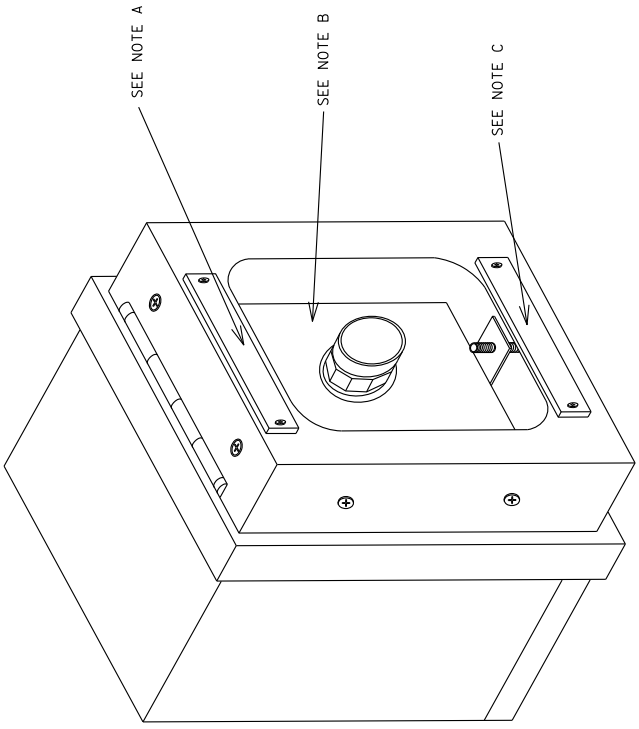
Title
FIRM DUPLICATE SUPPLY WITH 2 EXIT POINTS

Drg. No. 06/69/2895

Rev No 11





NOTE A
MAIN ELECTRICAL SUPPLY

NOTE B
EMERGENCY TRIP BUTTON

ONCE OPERATED THE INCOMING ELECTRICAL SUPPLY WILL BE DISCONNECTED. THE SUPPLY CAN ONLY BE RECONNECTED BY WESTERN POWER DISTRIBUTION

NOTE C
USE WITH EXTREME CAUTION

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1	RJB			1/00	BORDER ALTERATION

ORIGINAL ISSUE		DATE
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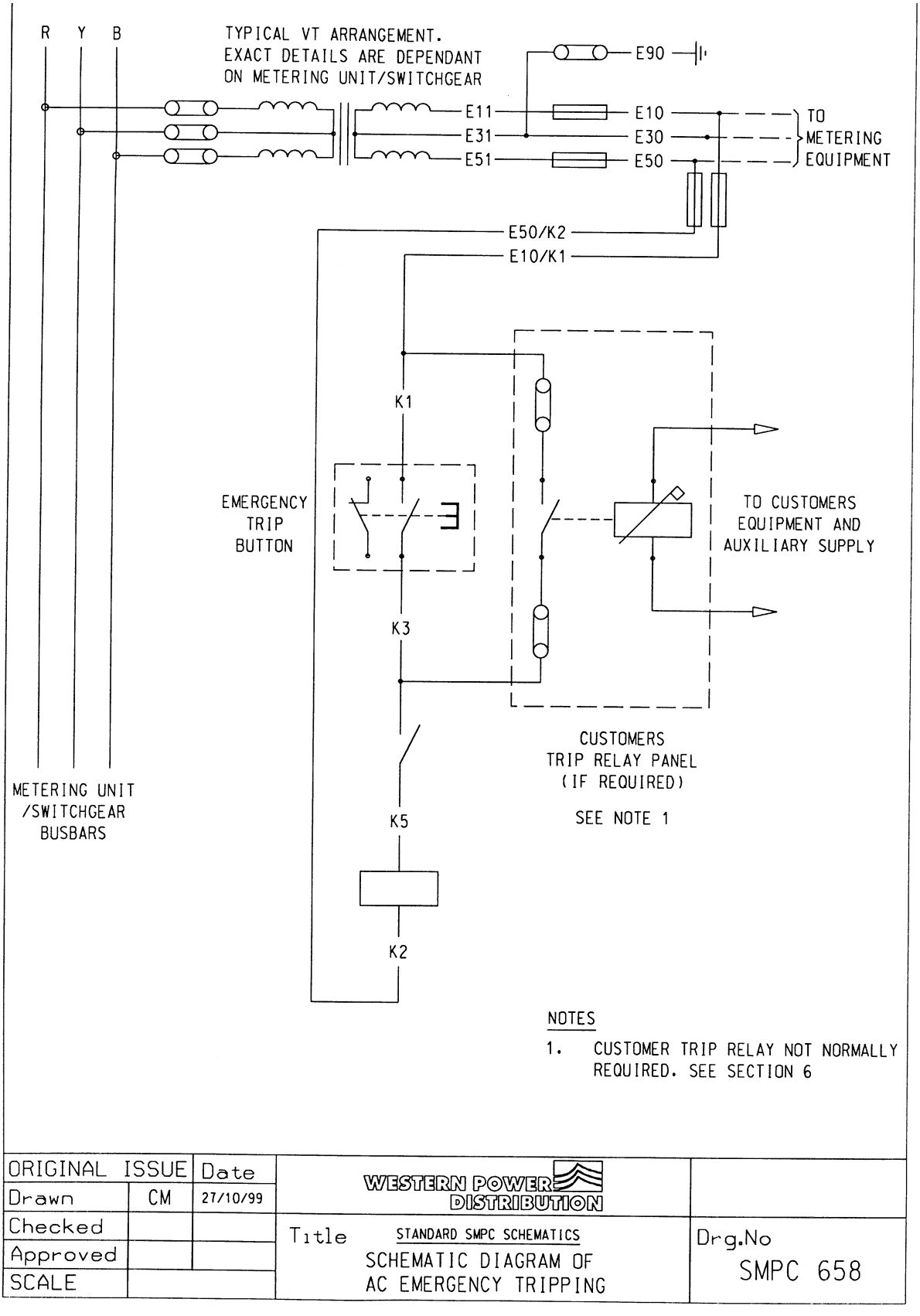
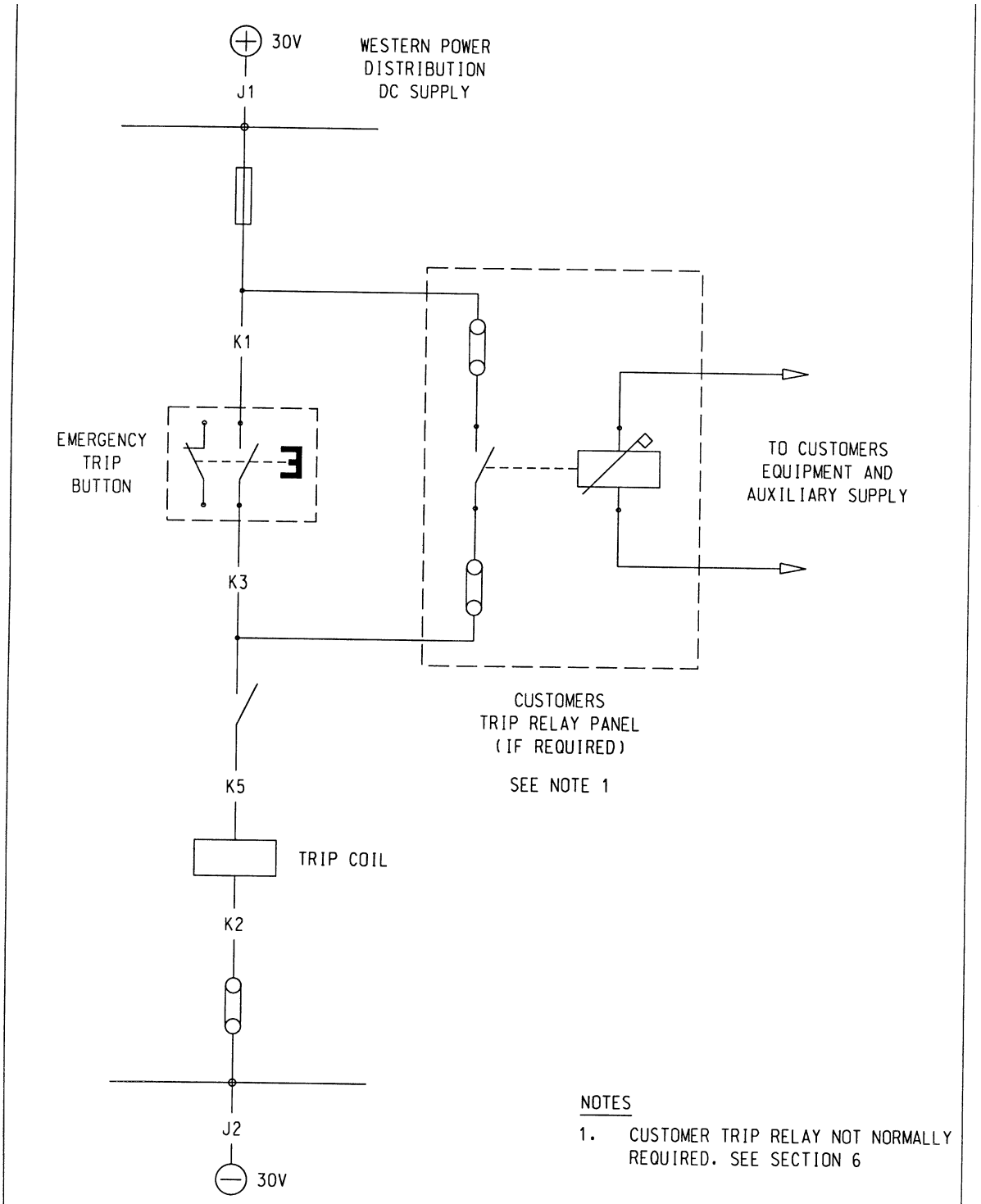
Title
OUTLINE DRAWING AND FIXING DETAILS OF EMERGENCY TRIP PUSH BUTTON BOX

Drg. No. 06/69/2898

Rev No 1



ORIGINAL ISSUE		Date	WESTERN POWER DISTRIBUTION	
Drawn	CM	27/10/99		
Checked			Title STANDARD SMPC SCHEMATICS SCHEMATIC DIAGRAM OF AC EMERGENCY TRIPPING	Drg.No SMPC 658
Approved				
SCALE				


30V
WESTERN POWER
DISTRIBUTION
DC SUPPLY
J1
K1
EMERGENCY
TRIP
BUTTON
TO CUSTOMERS
EQUIPMENT AND
AUXILIARY SUPPLY
K3
CUSTOMERS
TRIP RELAY PANEL
(IF REQUIRED)
SEE NOTE 1
K5
TRIP COIL
K2
J2
30V
NOTES
1. CUSTOMER TRIP RELAY NOT NORMALLY REQUIRED. SEE SECTION 6
ORIGINAL ISSUE
Date
Drawn
CM
25/10/99
Checked
Approved
SCALE
WESTERN POWER DISTRIBUTION
Title
STANDARD SMPC SCHEMATICS
SCHEMATIC DIAGRAM OF
DC EMERGENCY TRIPPING
Drg.No
SMPC 657

APPENDIX C

SUPERSEDED DOCUMENTATION

This document supersedes ST:SD4O dated November 2000 which should now be withdrawn.

APPENDIX D

ANCILLARY DOCUMENTATION

Electricity Supply Regulations 1988
Distribution Code
Electricity at Work Regulations 1989
Health and Safety at Work Act 1974
National Engineering Recommendation G59/1
National Engineering Recommendation G75
Technical Specification 09-6
Engineering Technical Report 113
IEC 255
HSE Approved Code of Practice, The Use of Electricity in Mines
HSE Approved Code of Practice, The Use of Electricity at Quarries
EE:SPEC 2 (As Amended)
EE:SPEC 3 (As Amended)

APPENDIX E

KEY WORDS

Standard, Arrangements, HV Connection, Mines, Quarries, Emergency Tripping, Generations.