

## Company Directive

### ENGINEERING SPECIFICATION EE SPEC: 28/8

#### Low Voltage Intake Metering Panels


##### Policy Summary

This Technical Specification specifies requirements for Low Voltage Intake Metering Panels rated at 800A, 1250A and 1600A that provide a point of metering, isolation and protection at large LV customer connections.

**Author:** Anthony Smith

**Implementation Date:** June 2024

**Approved by**



**Carl Ketley-Lowe**  
Head of Engineering Policy

**Date:** 25<sup>th</sup> June 2024

Target Staff Group	Procurement to utilise this document for future framework contracts. Plant centres to note but no action required.
Impact of Change	Green
Planned Assurance checks	Future framework contracts to be assessed against this specification. No effect on existing contracts or orders.

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## **IMPLEMENTATION PLAN**

### **Introduction**

This document revises the existing NGED specification.

### **Main Changes**

Errors corrected. Addition of metering umbilical requirements (wiring and components) that are now standard use within NGED.

### **Impact of Changes**

No direct impact on current application/use of this equipment.

### **Implementation Actions**

Specification EE SPEC 28/7 is to be withdrawn on release of this revised version.

Procurement to utilise this revised specification for establishing a new purchasing contract.

Plant Centres to note.

### **Implementation Timetable**

This revised document may be implemented immediately for the purpose of tender and establishing a revised Framework Contract. No affect to existing framework contracts.

## REVISION HISTORY

Document Revision & Review Table		
Date	Comments	Author
June 2024	<ul style="list-style-type: none"> <li>• 2.0 additions to tables for missing standards</li> <li>• 3.3 added to identify alternative cable entry requirement. Already utilised as necessary</li> <li>• 5.6 added STC to be wired out as standard</li> <li>• 10.4 split into 10.4 though 10.6 to make clear requirement for meter wiring via umbilical as this is already utilised as a standard</li> <li>• 10.5 &amp; 10.6 moved to 10.7 &amp; 10.8 respectively</li> <li>• 13.4 added CoG marking requirement</li> <li>• 14.1 added drawings to be in dxf or dwg format</li> </ul> <p>Following added. Already utilised as standard:</p> <ul style="list-style-type: none"> <li>• Appendix B Basic Material for Metering Umbilical Cable</li> <li>• Added Appendix C LV Metering Cable Wiring Requirements</li> </ul>	Anthony Smith
Jan 2019	<p>Added contents page</p> <p>Changes to section 7 as follows:</p> <ul style="list-style-type: none"> <li>• 7.1</li> <li>• Paragraph 3 - Amended number of predrilled holes from 4/7/8 to 8 or 11</li> <li>• Paragraph 4 – added comment “along with offset palm to ensure”</li> <li>• Table revised to allow for additional cable requirements from 4 to 7 or 8 on 800/1250A units and 7 or 8 to 10 or 11 for 1600A units</li> <li>• 7.2</li> <li>• Paragraph 1 – added “and offset palm”</li> <li>• Paragraph 4 – removed statement “either; 4 hole shear bolt lugs with M8 bolts”</li> </ul>	Anthony Smith
Dec 2017	<ul style="list-style-type: none"> <li>• Standards references updated</li> <li>• Detail on incoming cables and gland plates revised</li> </ul>	S. Hennell

## CONTENTS

1.0	INTRODUCTION.....	5
2.0	COMPLIANCE WITH STANDARDS.....	5
3.0	GENERAL ARRANGEMENT.....	6
4.0	CABINET.....	6
5.0	CIRCUIT BREAKER.....	7
6.0	SHORT CIRCUIT RATINGS.....	9
7.0	INCOMING CABLE TERMINATIONS.....	9
8.0	BUSBARS.....	10
9.0	EARTHING.....	10
10.0	CT MOUNTINGS & METERING CONNECTIONS.....	10
11.0	TEMPERATURE RISE.....	11
12.0	TYPE TESTS.....	11
13.0	LABELLING.....	11
14.0	DRAWINGS.....	11
APPENDIX A	CABLE GLAND CHARACTERISTICS.....	12
APPENDIX B	BASIC MATERIAL REQUIREMENT FOR METERING UMBILICAL CABLE ..	13
APPENDIX C	LV METERING CABLE WIRING REQUIREMENTS.....	15
APPENDIX D	SUPERSEDED DOCUMENTATION.....	17
APPENDIX E	RECORD OF COMMENT DURING CONSULTATION.....	17
APPENDIX F	ASSOCIATED DOCUMENTATION.....	17
APPENDIX G	KEYWORDS.....	17

## 1.0 INTRODUCTION

- 1.1 This Technical Specification specifies requirements for Low Voltage Intake Metering Panels used to provide a point of metering, isolation and protection to customers with large LV supplies.
- 1.2 The units are equipped with a Moulded Case Circuit Breaker (MCCB) or Air Circuit Breaker (ACB), arranged to provide a Customer's emergency trip. Provision is included for accommodation of metering potential fuses, CTs and associated CT terminations.

Where the term "shall" or "must" is used in this document, it means the requirement is mandatory. The term "should" is used to express a recommendation. The term "may" is used to express permission

## 2.0 COMPLIANCE WITH STANDARDS

- 2.1 This Technical Specification makes reference to or implies reference to the following documents and it is important that users of all standards and Technical Specifications ensure that they are in possession of the latest issues together with any amendments. Equipment shall comply with the listed standards unless otherwise specified to the contrary.

British Standard	Title	IEC/ISO Base
BS 5467	Electric Cables – Thermosetting insulated, armoured cables	-
BS 7655-1.3	Specification for insulating and sheathing materials for cables. Elastomeric insulating compounds. XLPE. Sec 1.3 XLPE	-
BS HD 60269	Cartridge Fuses for voltages up to and including 1000V a.c. and 1500V d.c.	IEC 60269
BSEN 60529	Specification for the degrees of protection provided by enclosures.	IEC 60529
BSEN 60947-1	Low-voltage switchgear and controlgear Part 1: General Rules	IEC 60947-1
BSEN 60947-2	Low-voltage switchgear and controlgear Part 2: Circuit Breakers	IEC 60947-2
BSEN 61439-1	Low voltage switchgear and controlgear assemblies. Part 1: General Rules	IEC 61439-1
BSEN 61439-2	Low voltage switchgear and controlgear assemblies Part 2: Power switchgear and controlgear assemblies	IEC 61439-2
BSEN 61869-1	Instrument transformers. General requirements.	IEC 61869-1
BSEN 61869-2	Instrument transformers. Additional requirements for current transformers.	IEC 61869-2

## 2.2 Electricity Networks Association Technical Specification (ENATS)

ENATS	Title
37-1	400 V a.c. switchgear, controlgear and fusegear assemblies
50-18	Design and Application of Ancillary Electrical Equipment
50-19	Standard Numbering for Small Wiring

### 3.0 GENERAL ARRANGEMENT

- 3.1 The unit shall be floor mounted with bottom cable entry for DNO and shall be suitable for extension to form part of a multi-panel switchboard by a busbar configuration that can be extended on both the left and right sides. Cabinet size will be typically approximately 1500mm high, 600mm wide by 400mm deep, though Suppliers may submit alternative dimensions when considering cable requirements per Appendix A.
- 3.2 The equipment shall be designed for minimal and simple maintenance. Any parts requiring maintenance access shall not require disconnection of either of the incoming cables or busbars.
- 3.3 Additional options as follows should be available as needs arise. Any adaptor unit shall include appropriate cable supports throughout cabinet.
- A cabinet (inclusive of all fittings) to the left hand side of main unit which adapts the DNO cables from bottom entry to top.
  - A cabinet (inclusive of all fittings) to the right hand side of main unit which adapts the customer cables from top entry to bottom.

### 4.0 CABINET

- 4.1 The unit shall comply with ENATS 50-18 and be constructed from sheet steel.
- 4.2 Door panels shall be hinged and lockable which will be secured by the use of a NGED System/Safety padlock of the following size to be fitted - body up to 38mm square with a 7mm diameter shackle having a clear inside width of 20mm and an inside length of between 16mm and 30mm. The holes provided for the shackle to pass through shall be not less than 8mm diameter.
- 4.3 All doors and panels *which can be opened or removed externally* are to be provided with sealing facilities for NGED standard copper compression seals on steel wire. On panels the sealing fittings shall be placed on diagonal corners.
- 4.4 On opening any door, any live metalwork shall be screened with easily removable clear Perspex to avoid inadvertent contact providing a protective level IPXXB per BSEN 60529.

- 4.5 The cabinet shall have three segregated compartments:
- (a) The lower compartment shall house the incoming cable terminations and busbars to the rear/underside of the circuit breaker, which shall be flush mounted.
  - (b) The upper compartment shall house the outgoing busbars complete with removable busbar links (for fitting/changing current transformers) and suitable accommodation for metering current transformers (Section 10). The compartment shall have large removable plates on the side to enable connection onto the busbar runs to the Customers switchgear. Such plates shall only be removable from the inside of the cabinet. The CT's shall be accessed from the front by means of an access panel having sealing facilities as specified in 4.3 above. It shall have adequate dimensions to allow the CT's to be easily installed or changed without disturbing adjacent parts of the unit.
  - (c) A separate fuse compartment (accessed by a lockable door) adjacent to the circuit breaker shall house the metering potential fuses (min 6A rated), clear test terminal block such as that by Owen Brothers SATB (see EE119), protection fuses (where fitted) and interlock key.
- 4.6 The segregation between upper and lower compartments shall be by means of a barrier to class IP3X. The segregation between the fuse compartment and the upper and lower compartments shall be not less than IP4X. Externally, the cabinet shall have overall protection approaching IP41, but not less than IP31. (BSEN 60529) Where appropriate the form of separation shall be Form 2a in accordance with BSEN 61439-2.
- 4.7 The cabinet shall be provided with ventilation (suitably baffled) providing class IP41 protection so as to comply with the temperature rise requirements of this specification (Section 11)
- 4.8 Metering potential fuses (6A) and CT's shall be readily accessible and replaceable without disconnection of incoming cables or busbars.
- 4.9 The insulating materials shall be non-flammable and non-hygroscopic and resistant to tracking as present manufacturing techniques allow.
- 4.10 Paintwork shall be light grey (Colour reference 631) in accordance with ENATS 50-18 unless otherwise agreed.
- 4.11 Suitable, tested, lifting eyes shall be provided to assist in the mechanical handling of the fully constructed cabinet(s).

## **5.0 CIRCUIT BREAKER**

- 5.1 The circuit breaker shall be a 3 pole type for use on the 433V a.c. system satisfying the requirements of BSEN 60947-2, classified as follows:
- Air circuit breaker (ACB) or moulded case circuit breaker (MCCB)
  - Selectivity category B
  - Independent manual operation
  - Suitable for isolation
  - Fixed installation

- 5.2 Minimum rated service short circuit breaking capacity ( $I_{cs}$ ) shall be 35kA. Minimum rated short time withstand current ( $I_{cw}$ ) shall be 20kA for 1 second. Rated Current for the circuit breaker and panel combination shall be 1600A, 1250A or 800A as specified at the time of tender.
- 5.3 A bolted neutral link shall be provided.
- 5.4 The circuit breaker shall be equipped with integral, adjustable, phase fault protection with characteristics and setting ranges specified below:
- Overload characteristic, adjustable between 0.5 x and 1.0 x circuit breaker Rated Current (at least 5 steps).
  - $I^2t$  characteristic with time settings adjustable between 1 and 20s at 6x the overload setting (at least 4 steps).
  - A short time characteristic, selectable between definite time and  $I^2t$  with current setting adjustable between 2x and 8x overload setting (at least 5 steps) and with time setting adjustable between 0 and 0.4s (at least 4 steps).
  - An instantaneous characteristic with current setting adjustable between 2x and 10x the circuit breaker Rated Current (at least 5 steps).
- 5.5 In addition to phase fault protection, 1600A circuit breakers shall be equipped with earth fault protection satisfying the following requirement:
- Earth fault characteristic selectable between definite time and  $I^2t$  with current setting adjustable between 600A and 1200A (at least 5 steps) and with time setting adjustable between 0 and 0.4s (at least 4 steps).
- 5.6 The circuit breaker and its associated protection features shall be suitably rated to meet the specified performance and temperature rise conditions in the PANEL ENCLOSURE SUPPLIED (i.e. not just in "free air" conditions.)
- 5.7 The circuit breaker shall have a 230V 50Hz shunt trip coil and auxiliary switch that shall be wired out to a termination via a protective fuse.
- 5.8 The method of closing the circuit breaker shall be by independent manual operation and the mechanism shall be of the trip-free type.
- 5.9 A facility must be provided to lock, with a padlock, the circuit breaker in either the closed or open position. The padlock used will be the System/Safety padlock specified in section 4.2 of this specification.
- 5.10 The equipment shall be arranged to permit the Customer to open the circuit breaker in order to disconnect the supply, but an interlock arrangement shall be provided to prevent reclosing of the circuit breaker by the Customer. This shall be achieved using a key type interlock arrangement where the key releases the auto-lock off. The interlock key shall be kept in the locked fuse compartment adjacent to the circuit breaker. (See 4.4 (c))



## 6.0 SHORT CIRCUIT RATINGS

- 6.1 The equipment contained within the intake panel shall be proven by test to be capable of carrying without undue distortion or deterioration the fault currents specified in Section 5 and in accordance with BSEN 61439-1.

## 7.0 INCOMING CABLE TERMINATIONS

- 7.1 A cable support and a non-ferrous gland plate system shall be provided to suit the requisite cable configuration required to meet the circuit breaker rating.

The gland plate system shall provide effective isolation of the cable armour wires and glands from the general earthed metallic construction of the metering panel so as to permit the bonding and earthing requirements of SD5E Figures 8 to 14 to be met.

The gland plate shall be pre-drilled to accept 8 or 11 glands with grommets provided to blank off holes that are not required.

This is most important now that centre palm (along with offset palm) terminal end connectors are being used as this then lines up the cleats, cable entry and end terminal connectors on to the busbar droppers.

Cables [Aluminium Tape Armoured]	Circuit Breaker Rating		
	800A	1250A	1600A
600mm <sup>2</sup> "Solidal"	7 or 8 (2 per ph. / 1 or 2 neutral)	7 or 8 (2 per ph. / 1 or 2 neutral)	10 or 11 (3 per ph. / 1 or 2 neutral)
740mm <sup>2</sup> Solidal"	7 or 8 (2 per ph. / 1 or 2 neutral)	7 or 8 (2 per ph. / 1 or 2 neutral)	10 or 11 (3 per ph. / 1 or 2 neutral)
630mm <sup>2</sup> Copper	7 or 8 (2 per ph. / 1 or 2 neutral)	7 or 8 (2 per ph. / 1 or 2 neutral)	10 or 11 (3 per ph. / 1 or 2 neutral)

In addition to the requirement above, provision must be made to accept 2 x 120 PVC covered earth cables.

- 7.2 The shear bolt terminal connectors are centre and offset palm and shall be accommodated as the cable termination, with one shear bolt end terminal connector per busbar dropper.

Bolts, nuts, washers and spring washers are to be supplied, however the company terminating the cables will supply the lugs or terminal connectors.

There shall be sufficient phase clearance between the installed shear bolt end terminal connectors and adjacent phases or if this can not be achieved then insulated phase barriers shall be provided.

Provision shall be made for the terminal connector to have a palm thickness of 12mm minimum. The busbar ends shall be drilled to accept standard 1 hole sheer bolt lugs with M16 bolts.

The distance between the cable gland plate and the lowest incoming busbar connection shall not be less than 550mm in order to allow for the cable bending radius for the above cables.

The gland plate shall be sized near to the total floor area of the panel and shall be removable internally.

## **8.0 BUSBARS**

- 8.1 Busbars shall be of hard-drawn high conductivity copper or other material as approved by National Grid Electricity Distribution. The normal rated current shall be equal to or greater than the circuit breaker rated current.
- 8.2 For busbars and busbar connections in air, the minimum electrical clearances and minimum creepage distances between phases and phase to earth, shall be a minimum of 19mm in accordance with ENA TS 37-1
- 8.3 The busbar arrangement shall provide for extension of the busbars to the left and/or to the right of the panel per section 3
- 8.4 A full size neutral conductor shall be provided for; i.e. the same current rating as the corresponding phases.

## **9.0 EARTHING**

- 9.1 Provision shall be made for the connection of either a Combined Neutral Earth (CNE) or Separate Neutral Earth (SNE). An additional earth at the top of the unit shall be provided for connection of customer earthing.
- 9.2 Manufacturers shall ensure earth continuity between panel sheets making up the enclosure, noting that some paint finishes have poor conductivity.

## **10.0 CT MOUNTINGS & METERING CONNECTIONS**

- 10.1 Provision shall be made for the installation of 3 metering CT's on the load side of the circuit breaker, one per phase in the upper compartment. Suitable mounting arrangements shall be made to facilitate changing of CT's using the removable links in the busbars. CT's shall be situated on the busbars immediately above the circuit breaker.
- 10.2 Metering CT's fitted in the 800A circuit breaker shall be 800/5, in the 1250A circuit breaker 1200/5 and in the 1600A circuit breaker they shall be 1600/5 unless otherwise specified. They shall be class 0.5S with 10VA burdens in accordance with BSEN 61869-2, and shall be supplied and fitted with test certificates supplied.
- 10.3 Three insulated metering potential fuse carriers, fitted with 6A fuses to BS88 Part 6 ref f1, shall be positioned within the fuse compartment and as close as possible to each outgoing phase busbar. They shall be connected to the busbars by a minimum 10 mm<sup>2</sup> cross section insulated conductor, positioned and screened to ensure safe withdrawal and replacement with the supplies energised and the circuit breaker closed.
- 10.4 A test terminal block containing captive links (e.g. Owen Brothers previously GEC or Campbell York Type KP0023 or equivalent) shall be supplied within the fuse compartment for the termination of CT and metering potential wiring.
- 10.5 Multicore wiring for connection to metering equipment by NGED staff; shall be made via permanent wiring within the cabinet utilising the key components A1-A4 in Appendix B. Connections shall be made per detail in Appendix C.
- 10.6 Umbilical cables to be manufactured utilising key components B1-K. All connections and lengths if umbilical shall be provided per detail in Appendix C.

- 10.7 The Metering CT's shall be earthed on the S2 side (D10/D30/D50) via a removable captive, accessible link within the cabinet.
- 10.8 Test Certificates for the CT's shall be provided to meet requirements of the Balancing and Settlement Code Metering CoP5 (up to 1MW) or CoP3 (Up to 10MVA) and also CoP4 as detailed in ST: TP14J "*Management of CT & VT Test Certificates*"

## **11.0 TEMPERATURE RISE**

- 11.1 The unit shall be designed and assembled to ensure that there is no adverse thermal interaction between any of the components. Temperature rise test certificates for the complete panel shall be available on request. Temperature rise requirements shall satisfy the requirements of BSEN 60947-2, BSEN 61439-1, BSEN 61439-2 and any electronic components shall not exceed their maximum operating temperature (ambient temperature of 35°C).

## **12.0 TYPE TESTS**

- 12.1 Type testing shall be carried out in accordance with ENA TS 37-1, BSEN 61439-1 and BSEN 60947-2.

## **13.0 LABELLING**

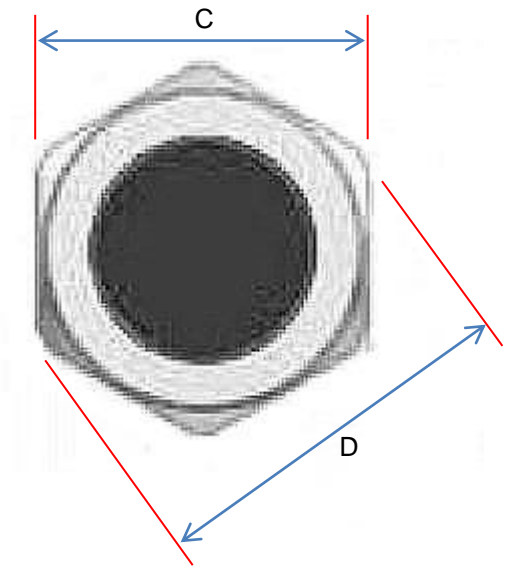
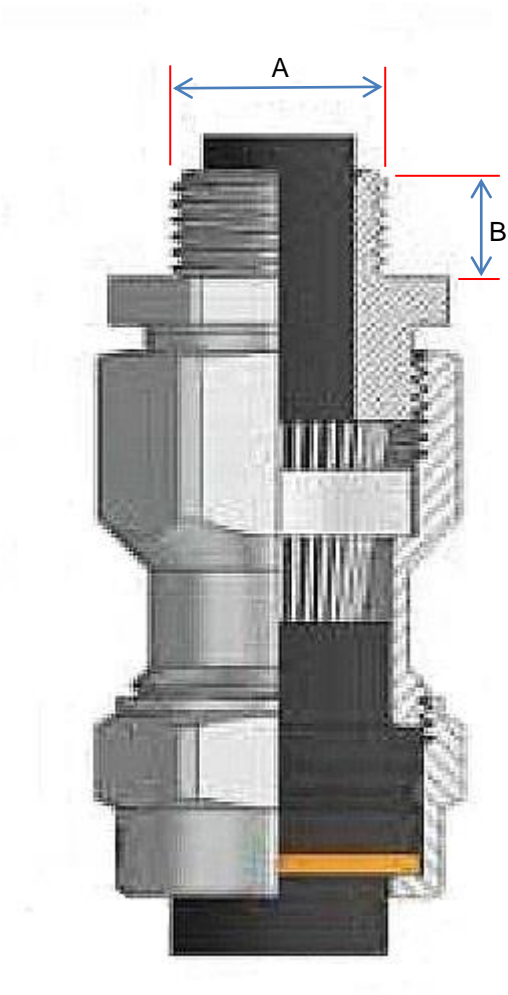
- 13.1 The unit shall be provided with an external front mounted nameplate in accordance with BS EN 61439-1 clause 5 and shall include the following additional information:
- (i) Serial number (unique).
  - (ii) Year of manufacture.
  - (iii) Normal current rating of busbar.
  - (iv) Normal and short circuit current ratings of Circuit Breaker.
  - (v) Reference to this specification.
  - (vi) Gross weight, when fully equipped (kg).
  - (vii) Manufacturer's name and reference number.
- 13.2 CT details shall also be displayed on an external front mounted nameplate. The nameplate shall include the information specified in BSEN 61869-2.
- 13.3 The circuit breaker operating handle shall have the following positions clearly marked - 'ON', 'TRIPPED', 'ISOLATED'.
- 13.4 Centre of Gravity shall be clearly marked on any panel.

## **14.0 DRAWINGS**









- 14.1 The Manufacturer shall submit general arrangement drawings in dxf or dwg format; for approval by NGED prior to commencing manufacture.

**Cable Gland Characteristics**  
**600mm<sup>2</sup>, 630mm<sup>2</sup> and 740mm<sup>2</sup> Aluminium Wire Armoured Cables**

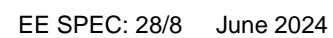
Gland Kit Reference	Entry Thread mm (A)	Thread Length mm (B)	Hexagon	
			Across Faces mm (C)	Across Corners mm (D)
KA422-58	M50 x 1.5	15	65.5	72.1
KA422-59	M50 x 1.5	15	70.1	77.2



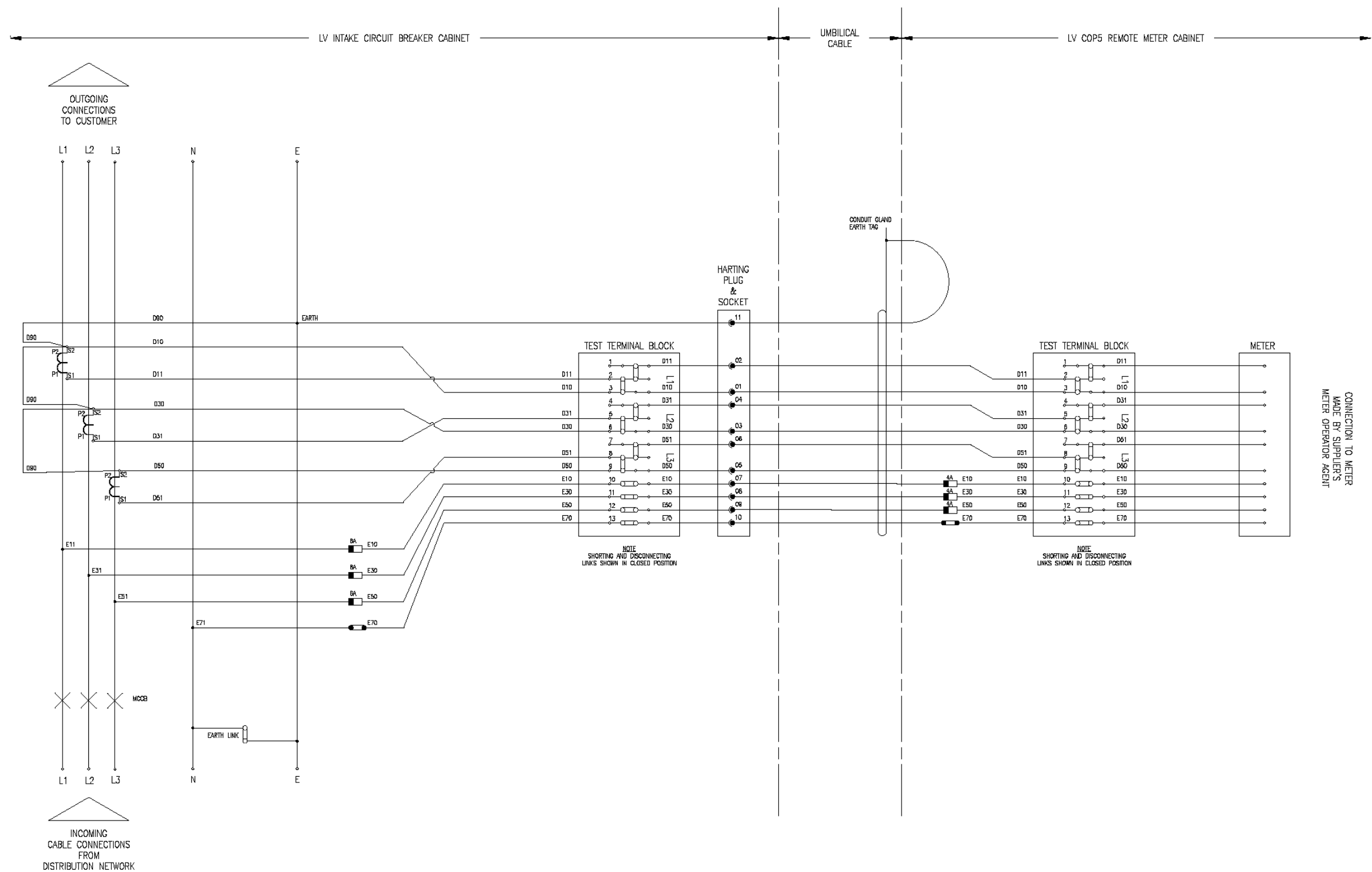
## BASIC MATERIAL REQUIREMENT FOR METERING UMBILICAL CABLE

ITEM	DESCRIPTION	PHOTOGRAPH	MANUFACTURER	PART NUMBER
A1	Han B - Size 16B - Surface Mounted Housing - Side Entry - 1x M25 - Han-Easy Lock		Harting (no alternative)	19 30 016 1231
A2	Han B - Size 16B - Protection Cover For Housing - Thermoplastic		Harting (no alternative)	09 30 016 5405
A3	Han K 12/2 - Size 16B - Han-Com Crimp Termination - Female		Harting (no alternative)	09 32 012 3101
A4	Han K 12/2 - Size 16B - Han C Crimp Contact - 2.5mm <sup>2</sup> - Female		Harting (no alternative)	09 32 000 6205
B1	Han B - Size 16B - Hood - Low Construction - Side Entry - 1x M25		Harting (no alternative)	19 30 016 1521
B2	Han B - Size 16B - Protection Cover For Hood - Metal - With Fixing Cord - Han Easy Lock		Harting (no alternative)	09 30 016 5422
B3	Han K 12/2 - Size 16B - Han-Com Crimp Termination - Male		Harting (no alternative)	09 32 012 3001
B4	Han K 12/2 - Size 16B - Han C Crimp Contact - 2.5mm <sup>2</sup> - Male		Harting (no alternative)	09 32 000 6105

ITEM	DESCRIPTION	PHOTOGRAPH	MANUFACTURER	PART NUMBER
C	Flexible Coated Metallic Conduit - Galvanised Steel - PVC Coated - 25mm Diameter		Flexicon (or equivalent)	FSU25B
D	Flexible Conduit Fitting - External Thread - Nickel Plated Brass - For 25mm Conduit		Flexicon (or equivalent)	FSU25-M25-M
E	Locknut - Nickel Plated Brass - For 25mm Conduit Fitting		Flexicon (or equivalent)	B-M25
F	Earth Tag - Brass - For 25mm Conduit Fitting		Flexicon (or equivalent)	ET-M25
G	Metallic Fixing Clip With PVC Liner		Flexicon (or equivalent)	FCC25
H	Grommet - EPDM - for cable diameter 26-35mm		Pro Power (or equivalent)	PG 36/47
I	Warning Label - 30x60mm - 'WARNING Do Not Disconnect'			
I	PVC Insulated Single Core Cable To BS6231 and ENATS 50-18			
J	Wire Identifiers (ferrules) Per Appendix B			
K	'Ring' Insulated Crimp For 2.5mm <sup>2</sup> Conductors			



Issue:



					nationalgrid Electricity Distribution		Engineering Design Department (East Midlands) Pagopus Business Park, Castle Donington, DE74 2TU.		
					Title: LV INTAKE CABINET WITH PLUG IN REMOTE METER CABINET			Scale: NTS	Orig. No.
					SCHEMATIC DIAGRAM				LVMU_SD_0001
									Rev No.
B	PJB	AMS	AMS	19.06.24	DRAWING FRAME REVISED. VT FUSES WERE 16A NOW 6A.				B
Rev	Drawn	Chk'd	App'd	Date	Revision Note				

DO NOT SCALE DRAWING. ONLY USE STATED DIMENSIONS IF IN DOUBT. ALL RIGHTS ARE RESERVED TO NED (EAST MIDLANDS) PLC. NO PART OF THIS DRAWING MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, INCLUDING PHOTOCOPYING AND RECORDING, OR STORED IN A RETRIEVAL SYSTEM OF ANY NATURE, WITHOUT PERMISSION.



## **APPENDIX D**

### **SUPERSEDED DOCUMENTATION**

This document supersedes EE SPEC: 28/7 dated January 2019 which has now been withdrawn.

## **APPENDIX E**

### **RECORD OF COMMENT DURING CONSULTATION**

No comments required as only minor update of document to align with current practices prior to new framework tender.

## **APPENDIX F**

### **ASSOCIATED DOCUMENTATION**

ST: SD5E      Design of Low Voltage Commercial and Industrial Connections

EE SPEC: 16    LV Distribution Fuseboards

EE SPEC: 119   Specification for HV & LV CT Metering Panels

ST: TP14J      Management of Metering CT & VT Test Certificates

## **APPENDIX G**

### **KEYWORDS**

Fuseboard; Metering Unit; MCCB; ACB