Electricity Distribution

nationalgrid

Company Directive

ENGINEERING SPECIFICATION
EE SPEC 2/8

12kV Cable Connected Outdoor Extensible and Non-Extensible (RMUs) Secondary Type Switchgear & Metering Units

Author: **Anthony Smith**

Implementation Date: **February 2025**

Approved by

Andrew Reynolds
Engineering Policy Manager

Date: **21st February 2025**

Target Staff Group	**Anyone involved with the addition, or alteration of, 12kV distribution substations inclusive of but not limited to Planners, Project Engineers, Technicians, EDS, PND, Plant Centres and Purchasing for any tenders**
Impact of Change	**Green – No impact on current working practices**
Planned Assurance checks	**Team Managers of target staff group shall be contacted within 3 months to confirm staff have been made aware of the documents reissue with minimal changes**

IMPLEMENTATION PLAN

Introduction

This document specifies the requirements for 12kV transformer mounted, cable connected secondary distribution switchgear (including RMU mounted metering units) for use on the National Grid Electricity Distribution (NGED) 11kV Network

Main Changes

Reorganisation of the document to align with the clause layout within ENATS 41-41 (2020) +A1 (2021).

The document also contains detail on the requirement for equipment to have low (<1) or no Global Warming Potential (GWP) by the replacement of SF6 gas within the unit by an alternative Interrupting and Isolating Gas (IIG) by the 1st January 2026.

Rationalisation of options has also been made so as to reduce and simplify the build and stocking variants, and to incorporate revisions required to meet SD4OA.

Impact of Changes

Any new contract will be based on this updated specification which is not retrospective for current contracts or orders.

When new technology or revised operational requirements occur, then briefing / awareness documents will be prepared for communication to operators and trainers. Any changes should not materially impact Operational Teams.

Implementation Actions

Managers, including Managers of Independent Connection Providers (ICPs) shall ensure that all staff and contractors involved in the tendering and purchasing of 12kV indoor substations as well as those involved with the design, installation, modification and maintenance of NGED 12kV substations are aware of, and follow, the requirements of this specification.

Implementation Timetable

EESPEC 2/8 will be used as part of the 2025 tender process for 12kV RMUs and extensible equipment and shall be implemented on issue.

ICPs will be expected to comply with this new specification within 6 months of its issue. (e.g., from 1st August 2025). From 1st January 2026 ICPs shall comply with National Grids requirement to not install new apparatus containing an IIG with a GWP greater than 1.

Items currently on order by an ICP, to EE2/7 shall continue to be acceptable to NGED so long as the order was placed before 1st August 2025 and the unit shall be commissioned on NGEDs network before 31st December 2025.

Any items of apparatus containing SF6 not operational on NGEDs network by the end of 2025 will unlikely be allowed to connect irrespective of project construction stage. This is subject to UK government implementation of EU Regulation 2024/573

ICPs will need to take this into consideration when placing orders after 1st August 2025 with a planned delivery from November 2025.

Exception to this may be made by NGED DNO Policy team upon formal request.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
Feb 2025	• This document has been updated following the withdrawal of ENATS 41-36 and issue of its replacements under the ENATS 41-4X series of documents which in turn are based on BS EN 62271-1. • The base document for EE2/8 is ENATS 41-41 iss1 which is part of a suite of new ENATS created to replace ENATS 41-36. The structure of the new documents aligns with that of BS EN 62271-1 and as such the new clause numbering is very different than before therefore there is no direct correlation clause to clause from EE2/7 to EE2/8 however the technical requirements for 12kV Cable Connected Outdoor Extensible & Non-Extensible (RMUs) Secondary Type Switchgear & Metering Units. • Certain parts been clarified where ambiguity existed and duplicated items have been removed. • The standard panel types within Schedules 1 to 4 have been updated to cover current working practices.	Anthony Smith
Dec 2020	• Updates to reflect new ENATS 41-41. • Inclusion of statement on the progress towards implementation of low or no GWP by the replacement of SF6 gas within the unit by an alternative technology or gas. • Make, type and colours of gas filling points specified to allow for different gas or gas mixtures. • Rationalization of variants to reduce stock options. • Some variants will be special order	Anthony Smith/ Stephen Hennell
12 Jan 2015	• Minor updates to incorporate revisions to ENATS 41-36 (2012)	R Lang

CONTENTS

1.0 INTRODUCTION

1.1.1 This Technical Specification (TS) sets out National Grid Electricity Distributions (NGEDs) requirements for the manufacture and supply of 12kV cable connected outdoor secondary distribution switchgear for use on 11kV and 6.6kV distribution networks. It includes ring main units, extensible switches and circuit breakers upto 630A, and metering units suitable for upto 400A.

All equipment shall be of a non-oil, non-SF6 type

1.1.2 This document is based on and must be read in conjunction with the current version of Energy Networks Association (ENA) Technical Specification 41-41 Issue 1 2020: "*Ground Mounted Distribution Substation 12 to 24 kV Rated RMU & Extensible Switchgear"* and other referenced Standards and Technical Specifications listed either within the ENATS or this NGED TS. NGED options, changes or additions to the ENATS requirements are stated in this NGED TS. Unless otherwise stated the requirements of the relevant part(s) of ENATS 41-41 shall apply.

1.1.3 Any selection of options or changes to this specification by NGED shall be made in writing.

1.1.4 Where this NGED TS is being used for Tender purposes then unless otherwise specified in writing at the time of Tender, all equipment offered against this TS shall be compliant with this TS.

1.1.5 NGED has a distinct preference for equipment which holds an ENA Notice of Conformity (NoC) to the current version or a previous version of an ENA Technical Specification (TS). Where equipment does not have a valid ENA NoC then the following preferences apply in order: -

- Equipment from a design where other ratings have an ENA NoC;
- Equipment manufactured in a facility where other equipment having an ENA NoC is manufactured;
- Other non-ENA Assessed equipment.

1.1.6 Where equipment offered does not have an ENA NoC then the manufacturer will be required to provide NGED with details and test data for review that will be equivalent to completing and ENA NoC Assessment. There is no guarantee that following NGED assessment of the equipment that it will be accepted for use by NGED.

1.1.7 The requirements of this document are not intended to restrict or inhibit the introduction of new forms of switchgear provided that such designs comply with those requirements in respect of safety, security and operation which are generally understood by manufacturers and users.

1.1.8 Equipment that would require major changes to the NGED Distribution Safety Rules and associated safe operating procedures, changes to the Electrical Network Management System software, and any consequential re-training of switchgear operators, may be considered however costs and timescales are highly likely to be a significant limiting factor in the selection and adoption of such equipment.

1.1.9 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 REQUIREMENTS

2.1 General

2.1.1 Suppliers and Manufacturers shall satisfy the requirements of BS EN ISO 9000 and BS EN ISO 9001 for all products supplied.

2.1.2 All equipment shall satisfy requirements of the EMC directive. EMC emissions and immunity requirements shall, as a minimum, satisfy the requirements of the generic emission and immunity standards for industrial environments BS EN 61000-6-2 and BS EN 61000-6-4 and also all relevant EMC product standards.

2.1.3 Details of failure analysis studies for the products being offered shall be included with any tender

2.1.4 In line with National Grid Company Policy, from the 1st January 2026 it will be NGED's policy to not purchase 12kV distribution apparatus which has a GWP of greater than 1.

2.1.5 Any new apparatus for use offered to NGED shall therefore not contain SF6 unless the supplier can provide proof that its current offering will have a viable alternative it can provide to NGED and will be ready for use from 1st January 2026

2.2 Guarantee

2.2.1 The supplier of the plant / equipment covered by this specification shall provide a guarantee for that equipment. The guarantee period that the supplier warrants will be a minimum of 60 months (five years) from the date of completion of cold commissioning on site of the relevant plant / equipment; or where equipment has been manufactured but not delivered to NGED but placed into storage at NGED request, or delivered to NGED but not cold commissioned within 6 months, then the warranty period shall be 66 months from the date of storage or delivery.

2.2.2 This requirement applies to plant / equipment purchased by Independent Connection Providers (to be adopted by NGED) as well as equipment purchased directly by NGED. The 60-month timeframe commences on transfer of ownership to NGED.

2.2.3 Manufacturers shall state at time of tender how a population of the equipment offered would be checked and cleared of any potential type defect occurring in the future. This information shall also detail any cost implications to NGED.

2.3 Drawings

2.3.1 The manufacturer shall provide the following drawings for approval within one month of the commencement date of the contract or by mutually agreed date at the placement of the order. One paper copy of each drawing, prepared in accordance with EA TS 50-18 and not exceeding A1 size, one electronic .dwg/.dxf CAD format and one electronic copy in .pdf format shall be supplied for approval.

- General Arrangement of each circuit breaker / cubicle
- Schematic Diagram for each circuit breaker / cubicle
- Wiring diagram for each circuit breaker / cubicle

2.3.2 Once approval has been obtained an updated electronic copy .dwg/.dxf and .pdf format shall be supplied. After on-site installation and commissioning of the cubicles has been completed the manufacturer shall incorporate any alterations within 3 months of the drawings being returned for correction. The manufacturer shall provide final drawings in .dwg/.dxf CAD and .pdf formats.

2.4 Safety Labels

2.4.1 Safety labels, warning signs and notices shall be compliant with UK standards in terms of colours, pictograms and layout. [BS 5499]

2.5 Training

2.5.1 Current versions of the operational and maintenance manuals relevant to the equipment to be supplied shall be provided at the start of contract.

2.5.2 If deemed necessary by NGED then the manufacturer (or their UK supplier or agent) shall provide suitable training on installation and operational procedures with the first units supplied

2.6 Accessories

2.6.1 Accessory kits shall be available to allow fitment of RMU and/or metering units onto other manufacturer current and legacy equipment. These include:

- Schneider RN2, RN2c, RN2d ring main units
- Lucy VRN2a, VRN6a ring main units
- Schneider metering units MU2, MU6c, MU2d, MU6d
- Lucy metering units AIMU
- Long & Crawford metering units T4M, T5M

2.7 Metering Unit CT and VT output connections

2.7.1 Metering units, and circuit breakers equipped with metering CTs and VTs, shall be provided with a Harting Socket to facilitate the ready connection of the outputs to a remote metering cabinet. [See Appendix H and I]

2.7.1.11 It is be a requirement of the manufacturer to supply the associated cable with a fully made off Harting Plug per drawings in appendix H and I at lengths of 5m 10m and 15m.

2.7.2 Metering units, and circuit breakers equipped with metering CTs and VTs, shall be provided with terminals to facilitate the ready connection of a Connection Control Panel. [See Appendix H and I].

2.8 Actuators and Controllers

2.8.1 The tenderer shall include separately to the tender, details and costs of retrofit actuator units to their apparatus which shall include details of the associated controller. Detailed consideration of section 2.9-2.11 will be necessary for compliance.

2.9 Controller Battery and Charger

2.9.1 General

Power supplies required by the switching device’s control and ancillary equipment shall be derived from a continuous charge-maintained battery supplied from a 240Vac external power supply.

It is preferred that a common battery is used for all functions e.g., radio, RTU, protective relay and switchgear operating mechanism.

The manufacturer shall complete and submit with their tender a completed Schedule 4 for each switching device offered.

2.9.2 Rated supply voltage of auxiliary and control circuits (Ua)

The nominal supply voltage of the battery system to supply control circuits shall be 24 V. (Clause 5.9 of ENATS 41-41).

2.9.3 Battery

The battery shall employ 12 V valve regulated lead-acid monoblocs complying with BS EN 60896-21 and BS EN 60896-22.

The design life of the monoblocs shall be at least 10 years, which shall be calculated using an average ambient temperature of 20°C.

Monoblocs shall be classified as “10/12 Years – Long Life” according to Eurobat.

Monoblocs shall be manufactured using flame retardant plastic materials and have a flammability classification of V-0 according to BS EN 60695-10-11.

2.9.4 Battery Duty Cycle

The battery system shall be sized to deliver the following duty cycle using the methodology described in IEEE Standard 485: Recommended Practice for Sizing Lead Acid Batteries for Stationary Applications.

The battery system shall, in the event of a failure of either the charger or its ac supply, be capable of supporting:

- The standing dc load for a period of 24 hours, followed by
- The following switchgear operating sequence:

Circuit breakers: O - 5s - CO - 5s - CO - 5s – CO

Switch disconnectors: O - 30s - C - 30s - O - 30s - C

The minimum permissible voltage at the battery terminals at the end of the duty cycle shall be not less than 21.6V (12 cells @ 1.80 volts per cell).

The standing dc load shall include that associated with the radio, RTU and control & protection relays. The following standing load should be assumed for the radio:

- A constant drain of 0.25 A
- A transmit / receive cycle of 2.5 amps for 30 seconds in every 6 hours

2.9.5 Battery Sizing Margins

Battery Design Margin

A margin shall be provided to allow for unforeseen additional load on the dc system or for ambient temperatures being lower than expected.

A battery design margin of 1.1 shall be applied to the battery sizing calculation.

Battery Temperature Correction Factor

A temperature of 5°C shall be assumed for the purpose of sizing the battery system.

The available capacity in a monobloc is affected by its operating temperature and rated capacity is typically based upon an ambient temperature of 20°C or 25°C.

The following temperature correction factor shall be applied to the battery sizing calculation:

1.32 where rated capacity is based on an ambient temperature of 20°C

1.42 where rated capacity is based on an ambient temperature of 25°C

Battery Aging Factor

End of service life shall be deemed to be the point at which the actual capacity of the battery has reached 80% of the nominal capacity. The battery shall be able to perform the specified discharge duty cycle throughout its service life.

An aging factor of 1.25 shall be applied to the battery sizing calculation.

2.9.6 Monobloc Approval

The supplier shall arrange, at its own expense, for the battery capacity to be verified by discharge testing at an independent test facility, and for the worst performing monobloc to be subject to a tear-down inspection. A formal written report shall be provided for both the discharge test and the tear-down inspection.

Unless otherwise agreed by NGED in writing, the independent test facility shall be:

Northern Industrial Battery Services Ltd (NIBS)

Four Crosses Business Park
Four Crosses
Llanymynech,
Powys
SY22 6ST

The discharge test shall be carried out in accordance with the following requirements:

- The test shall be performed on a single battery string consisting of six series-connected monoblocs
- The monoblocs shall be selected at random from a batch of new monoblocs which have not previously been subject to any discharge
- The blocs shall be positioned side-by-side at the manufacturer's recommended spacing and with the terminals linked using the manufacturer's recommended interconnects
- The ambient temperature shall be 20°C
- The voltage per monobloc and the overall string voltage shall be automatically recorded at one-minute intervals during the test
- The temperature of each bloc shall be periodically measured during the test
- The battery shall be discharged at the three-hour rate
- The test shall be terminated when a string voltage of 61.2V is reached (i.e., 36 cells x 1.70V per cell) or when one of the six monoblocs has reached a voltage 10.2V (6 cells x 1.70V per cell), whichever occurs first
- The monoblocs will have failed the discharge test if the test has to be terminated after less than 180 minutes have elapsed

No change of monobloc is permitted after approval has been granted without prior notice and without agreement in writing from NGED. A precondition for the latter is that the supplier repeats the approval process for the proposed replacement monobloc.

2.9.7 Battery Enclosure

Whilst the volume of gas emitted by valve-regulated lead-acid cells or monoblocs is very small under normal charging conditions, it increases significantly in the event of overcharging. Sufficient natural ventilation shall be provided to prevent the formation of an explosive hydrogen concentration within the enclosure under fault conditions, specifically, in the event of an overvoltage condition of 2.40V per cell.

Ventilation requirements shall be calculated in accordance with BS EN 50272-2.

2.9.8 Battery Charger

The charger shall be an automatic, temperature-compensated, constant-current / constant-voltage charger which shall operate from the 110 Vac single phase 50Hz supply i.e., shall charge initially using constant-current charging (to prevent overcurrent charge conditions) and then switch to constant-voltage charging (to prevent overvoltage charge conditions).

DC Output Current

The charger dc output current rating shall be not less than:

C_{10} current for the battery + (Charger Design Margin x Standing Load Current)

A charger design margin of 1.1 shall be employed in the charger sizing calculation.

The charger output current shall be adjustable between 50% and 100% of the current rated output current.

DC Output Voltage

The float voltage setting shall be adjustable about the set value, accommodating the range of float voltages recommended by the battery manufacturer.

Boost charging facilities shall not be provided.

On float charge, the output voltage shall not vary by more than ±1% under the following conditions:

a) Frequency varying between ±1 % of 50 Hz

b) AC input voltage varying between ±6 % of 110 V

c) Charger DC current output varying between 0 % and 100 % of the nominal rating

The AC ripple permitted on the battery system output shall not exceed 2% of rated voltage and shall not exceed levels that have an adverse effect on battery life.

2.9.9 Battery & Charger Monitoring Requirements

The following battery and charger monitoring functions shall be provided:

a) AC supply monitoring

b) Charger monitoring

c) Low voltage monitoring

d) High voltage monitoring

e) Battery impedance monitoring

AC Supply Monitoring

The status of the incoming 110Vac supply shall be continuously monitored and an alarm shall be triggered in the event the supply fails.

The alarm shall self-reset on restoration of the incoming supply.

Charger Monitoring

The status of the charger shall be continuously monitored and an alarm shall be triggered in the event the charger becomes faulty.

The charger monitoring function shall be hand-reset i.e., latches once operated.

Low Voltage Monitoring

The charger output / battery voltage shall be continually monitored and an alarm shall be triggered in the event the DC voltage falls below a user-settable limit.

The user-settable voltage limit shall be adjustable between 19.2 V and 21.6 V (i.e., between 1.60 and 1.80 volts per cell). The limit shall normally be set to operate at 21.0 V (i.e., 1.75 volts per cell).

The low voltage monitoring function shall self-reset. Once operated, the alarm shall not reset until the voltage is at least 0.6 V higher than the operate value.

High Voltage Monitoring

The charger output / battery voltage shall be continually monitored and an alarm shall be triggered in the event the DC voltage rises above a user-settable limit.

The user-settable voltage limit shall be adjustable between 27.6 V and 28.8 V (i.e., between 2.30 and 2.40 volts per cell). The limit shall normally be set to operate at 28.2 V (i.e., 2.35 volts per cell).

The high voltage monitoring function shall self-reset. Once operated, the alarm shall not reset until the voltage is at least 0.6 V lower than the operate value.

Battery High Impedance Monitoring

At least once in each 7-day period the battery shall be actively tested (using an automatic routine) to detect faulty cells and poor connections. The test should, where at all possible, be carried out in the morning (say 8:00am) so that in the event a problem is detected any remedial work can be carried out during normal working hours.

The test method shall not adversely affect the life of the battery.

The preferred method of carrying out this test is to temporarily disconnect the charging supply, apply a known load to the battery and monitor the battery voltage. If the drop in battery voltage is above appropriate limits a possible high impedance condition is indicated. An alarm shall be triggered in the event high impedance conditions are detected during two consecutive tests.

Details of their test method / routine shall be submitted to NGED for approval.

The battery impedance monitoring function shall be hand-reset i.e., latches once operated.

2.9.10 Battery Low Voltage Disconnect

The charger output / battery voltage shall be continually monitored and battery shall be automatically disconnected from the load in the event the voltage falls below 19.2 V (i.e., below 1.60 volts per cell) in order to safeguard it against damage from deep discharge.

The battery shall be automatically re-connected once the charger output voltage is above 19.8 V (i.e., above 1.65 volts per cell)

2.10 Controller Cabinet

2.10.1 The control cabinet must be suitable for mounting within or to the side of the switchgear it is to work with. The apparatus shall take due regards for flood resilience per clause 6.102.

2.10.2 A 12Vdc regulated supply at 2A shall be provided within the controller system for the radio/outstation. This shall not be provided from a tapping off the battery. The radio will earth the negative of this supply.

2.10.3 External connections from the controller cabinet shall be by an undrilled non-ferrous gland plate sized for the associated umbilical cables for the circuit breaker and switch disconnector motors.

2.10.4 Supply of the umbilical cables for the left hand and right-hand switches as well as the circuit breaker is the responsibility of the RMU supplier.

2.10.4.11 Umbilical's shall be available in 3m, 5m and 10m lengths

2.10.4.12 The controller should be able to provide the following functions and indications listed in the tables below

	Operation	**Indication**
Circuit Breaker	Open. Close	Local/Supervisory
	Protection Enable/Disable	Open/Closed
	SEF protection Enable/Disable	Protection In/Out
	Instantaneous protection Enable/Disable	SEF protection In/Out
		Instantaneous protection In/Out
		SEF Trip
		Directional fault flow
		Voltage monitoring on incoming cable
		Loss of phase
		Loss of phase trip
		Low gas pressure alarm

	Operation	**Indication**
Ring Switch	Open/Close	Local/Supervisory
		Open/Closed
		Voltage monitoring on incoming cable
		Directional fault flow
		Loss of phase
		Low gas pressure alarm

	Operation	Indication
Controller		Loss of charging supply/mains
		Low battery alarm
		Battery test failure

2.10.5 Communication Medium

Control signals, indications and alarms are relayed from/to the NGED SCADA system using NGED owned and operated radio systems.

2.10.6 Cyber Security

It will be a requirement of any tenderer to NGED to provide a fully functioning device and any associated software and ancillaries (inclusive of a default config file) for cyber/security assessment.

The cost of this apparatus and any associated software access will be entirely borne by the prospective tenderer without exception nor expectation of any orders.

NGED will happily work with any prospective supplier to support their equipment for an NGED cyber approval where apparatus falls short of requirements however any costs associated with bringing apparatus up to UK/NGED needs is entirely that of the supplier and said supplier needs to recognise that acceptance does not necessarily mean orders will immediately occur as other factors may delay use of any apparatus.

2.11 Manuals and Spares

2.11.1 A copy of the installation, operation and maintenance manual/s and a list of recommended, priced spares, shall be included with the tender.

2.12 Non-Conformances

2.12.1 All non-conformance with ENATS 41-41 Issue 1 (2020) + A1 (2021) shall be outlined by the tenderers on return of tenders

3.0 MODIFICATIONS AND ADDITIONS TO ENATS 41-41

3.1 References

3.1.1 References are in accordance with ENATS 41-41 with the following additions in Table 1, below.

3.1.2 It is important that users of all standards and technical specifications ensure they are applying the most recent editions together with any amendments.

3.1.3 Whilst the IEC base document is listed for information, the prime document that shall take priority is the British Standard enacting the European Standard (EN) or European Harmonisation Document (HD).

BS No.	Title	IEC / ISO base
BS HD 60269	Cartridge fuses for voltages up to and including 1000V ac and 1500V dc	IEC 60269
BS EN 60255	Specification for electrical protection relays	IEC 60255
BS EN 60688	Electrical measuring transducers for converting A.C. electrical quantities to analogue or digital signals.	IEC 60688
BS EN 60898	Circuit breakers for overcurrent protection for household and similar installations	IEC 60898
BS EN 61000-6-2	Electromagnetic compatibility (EMC) Generic standards – Immunity for industrial environments	IEC 61000-6-2
BS EN 61000-6-4	Electromagnetic compatibility (EMC) Generic standards – Emission Standard for industrial environments	IEC 61000-6-4
BSEN 61000-6-5	Electromagnetic compatibility (EMC) Generic standards – Emission Standard for Power Station and Substation Environments	IEC 61000-6-5
BS IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems	IEC 61508
EREC G110	Instantaneous High Impedance Differential Protection	
ENATS 48-4	DC Relays Associated with a Tripping Function in Protection Systems	
ENATS 48-5	Environmental Test Requirements for Protection and Control Equipment and Systems	

Table 1 Additional References

4.0 SPECIFIC REQUIREMENTS

4.1 System earthing (BSEN 62271-1 – clause 9.1)

4.1.1 The equipment shall be suitable for use on three phase systems in which the neutral is earthed either solidly or through a resistance or reactance of low value or through a reactor or arc suppression coil. It should be noted that parts of NGEDs network employ arc suppression coil earthing and Tenderers are advised to consider carefully the implications of this, with particular emphasis on the phase voltages during earth fault conditions.

5.0 RATINGS

5.1.1 All requirement of ENATS 41-41 section 5 apply except for the following clarifications or requirements and any detail within Schedules 1 to 4:

5.3 Rated insulation Level

5.3.1 Rated insulation Level shall be per ENATS 41-41 cl.5.1 which states

Rated Voltage U_r kV (r.m.s. value)	**Rated short duration power-frequency withstand voltage Ud (r.m.s. value) for 1 minute**		**Rated lightning impulse withstand voltage U_p kV (peak value)**
	Common Value Dry and Wet	**Across the isolating distance Dry and Wet**	**Common Value**
12	28	32	95

5.5 Rated Continuous Current

5.5.1 Rated continuous current of busbars shall be 630A.

5.5.2 Rated continuous current of circuit breaker panels shall be either 200 or 630A as shown in Schedules 1 to 4 of this document.

5.6 Rated short-time withstand current

5.6.1 The default rating shall be as shown in Schedules 1 to 4.

5.9 Rated Supply Voltage of Auxiliary and Control Circuits (Ua)

5.9.1 The nominal supply voltage for actuators/motors and auxiliary circuits shall be 24Vdc.

Nominal Voltage	**Criteria for rated supply voltage operating range**	**Closing and Opening releases and operating devices**		**Other operating devices**
		Close volts	**Open volts**	**Volts**
24 V	Maximum operating voltage (max battery charging voltage)	30	30	30
	Minimum operating voltage	19.2	16.8	19.2

Table 2 Rated Supply voltage and auxiliary control circuits

5.10 The rated supply frequency for auxiliary and control circuits

5.10.1 Rated supply frequency shall be DC.

6.0 DESIGN AND CONSTRUCTION

6.1.1 All requirements of ENATS 41-41 section 6 apply except for or in addition to the following clarifications and per the detail shown within Schedules 1 to 4:

6.2 Requirements for gases in switchgear and controlgear

In addition to the requirements in ENATS 41-41 the following is required.

6.2.1 Where gas filling points are readily accessible then they shall be fitted with self-sealing valves with a padlockable cover or closure that can be secured using an NGED standard operational padlock. [See 6.12.202 below].

6.2.2 Where gas filling points are behind covers requiring a NGED Safety Document and/or the application of tools, then these would be considered not readily accessible and the requirements of 6.2.1 above shall not apply.

6.2.3 Gas filling points shall follow the colour scheme and connection type / sizing as specified in the table below

Gas / Gas Mixture	Colour	RAL	Connection
N_2 / O_2 mixtures	Light Blue	5012	DILO DN12 with M30 thread or DILO DN20 with M50 thread
Mixtures containing C4-FN (C_4F_7N)	Yellow Green	6018	DILO DN8 with M28 thread or DILO DN20 with M48 thread
Mixtures containing C5-FK ($C_4F_{10}N$)	Telemagenta	4010	DILO DN8 with M24 thread or DILO DN20 with M43 thread
CO_2 / O_2 mixtures	Dusty Grey	7037	Malmquist valve with M32 thread

[*Note: Table may be subject to revision to maintain alignment with future ENATS*.]

6.2.4 These requirements shall be achieved without the use of adaptors.

6.2.5 All filling points and apparatus shall be clearly labelled to indicate the type of gas contained within the equipment.

6.2.6 Labels shall be engraved and mechanically secured such that they cannot be removed other than by disassembly of the equipment filling point.

6.2.7 The same colour coding and sizing shall also be used on monitoring devices and gas handling equipment.

6.3 Earthing of Switchgear and controlgear

6.3.1 Within the HV connection compartment a single earthing terminal shall be provided for cable sheath connections. This lug shall be suitably connected to the wider earthing conductor.

6.4 Auxiliary and control equipment and circuits

6.4.1 All units shall be pre-wired for the provision of the retro-fitment of actuator units unless there is a cost benefit or requirement to fit the actuators in the factory.

6.4.1.1 The provision shall include pre-wired auxiliary contacts for switch position indication based on prime driven contacts not from an auxiliary relay. At least 1 spare normally open and 1 spare normally closed auxiliary contact will be available. They shall be rated for 24Vdc.

6.4.1.2 They shall be wired to a readily accessible terminal block per clause 6.4.203, that can be accessed without requiring the removal of fixed covers.

6.4.2 Protection and Alarm Relays

6.4.2.1 The list of NGED assessed protection relays for use on NGEDs secondary distribution system can be found in EE98

Other relays with equivalent functions per below, may be acceptable to NGED subject to approval by the NGED Policy Team, prior to placement of any contract. 6.4.2.2 - 6.4.2.5 gives information as to the minimum requirements for non-approved relays.

6.4.2.2 Protection relays shall satisfy the requirements of BS EN 60255 and IEC 60255.

6.4.2.3 Self-powered protection relays shall as a minimum include the following functions:

- Instantaneous high set overcurrent protection
- 2 or 3 phase IDMT overcurrent protection (with selectable IEC type characteristics)
- IDMT earth fault protection (with selectable IEC type characteristics)
- Suitable for use with CTs with a 1A secondary rating

6.4.2.4 Sensitive earth fault (SEF) protection relays as minimum include

- SEF protection (current pick up selectable between 0.03A and 0.4A)
- Definite time characteristic (time setting selectable between 0 to 10s)
- 24V d.c. auxiliary supply
- Suitable for use with CTs with a 1A secondary rating

6.4.2.5 Neutral voltage displacement (NVD) protection relays shall include

- NVD protection (with voltage pick up selectable between 10 and 50V)
- Definite time characteristic (time setting selectable between 0 and 10s)
- 24/30Vd.c. auxiliary supply

6.4.203 Terminals and terminations

6.4.203.1 Any auxiliary enclosures and terminal boxes shall be placed such that any work on the secondary wiring of the RMU or any fitted automation equipment can be completed with minimal restrictions particularly when an RMU is transformer mounted along with an LV cabinet.

6.4.203.2 All enclosures, terminal boxes and secondary wiring cubicles shall take into consideration flood resilience needs per clause 6.102

6.4.203.3 Fuses and Links

6.4.203.3.1 Secondary fuselinks, links and fuse carriers shall be in accordance with EATS 50-18, BS HD 60269-2 reference A. Fuses and fuse holders up to 20A rating shall be in accordance with BS HD 60269-2 reference A1.

6.4.203.3.2 The fuse holders and bases shall be coloured as follows:

- 6A fuselink ratings: black colour 642 of BS 381C
- Solid links: white

6.4.203.3.3 GE Power Controls or Mersen Red Spot fuse holders shall be provided unless otherwise agreed at the time of tender.

6.4.203.3.4 All fuses and links shall be mounted vertically, grouped logically and consistently within the panel or separate enclosure and shall be clearly labelled. The label shall show the function of the fuses/links and include the fuse/link number as specified on the schematic drawings. Where a double row of fuses and links is required, the labelling of the bottom row may need to be mounted on a stand-off bracket to ensure they are clearly visible. Fuses shall, as far as possible, be positioned consistently across the suite of panels and cubicles.

6.4.203.3.5 Fuse terminals shall be suitably shrouded to minimise electric shock hazards. The incoming (supply) side of each circuit shall be connected on the bottom terminal of the fuse/link

6.9 Operation of releases

6.9.1 All circuit breakers shall be fitted with a shunt trip coil separate to that used with the integral protection device or TLFs.

6.9.2 The coil shall have multiple ratings including 230/110V a.c./d.c. and 20 to 48V d.c. auxiliary supply.

6.9.3 Auxiliary contacts to be incorporated into trip coil circuit.

6.9.4 The coil shall be pre-wired to a readily accessible terminal block that can be accessed without requiring the removal of fixed covers.

6.11 Nameplates

Safety labels warning signs and notices shall be compliant with UK standards in terms of colours, pictograms and layout. As a minimum per details in ENATS 41.41 clause 6.11

6.12 Locking Devices ?(page 38)

6.12.201 Interlocking Devices

6.12.201.1 General

Interlocks and locking provision shall be as prescribed in ENATS 41-41 clause 6.12

Locking and interlocking provision shall be compatible with normal NGED operational practice and allow full compliance with the NGED Distribution Safety Rules.

6.12.201.2 3-position device

NGED strongly prefer that the selection between busbar, isolated and earthed is provided by a three-position device. Where an alternative is proposed then it shall meet the additional requirements in the following clauses below. Outlines of the various arrangements acceptable to NGED are contained in Appendix B

Vacuum devices rated as disconnectors to BS EN 62271-102, are acceptable to provide electrical isolating distance, but are not acceptable to provide safety isolation for work, or testing, on the circuit

Operation of the isolating device from busbar selected to the isolated position shall be by a switch disconnector or alternatively via a disconnector in series with a suitable current interrupting device. It shall not be possible to operate the isolating device without the current interrupting device being open.

Where operation of the isolating device is from busbar selected to earth selected without an intermediate position, then this shall be in series with a suitable current interrupting device. It shall not be possible to operate the isolating device without the current interrupting device being open

Circuit earthing shall be provided by a make-proof device. This shall either be applied directly via a rated earth switch, a rated switch disconnector or via a circuit breaker

Where indication of the isolating device position is provided from the driving mechanism and not from a driven shaft, then suitable means shall be provided to allow the operator to readily visually establish the position of all phases of the isolating device.

6.12.201.3 Test Access

6.12.201.3.1 NGED require cable test facilities to be achieved by means of 3 phase integral device

6.12.201.3.2 Cable test access shall be interlocked as per ENATS 41-41 Clause 6.12.201.3

6.12.201.3.3 Where cable test devices are required to be used then these shall be as per ENATS 41-41 Clause 6.12.201.4.

6.12.202 Padlocking facilities

Wherever padlocking facilities are provided, they shall be made for a padlock with 38mm square body and with a 7mm diameter shackle having a clear inside width of 20mm and an inside length of 16mm to 30mm. The holes provided for the shackle shall not be less than 8mm diameter.

Safety padlocking provision shall meet the requirements of ENATS 41-41 Clause 6.12.202.

6.16 Gas and vacuum tightness

The leakage rate F_{rel} of the gas of a closed pressure system shall be such that it shall not require replenishment during its expected minimum operating life of 30 years.

6.16.1 Sealed pressure systems for gas

6.16.1.1 The tightness of sealed pressure systems is specified by their expected operating life. The standard value is 30 years.

6.16.1.2 The leakage rate shall not exceed 0.1% per year at 20 °C.

6.16.1.3 Gas systems shall be fitted with a pressure or density switch with volt-free contacts that provides indication that the internal pressure is below the minimum functional pressure for the device. This shall be wired to a readily accessible terminal block that can be accessed without requiring the removal of fixed covers.

6.101 Internal arc fault

6.101.1 Units should as a minimum have a rated internal arc classification (IAC) of AF.

6.101.2 The IAC requirements for transformer mounting units shall be maintained when installed on a close coupled transformer and with an LV cabinet installed.

6.101.3 Cable boxes shall be able to contain and internal arc at a current equivalent to rated short-time withstand current. In the event that this is not possible then the manufacturer shall state what ratings are available and what alternatives are present in the design in order to prevent injury to an operator stood at the operating position of the switchgear.

6.102 Enclosure

6.102.1 General (Flood Resilience)

6.102.1.1 All auxiliary enclosures and secondary cabinets shall be mounted as high as is reasonably practicable such that there is inherent flood protection built into the device. A minimum height of 500mm would be preferred achieved by mounting of cabinets so that the base is above this level.

6.102.1.2 If practicalities of this are not possible suppliers shall indicate how they will be able to enhance any secondary cubicle on any RMU/Extensible/MU/RTU to provide a rating of IPx8 (suitable for immersion) per BSEN 60529 by addition of suitable seals.

6.103 High Voltage compartments

6.103.1 Connection compartments

6.103.1.201 Connection (Cable) Compartments (ENATS 41-41 clause 6.103.1.201)

6.103.1.201.1 It is NGED's requirement that all cable terminations shall be of the dry termination design and shall have screened terminations of outer cone interface type C per ENA TS 12-11 clause 5.7.2 which states:

6.103.1.201.2 "Where the facility for a fully-insulated bolted connection termination is provided, the bushing profile shall be of an outside cone type as dimensioned in BSEN 50181. Where the facility for a partially-insulated bolted connection cable termination is provided the bushing design shall be to the manufacturer's standard.

6.103.1.201.3 Cable lugs shall not be supplied, but the design of the cable compartments shall permit use of compression or mechanical shear bolt cable lugs which have centre or off set palms with the dimension from the centre of the hole to the closed (top) end of the barrel along the axis of the barrel being a minimum of 23mm at 12kV and 33mm at 24kV and 36kV."

Note, NGED use mechanical shear bolt cable lugs which have a centre palm therefore the cable box dimensions shall reflect this fact.

6.103.1.201.4 In the event that "C" profile bushings cannot be provided then the supplier shall indicate how their design can be modified and tested to accommodate this requirement.

Manufacturer specific bushing profiles requiring the use of specific bespoke connectors shall not be offered.

6.103.1.201.5 Cable connection compartments shall be fitted with gland plates suitable for cable size up to 400mm single core EPR or XLPE.

6.103.1.201.6 Gland plates shall be made of a non-ferrous material and of the "three single core" type.

6.103.1.201.7 A single-hole gland plate shall be available as an optional accessory for tee off and metering unit cable boxes only.

6.103.1.201.8 All cover plates shall be provided with vandal resistant fixings.

6.103.1.201.9 Cable compartments should be suitable to be modified as necessary to provide flood protection per requirements of clause 6.102

6.103.2 Fluid filled compartments (gas or liquid)

6.103.2.1 Pressure relief of fluid-filled compartments [BS EN 62271-200]

6.103.2.2 Bursting discs and explosion vents

Pressurized systems shall be provided with pressure relief devices such as bursting discs.

Bursting disks and explosion vents shall be installed so that exhaust gasses are directed away from the normal local operating position of the equipment.

6.103.203 Requirements for combinations of switching devices

6.103.203.10 Facilities for checking voltage and phase identification.

6.103.203.10.1 A voltage presence indicating system (VPIS) in accordance with BS EN 62271-206, or a voltage detecting system (VDS) in accordance with BS EN 61243-5, shall be provided to all units, to provide operators with information about the voltage condition of the main circuit in which they are installed, and to allow phase comparison to be carried out between any circuits

6.103.203.10.2 The complete VPIS and VDS systems, including the detecting and indicating elements shall be integral to the switchgear

6.103.203.10.3 Indicators meeting these requirements shall be fitted to

- All switch disconnectors (ring switches) on RMUs
- Extensible type switch disconnectors
- Circuit breakers on RMUs
- Extensible type circuit breakers

6.103.203.10.4 The socket arrangement at the interface ('connecting point') for plugging in an indicator and / or a phase comparator, shall be suitable for system HR or LRM to BS EN 1314 61243-5 to accept 4 mm diameter banana type plugs. [ENATS 41-41 Clause 6.103.202.8]

6.103.203.10.5 The VPIS or VDS system outputs shall be compatible with a Pfisterer EPV Phase Comparator

6.103.203.11 Facilities for measuring voltage

6.103.203.11.1 The VDS or VPIS system shall also provide a separate voltage reference that can be connected into fault flow indicators, relays or automation controllers so as to provide for the detection of directional flow of current and/or indication of the presence of voltage

6.103.203.11.2 Where the VDS or VPIS system is unable to provide a separate voltage reference and a voltage reference is to be provided by other means then it should be derived within the switchgear and not from separable connectors forming part of a cable termination

6.103.203.11.3 This voltage reference shall be wired to a readily accessible terminal block that can be accessed without requiring the removal of fixed covers. The terminal block shall be suitably screened to prevent inadvertent contact or interference with connections.

6.201 CT and VT General Requirements

6.201.1 CT Requirements

6.201.1.11.1 Current transformers (CTs) shall be in accordance with EA TS 41-41 and BSEN 61869-2 with the following additions. Characteristics and ratios are specified in the accompanying Schedules and as set out below.

6.201.1.11.2 All CTs shall be mounted on the cable bushings and/or inside the switchgear.

6.201.1.11.3 All connections from secondary windings shall be brought out and taken, by means of separate insulated leads, to an accessible terminal board to permit testing of individual CTs. Any joints or connections in the secondary leads shall be carried out at an accessible terminal board

6.201.1.11.4 The class and characteristics of protection CTs shall be adequate for the burden and function of the associated protection equipment and wiring, over the full range of available fault current.

6.201.1.11.5 Preferred CT ratios are included in the schedules but in all situations the CT ratings should not limit the overall rating of the switchgear.

6.201.1.12 Class PX CTs for Fault Passage Indication

6.201.1.12.1 Class PX current transformers shall comply with BSEN 61868-2 and shall provide accurate transformation up to the maximum fault current rating of the associated main plant and ensure this performance under steady state conditions without undue saturation.

6.201.1.12.2 CTs shall be 500/1 and thermally rated per 6.201.1.1.4

6.201.1.12.3 RMUs shall have CTs mounted over the cable bushings in the left-hand switch

6.201.1.12.4 Extensible switches shall have the CTs fitted to the outgoing cable bushings.

6.201.1.12.5 The minimum knee point requirements for CTs shall be determined by the manufacturer based on a magnetisation current of each CT being less than 50mA at the knee point.

6.201.1.12.6 Each current transformer forming part of a group of CTs to provide a given function shall have a knee point voltage within 20% of the other CTs within the same group. For example, a group of 3 CTs used as part of an overcurrent and earth fault protection scheme shall have knee point voltages within 20% of each other

6.201.1.12.7 In addition to the knee point requirement the magnetising current for each CT shall be less than 50mA at the CT’s knee point voltage.

6.201.2 VT General Requirements

6.201.2.1 Voltage transformers (VTs) shall be in accordance with ENA TS 41-41 with the following additions:

6.201.2.1.1 Dry type, encapsulated, voltage transformers are required.

6.201.2.1.2 Voltage transformers used for metering and protection purposes shall comprise of three single phase VTs or one 3 phase 5 limb VT.

6.201.2.1.3 The HV star point of the windings shall be connected to earth.

6.201.2.1.4 The LV star winding shall be earthed on the yellow phase. No facility to allow the user to select neutral point earthing shall be provided.

6.201.2.1.5 All secondary neutral points shall be brought out to accessible terminal blocks.

6.201.2.1 VT Performance Characteristics

6.201.2.1.1 Each VT star winding shall have a rating of 25VA per phase.

6.201.2.1.2 A minimum acceptable rating for the 6.6kV winding on dual winding VTs is 15VA. The 11kV winding shall comply with 6.201.2.1.1

6.201.2.1.3 Open delta windings shall also be rated at 25VA.

6.201.2.1.4 All windings shall be rated for a voltage factor of 1.9 for 8 hours.

6.201.2.1.5 All Star connected windings shall satisfy the requirements for both Class 3P and Class 0.5 irrespective of their intended use.

Residual voltage windings connected to form a broken delta shall be Class 3P but are not required to satisfy Class 0.5.

6.201.2.1.6 Voltage transformer rated transformation ratios shall be in accordance with Table4

6.201.2.1.7 Voltage transformers shall have their rated transformation ratios and voltages shown on drawings, diagrams and rating plates as shown in Table 4.

System Voltage	Primary Winding	Secondary Windings		
		Protection	Metering	Residual [1]
	Voltage (Upn)	Voltage (Usn)	Voltage (Usn)	Voltage (Usn)
11kV	11000/√3	110/√3	110/√3	110/3
6.6kV	11000/√3 and 6600/√3	110/√3	110/√3	110/3

Table 4 VT Windings

Note Voltage transformers specified for use on the 6.6kV system shall initially be connected for use at 6.6kV. It shall be possible to subsequently convert the VT to 11kV operation by means of internal links with minimal operational difficulty.

6.201.2.2 Ferroresonance Damping Resistors

6.201.2.2.1 Ferroresonance damping resistors shall be provided for VT open delta windings. The VTs and resistors shall have sufficient thermal rating to satisfy the requirements of 3.5.4.

6.201.2.3 Voltage Transformer Connections

6.201.2.4 VT star type secondary windings used for protection and metering purposes should be fused at 6A. VT residual windings via removable links.

An MCB may be offered where it provides an operational and cost benefit. If provided it shall be connected through suitable miniature circuit breakers (MCBs) and links. The arrangement of MCBs and links if used shall be in accordance with the following and Figure 1.

6.201.2.5 MCBs used for protection of the VT secondary circuits shall, unless otherwise agreed at the time of tender, be rated at 6A and, as a minimum, satisfy the requirements of BS EN 60898. 2 adequate, normally closed auxiliary contacts shall be provided per MCB for alarm and protection blocking purposes. The status of each contact shall reflect the open/closed status of the associated MCB. MCB characteristics shall be chosen to grade with the following type and rating of fuses, over the full range of available fault current:

- 2A fuses to BS HD 60269-2, reference F1 and F2
- 2A fuses to BS HD 60269-2, reference A1

6.201.2.6 MCBs, fuses and links shall be located as close as practicable to the VT (subject to being able to gain ready access to them with the equipment in service).

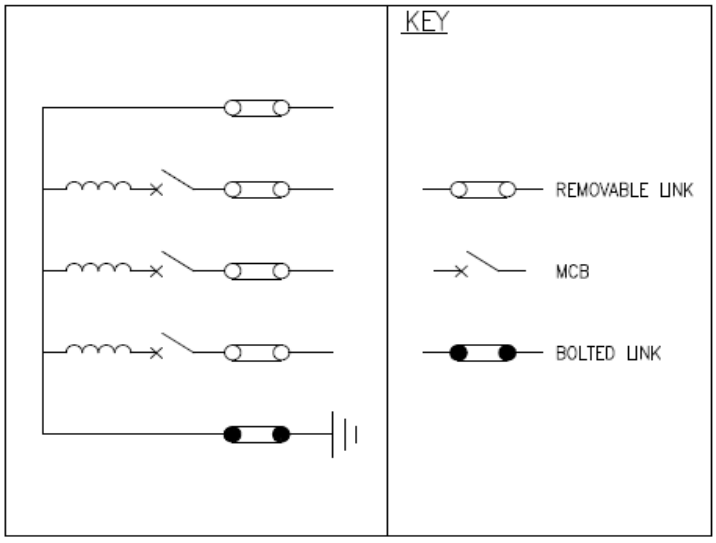


Figure 1 VT Miniature Circuit Breaker (MCB) and Link Arrangement

6.202 Metering Requirements

6.202.1 Metering CTs and VT shall comply with latest version of the UK Balancing and Settlement Code. NGED specific requirements are as follows

Provision shall be made to prevent un-authorised access to metering CTs and VTs and their associated secondary circuits. A lockable securing bar or equivalent shall be fitted across any fuses and links and an appropriate securing measure across any points of access to the current and voltage wiring of the metering equipment.

6.202.2 Metering CTs

6.202.2.1 Metering CT ratio options and class requirement shall be as follows

CT Ratio Options	VA Rating	Class	Additional Error Data
12kV Switchgear			
200/5 400/5	10VA	0.5S	5%, 20%, 100% and 120% load points with a burden of 10VA 0.9 power factor

Table 3 Metering CT Requirements

6.202.2.2 Metering current transformers shall have independent cores and secondary windings from those provided for protection purposes

6.202.2.3 Three metering CTs, one per phase, shall be installed, in each metering unit with each suitably wired out to the terminal box.

6.202.2.4 Metering CTs shall be tested to confirm compliance with BSEN 61869-1 on each ratio. In addition to these requirements, CTs shall be error tested per the detail in Table 3. These additional CT errors shall either be separately tested or calculated from other error test results.

6.202.2.5 Electronic copies of the test certificates in PDF format, including any error tests used as the basis of the calculations described above, shall be provided in advance of switchboard delivery for each metering current transformer.

All test certificates shall be sent to the NGED by electronic mail.

A hard copy of the test certificate/s shall accompany any unit containing metering CTs.

6.202.3 Metering VTs

6.202.3.1 Metering VTs shall be error tested by the manufacturer. In all cases individual test certificates shall be provided.

6.202.3.2 All metering VT test certificates shall include tests to confirm compliance with BS EN 61869-3.

In addition, VT errors shall be supplied on brown/black (L1/L2) and black/grey (L2/L3) phases at 10VA 0.5 power factor lagging burden. These additional VT errors shall either be separately tested or alternatively calculated from other error test results.

6.202.3.3 Whenever possible metering VTs and CTs shall be arranged so that the VT is connected before the CTs, in respect of normal power flow.

6.202.3.4 Electronic copies of the of test certificates in PDF format, including any error tests used as the basis of the calculations described above, shall be provided in advance of unit delivery for each metering voltage transformer. These shall be sent to the NGED by electronic mail

6.202.4 Secondary Connections for Metering Unit CT and VT outputs.

6.202.4.11 Metering units, and circuit breakers equipped with metering CTs and VTs, shall be provided with a Harting Socket to facilitate the ready connection of the outputs to a remote metering cabinet. [See Appendix H and I]

6.202.4.12 Metering units, and circuit breakers equipped with metering CTs and VTs, shall be provided with terminals to facilitate the ready connection of a Connection Control Panel. [See Appendix H and I]

6.205 Transformer mounting arrangement

6.205.1 Transformer mounting units shall not foul the LV cabinet when fitted on a transformer with same side HV and LV couplings as per ENATS 35-1 Part 3 Clause 4.1(d) (including figures 3, 4, 6, 7 and 8).

7.0 Schedule 1 NON-EXTENSIBLE RING MAIN UNIT (RMU) (Clause 3.7)

Equipment	Further Details		Type RMUF12A	Type RMUF12B	Type RMUF12C	Type RMUF12D	Type RMUF12F		Type RMUT12A (See Note 1)	Type RMUT12B (See Note 1)	Type RMUT12C **(See Note 1)**	Type RMUT12D **(See Note 1)**	Type RMUT12E **(See Note 1)**
General	Normal rated voltage: Rated short time current:	12kV 20kA	Free standing, non-extensible RMU with TLF protection	Free standing, with self-powered protection relay	Free standing, with DC-powered protection relay	Free standing, with self-powered protection relay	Free standing, with DC-powered protection relay		Transformer mounted with TLF protection	Transformer mounted with self-powered protection relay	Transformer mounted with DC-powered protection relay	Transformer mounted with self-powered protection relay	Transformer mounted with DC-powered protection relay
Busbars	Nominal rating:	630A	1 set	1 set	1 set	1 set	1 set		1 set	1 set	1 set	1 set	1 set
Ring switches	Nominal rating:	630A	2	2	2	2	2		2	2	2	2	2
Ring cable earth switch	Fitted with built in test facilities		1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch		1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch
Tee off circuit breaker	Nominal rating:		200A	200A	200A	630A	630A		200A	200A	200A	630A	630A
Tee off earth switch	Short time (3s) withstand:		≥13.1kA	≥13.1kA	≥13.1kA	20kA	20kA		≥13.1kA	≥13.1kA	≥13.1kA	20kA	20kA
Tee off test facility	Fitted with built in test facilities		-	Yes	Yes	Yes	Yes		-	Yes	Yes	Yes	Yes
Voltage/Phase comparison (Clause 5)	Fitted to all ring switches and circuit breakers		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Ring Switch cable termination chamber	Suitable for 3 single core cables up to 400 mm^2 with interface “C” outer cone separable connectors.		1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch		1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch	1 per ring switch
Transformer tee off cable termination chamber	Suitable for 3 single core cables terminated with interface “C” outer cone separable connector.		185 mm^2 (Max)	185 mm^2 (Max)	185 mm^2 (Max)	400 mm^2 (Max)	400 mm^2 (Max)		N/A	N/A	N/A	N/A	N/A
Protection on Transformer tee off circuit breaker (Clause 6)	2 overcurrent and 1 earth fault, time limit fuse protection utilising XF type TLFs and suitable a.c. trip coils.		1 set	-	-	-	-		1 set	-	-	-	-
	Self-powered protection relay and suitable circuit breaker release.		-	1	-	1	-		-	1	-	1	-
	DC-powered protection relay and suitable circuit release		-	-	1	-	1		-	-	1	-	1
Protection CTs (Clause 6.1)	100/50/5 CTs for TLF protection		Set of 3	-	-	-	-		Set of 3	-	-	-	-
	CTs for self-powered protection relay (set of 3)		-	200/1	-	600 or 800/1	-		-	200/1	-	600 or 800/1	-
	CTs for DC-powered protection relay (set of 3)		-	-	200/1	-	600 or 800/1		-	-	200/1	-	600 or 800/1
Fault Passage indication CTs (Clause 6.3)	Fitted over bushing in Left Hand Cable box (set of 3)		Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes
Shunt trip coil	Rated for both 110V a.c./d.c. and 20 to 48V d.c. auxiliary supply		1	1	1	1	1		1	1	1	1	1
Multicore Box			1	1	1	1	1		1	1	1	1	1
Terminals, fuses and links			As required	As required	As required	As required	As required		As required	As required	As required	As required	As required

Note 1: Transformer mounted equipment shall also be suitable for connection to TM type metering units included in Schedule 4.

8.0 Schedule 2 NON-EXTENSIBLE CIRCUIT BREAKER TEE OFF

Equipment	Further Details		NFCB12	NTC12A **(See Note 1)**	NTC12B **(See Note 1)**
General	Normal rated voltage: Rated short time current:	12kV 20kA	Free standing, non-extensible circuit breaker with TLF protection	Transformer mounted circuit breaker with TLF protection	Transformer mounted circuit breaker with self-powered protection relay
Tee Circuit Breaker	Nominal current rating:		200A	200A	200A
Ring Cable Switches	Nominal current rating:		630A	630A	630A
Incoming cable earth Switch	Fitted with built in test facilities Short time (3s) withstand:	20kA	1	1	1
Transformer tee off earth switch	Short time (3s) withstand:	3.15kA	1	1	1
Incoming cable termination chamber	Suitable for 3 single core cables up to 185mm^2 with interface “C” outer cone separable connectors.		1	1	1
Transformer tee off cable termination chamber	Suitable for 3 single core cables up to 185mm^2 fitted with interface “C” outer cone separable connectors.		1	-	-
Protection on Transformer tee off circuit breaker	2 overcurrent and 1 earth fault, time limit fuse protection utilising XF type TLFs and suitable a.c. trip coils.		1 set	1 set	-
	Self-powered protection relay with suitable circuit breaker release.		-	-	1
Protection CTs (Clause 6.1)	100/50/5 CTs for TLF protection		3	3	-
	200/1 CTs for self-powered protection relay		-	-	3
Fault Passage indication CTs (Clause 6.3)	Fitted over bushing in cable box (Set of 3)		-	-	-
Shunt trip coil	Rated for both 110V a.c./d.c. and 20 to 48V d.c. auxiliary supply		1	1	1
Multicore Box			1	1	1
Terminals, fuses and links			As required	As required	As required

Note 1: Transformer mounted equipment shall also be suitable for connection to TM type metering units included in Schedule 4

9.0 Schedule 3A EXTENSIBLE SWITCHGEAR – NON-METERING UNITS

Equipment	Further Details		EFS12	EFC12A	EFC12B	EFC12C	EFBS12	EFBES12
General	Normal rated voltage: Rated short time current:	12kV 20kA	Free standing extensible switch disconnector	200A Free standing extensible circuit breaker with TLF protection	200A Free standing extensible circuit breaker with self-powered protection relay	630A Free standing extensible circuit breaker with self-powered protection relay	630A Free standing bus-section circuit breaker with self-powered protection relay	Free standing busbar earth switch
Busbar extensions	Nominal rating:	630A	1 set	1 set	1 set	1 set	1 set	1 set
Switch disconnector	Nominal rating:	630A	1	N/A	N/A	N/A	N/A	N/A
Switch disconnector earth switch	Fitted with built in test facilities Short time (3s) withstand:	20kA	1	N/A	N/A	N/A	N/A	N/A
Circuit breaker	Nominal rating:		N/A	200A	200A	630A	630A	N/A
Circuit breaker earth switch	Fitted with built in test facilities. Short time (3s) withstand:	20kA	N/A	1	1	1	1	N/A
Busbar earth switch	Make proof earth switch Short time (3s) withstand:	20kA	N/A	N/A	N/A	N/A	N/A	1
Switch disconnector unit cable termination chamber	Suitable for 3 single core cables up to 400 mm^2 with interface “C” outer cone separable connectors.		1	N/A	N/A	N/A	N/A	N/A
Circuit breaker cable termination chamber	Suitable for 3 single core cables up to 400 mm^2 with interface “C” outer cone separable connectors.		N/A	1	1	1	N/A	N/A
Circuit breaker Protection	2 overcurrent and 1 earth fault, time limit fuse protection utilising XF type TLFs and suitable a.c. trip coils.		N/A	1 set	-	-	N/A	N/A
	Self-powered protection relay (clause 13) and suitable circuit breaker release.		N/A	-	1	1	1	N/A
Protection CTs (Clause 6.1)	100/50/5 CTs for TLF protection		N/A	3	-	-	-	N/A
	200/1 CTs for self-powered protection relay		N/A	-	3	-	-	N/A
	600 or 800/1 CTs for self-powered protection relay		N/A	-	-	3	3	N/A
Fault Passage indication CTs (Clause 6.3)	Fitted over bushing in cable box (Set of 3)		Yes	N/A	N/A	N/A	N/A	N/A
Multicore Box			1	1	1	1	1	-
Shunt trip coil	Rated for both 110V a.c./d.c. and 20 to 48V d.c. auxiliary supply		N/A	1	1	1	1	N/A
Terminals, fuses and links			As required	As required	As required	As required	As required	As required

10.0 Schedule 3B EXTENSIBLE SWITCHGEAR – METERING CIRCUIT BREAKERS

Equipment	**Further Details**		**EFC12AM**	**EFC12BM**	**EFC12CM**	**EFBS12M**
General	Normal rated voltage: Rated short time current:	12kV 20kA	200A Free standing extensible metering circuit breaker with TLF protection	200A Free standing extensible metering circuit breaker with self-powered protection relay	630A Free standing extensible metering circuit breaker with self-powered protection relay	630A Free standing metering bus-section circuit breaker with self-powered protection relay
Busbars	Nominal rating:	630A	1 set	1 set	1 set	1 set
Switch disconnector	Nominal rating:	630A	N/A	N/A	N/A	N/A
Switch disconnector earth switch	Fitted with built in test facilities Short time (3s) withstand:	20kA	N/A	N/A	N/A	N/A
Circuit breaker	Nominal rating:		200A	200A	630A	630A
Circuit breaker earth switch	Fitted with built in test facilities. Short time (3s) withstand:	20kA	1	-	-	1
Switch disconnector unit cable termination chamber	Suitable for 3 single core cables up to 400 mm^2 with interface “C” outer cone separable connectors.		N/A	N/A	N/A	N/A
Circuit breaker cable termination chamber	Suitable for 3 single core cables up to 400 mm^2 with interface “C” outer cone separable connectors.		1	1	1	N/A
Circuit breaker Protection	2 overcurrent and 1 earth fault, time limit fuse protection utilising XF type TLFs and suitable a.c. trip coils.		1 set	-	-	N/A
	Self-powered protection relay (clause 13) and suitable circuit breaker release.		-	1	1	1
CTs (Clause 6.1)	100/50/5 CTs for TLF protection		3	-	-	-
	200/1 CTs for self-powered protection relay		-	3		
	600 or 800/1 CTs for self-powered protection relay		-	-	3	3
	200/5 CTs for metering		3	3	-	-
	400/5 CTs for metering		-	-	3	3
VT (Clause 9)	11000/√3 / 110/√3V Winding for metering		1	1	1	1
	11000/√3 / 110/3V broken delta winding for NVD protection		-	-	√	-
Shunt trip coil	Rated for both 110V a.c./d.c. and 20 to 48V d.c. auxiliary supply		1	1	1	1
Multicore Box			1	1	1	1
Terminals, fuses and links			As required	As required	As required	As required
Additional requirements for 6.6kV system			**EFC6AM** As EFC12AM except VT has a dual primary winding 11000/6600 for use on 6.6kV system	**EFC6AM** As EFC12AM except VT has a dual primary winding 11000/6600 for use on 6.6kV system	**EFC6AM** As EFC12AM except VT has a dual primary winding 11000/6600 for for use on 6.6kV system	**EFBS6M** As EFBS12M except VT has a dual primary winding 11000/6600 for use on 6.6kV system

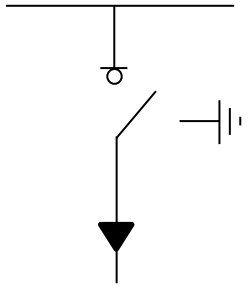
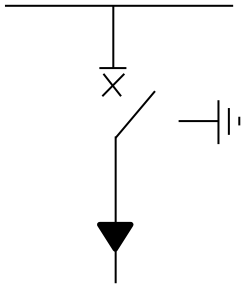
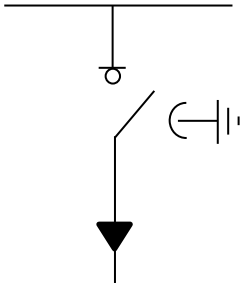
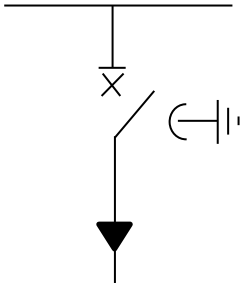
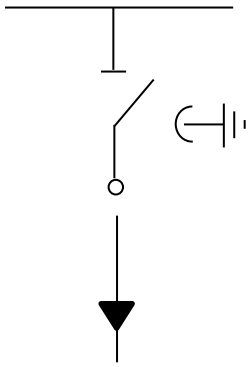
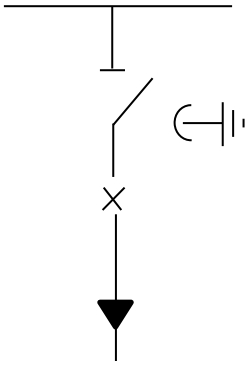
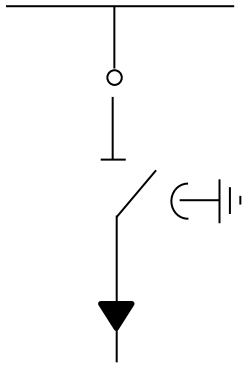
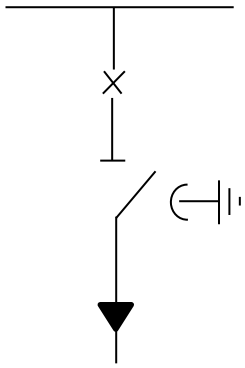
11.0 Schedule 4 TM TYPE METERING UNITS

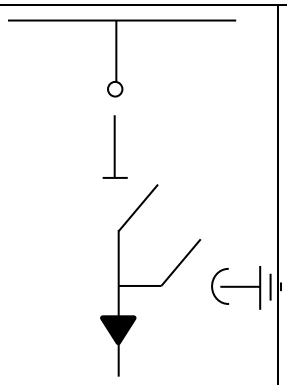
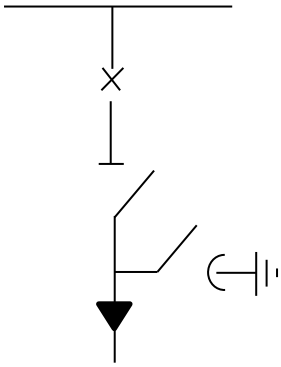
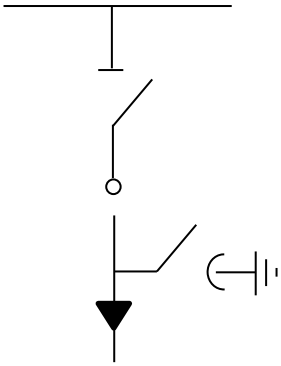
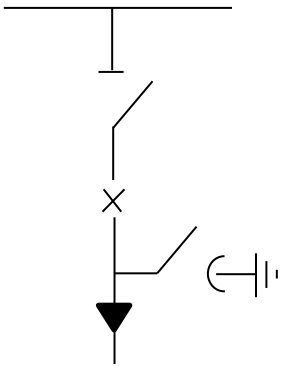
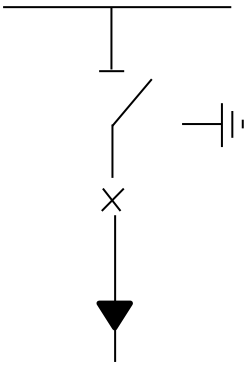
Description	**Further Details**	**TM12B/1**	**TM12C/1**
General requirements	Normal rated voltage: 12kV	Non-extensible metering unit for direct coupling to transformer circuit flange of switchgear	Non-extensible metering unit for direct coupling to transformer circuit flange of switchgear
	Rated short time (3s) withstand current: 16kA		
	Nominal Rating	200A	400A
Supporting Steelwork for metering unit and switchgear		Yes	Yes
Incoming circuit flange and bushings	Suitable for mounting on Transformer mounted type RMU and tee off circuit breakers in Schedule 1 and 2	Yes	Yes
Outgoing circuit cable box	Suitable for 3 single core cables up to 185 mm^2 fitted with shear bolt connections.	1	√1
CTs	Metering CTs	200/5	400/5
VT (Clause 9)	11000/√3 / 110/√3V winding for metering	1	1
	11000/√3 / 110/3 broken delta winding for NVD protection	1	1
Multicore Box		1	1
Terminals, fuses and links		As required	As required
Additional requirements for 6.6kV system		TM12B/1A As TM12B/1 except VT has a dual primary winding 11000/6600 for use on 6.6kV system	TM12C/1A As TM12C/1 except VT has a dual primary winding 11000/6600 for use on 6.6kV system

APPENDIX A Assessed Protection Relays

Details for approved relays for use in ring main units only; can be found in EE Spec 98.

APPENDIX B Arrangements of Disconnectors, Switches, CBs & Earth Switches

	A Switch Disconnector	B Circuit Breaker	Notes
1			• Combined switch disconnector or circuit breaker-disconnector and earthing switch. • Disconnector is a three-position device. • Make-proof earthing switch. • Cable testing via cable connecting chamber. • Cable connecting chamber cover to be two-way interlocked with three position device.
2			• Combined switch disconnector or circuit breaker-disconnector and earthing switch. • Disconnector is a three-position device. • Make-proof earthing switch. • Cable testing via earth star-bar arrangement. • Star-bar or star-bar access cover to be two-way interlocked with three position device.
3			• Circuit breaker or switch with separate disconnector. • Disconnector is a three position device. • Earthing achieved via circuit breaker or switch • Cable testing via earth star-bar arrangement. • Star-bar or star-bar access cover to be two-way interlocked with three position device. OR • Cable testing via cable connecting chamber. • Cable connecting chamber cover to be two-way interlocked with three position device.
4			• Circuit breaker or switch with separate disconnector. • Disconnector is a three-position device. • Make-proof earthing switch. • Cable testing via earth star-bar arrangement. • Star-bar or star-bar access cover to be two-way interlocked with three position device. OR • Cable testing via cable connecting chamber. • Cable connecting chamber cover to be two-way interlocked with three position device.

5			• Circuit breaker or switch with separate disconnector. • Disconnector is a two-position device. • Separate make-proof earth switch. • Cable testing via earth star-bar arrangement. • Star-bar or star-bar access cover to be two-way interlocked with three position device. OR • Cable testing via cable connecting chamber. • Cable connecting chamber cover to be two-way interlocked with three position device.
6			• Circuit breaker or switch with separate disconnector. • Disconnector is a two-position device. • Disconnector shall be make-proof or interlocked with switch or circuit breaker. • Separate make-proof earth switch. • Cable testing via earth star-bar arrangement. • Star-bar or star-bar access cover to be two-way interlocked with three position device. OR • Cable testing via cable connecting chamber. • Cable connecting chamber cover to be two-way interlocked with three position device.
7	**N/A**		<u>This option limited to circuit breakers directly connected to a unit substation distribution transformer</u> • Circuit breaker with separate disconnector. • Disconnector is a two-position device. • Earthing achieved via circuit breaker. • Disconnector shall be make-proof or interlocked with circuit breaker.
			Additional Notes
			• Separate switch may be either in gas or as a vacuum device. • Switch disconnector may be either in gas or as a moving/rotating vacuum device.

APPENDIX C SUPERSEDED DOCUMENTATION

This document supersedes EE2/7 dated December 2020 which has now been withdrawn.

APPENDIX D RECORD OF COMMENT DURING CONSULTATION

No comments required as document has only been updated to align with ENATS 41-41 issue 1 (2020) + A1 (2021) and with current working.

APPENDIX E ASSOCIATED DOCUMENTATION

EESPEC 98	"*Approved Protection, Voltage Control and Alarm Relays and Test Access Blocks*"
EESPEC 136	"*Ancillary Electrical Equipment for Use in Conjunction with Switchgear and Protection/Control Panels*"
ST:SP10P	*"'Plug-In' Remote Meter Cabinet Installations"*
ST:SP10PC	*"Procedure for Fabricating A 'Plug-In' Remote Meter Cabinet for an HV Metering Unit"*
ST:SP10PD	*"Procedure For Modifying an HV Metering Unit for Use with A 'Plug-In' Remote Meter Cabinet"*
ST:SD10PE	*"Alternative Procedure for Fitting Constraint Panels Onto 11kV Switchgear (RMUs etc.) When 'Plug-In' Remote Meter Cabinets Are Employed"*
ST:TP18A	*"Application of Connection Control Panels for Soft Intertrip and/or Voltage Constraint Schemes"*
ENATS 41-41	*"Ground Mounted Distribution Substation 12 to 24 kV Rated RMU & Extensible Switchgear"*
ENATS 35-1 part 3	*"Distribution Transformers Part 3 Ground Mounted Transformers - close-coupled"*

APPENDIX F IMPACT ON COMPANY POLICY

None as only minor amendment. No impact on current working practices.

APPENDIX G KEY WORDS

Circuit Breaker, Panel, Cubicle, Protection, Alarm, Transducer, Telecontrol

APPENDIX H Wiring Diagram for Secondary Distribution Metering Units

Wiring Diagram for Secondary Distribution Metering Units with 3 x PH-to-Neutral VTs including connections to Harting Socket
{HVMU_WD_0001_RevA.pdf}

APPENDIX I Wiring Diagram for Umbilical Cable and Male Harting Plug

Wiring Diagram for Umbilical Cable and Harting Plug
{HVMU_WD_0005_RevA.pdf}