NPS/003/004 – Technical Specification for Indoor 33kV Switchgear

1. Purpose

This document is the technical specification for 33kV indoor switchgear for use on the distribution networks of Northern Powergrid.

This document supersedes the following documents, all copies of which should be removed from circulation:

Document Reference	Document Title	Version	Published Date
NPS/003/004	Technical Specification for Indoor 33kV Switchgear	3.2	July 2019

2. Scope

This specification covers the technical requirements for indoor 33kV cable connected switchgear for use on the distribution networks of Northern Powergrid and includes a requirement for suppliers to provide periodic inspection and maintenance information.

It will also be necessary to consider and include any project specific requirements in Appendix 4: Addendum to Supplier Requirements.

The following appendices form part of this technical specification.

- Appendix 1: Technical Specification Sheet
- Appendix 2: Technical Schedules Sheet
- Appendix 3: Self-Declaration to ENATS 41-40
- Appendix 4: Addendum to Supplier Requirements
- Appendix 5: Pre-Commission Testing, Routine Inspection and Maintenance Requirements
- Appendix 6: Technical Information Check List

2.1. Table of Contents

3. Technical Requirements

3.1. Compliance with other Specifications and Standards

Where reference is made within this specification to any International Standard, British Standard, Energy Networks Association Technical Specification (ENATS) or any other standard, this shall be to the latest version of that standard current at the time of supply.

3.2. Overview

All switchgear shall comply fully with the requirements of the Energy Networks Association Technical Specification (ENATS) 41-40 and all associated specifications, standards and regulations to which ENATS 41-40 refers.

Switchgear shall preferably have been assessed by the ENA Switchgear Assessment Panel and been awarded an ENA Notice of Conformity. Any variations in the specification of the switchgear offered to that described in the ENA Notice of Conformity or to any previously supplied to Northern Powergrid shall be stated.

At joint NGET/NPg substations, the switchboard shall also meet the requirements of NGET specification TS 2.29 and ideally be Type Registered by NGET.

The insulating and current interrupting medium shall not be oil.

Variations from, or enhancement to ENATS 41-40 are described in Section 3.3. The options selected within ENATS 41-40 are listed in Appendix 1 of this document.

The CT specifications included in Appendix 1 are provided as a guide and should not be taken as being the definitive requirement for any particular switchboard.

3.3. Variations and Enhancements to ENATS 41-40

Design and Construction

Circuit breakers shall be of a fixed-pattern, non-oil design; withdrawable designs will not be considered.

Innovative products utilising an insulation medium with reduced global warming potential as an alternative to SF6 will be considered.

The rated Normal Current (I_r) shall be as shown in Table 1 & 2 of this section as expanded in Appendix 2.

Switchgear shall be indoor, ground mounted, cable connected, single busbar and extensible. Where busbars are insulated within a common chamber, the busbars and the busbar joints shall be designed with measures taken to limit the progression of a single phase earth fault into a three phase fault such as screening of each phase. All the busbars and joints shall be separately insulated.

Circuit breaker panels shall be equipped to allow individual isolation and earthing of all incomer and feeder circuits, and all sections of busbar. Current transformers and voltage transformers will be provided as specified in this document or as specified at the time of ordering. Voltage indicating and phase comparison connections shall be provided on all panels. Cable test facilities shall be provided on all cable connected panels.

Each circuit breaker panel shall comprise a circuit breaker, at least one disconnector, and at least one earth switch.

Circuit breaker panels may contain combined function switching devices: Where a combined disconnector earthing switch is used this shall have three separate lockable positions; service, isolated and earth.

Open terminal connected equipment shall not be offered.

Internal wiring and Terminations

All internal wires shall have a minimum cross-sectional area of 2.5mm^2. For 110V AC and DC circuit, the wire shall be white insulated core. For 230V AC and above, the wire shall conform to the requirements of BS7671.

All cable terminations shall be made by hooked blade crimps. Bootlace Crimps shall not be used. In cases where the equipment cannot be terminated using a Hooked Blade Crimp, the use of manufacturer recommended crimp shall be deemed acceptable, but must be proven to provide an equivalent degree of connection security to a hooked blade crimp.

Auxiliary Equipment

Secondary Wiring Terminals: Terminal blocks shall be rail mounted, spring loaded or cage clamp design. Those used for SCADA wiring which shall be of the knife disconnecting type and be equipped with 2.3mm test sockets.

CT secondary terminals shall be of the spring loaded or cage clamp design, or spring washer on stud design. Secondary terminals for CT bus wiring shall have a shorting/disconnecting facility. Terminals which cannot be made dead by removing the panel fuses and links, shall be shrouded to protection IPXXD as specified in BS EN 60529 to prevent electric shock by accidental contact.

Fuses and links shall be in accordance with ENATS 50-18 (GEC type RS 20 or equivalent) having labels mounted above to the relevant fuse or link. The label inscription shall include the fuse current rating.

Following initial commissioning of the circuit breaker, it shall be possible to safely install and terminate additional cables without the need to make the busbars dead.

Pressure Level Indication

The gas pressure of circuit breaker interrupters shall be monitored in two stages. Stage 1 shall initiate a Stage 1 “warning” alarm only and not affect normal operation. Stage 2 shall initiate a Stage 2 “critical” alarm and inhibit circuit breaker operation, except in the case of bus section circuit breakers which shall auto-open.

The gas pressure in each segregated compartment shall be monitored separately. Falling pressure in any compartment shall initiate an alarm.

Labelling

All handles and other devices supplied for operating, isolating, earthing or other purpose shall be clearly labelled with their function.

In addition to normal circuit labels specified in section 6.11.201 of ENATS 41-40, a label stating the circuit number shown on the Circuit Diagram of Connections and Protection shall be applied to the fixed portion of each circuit breaker. The label shall be circular and the number black on a white background. The label shall be secured by non-rusting screws to the left-hand side of the fixed portion, clear of the circuit label to avoid confusion.

Connection Compartments

Northern Powergrid has a preference for separable connectors. In all cases terminations must comply with Northern Powergrid technical specification NPS/002/016: Specification for 33kV Cable Joints and Terminations.

The cable termination compartment shall be segregated from all compartments containing electrical components by an earthed metal or insulating barrier having Degree of Protection IP 3XD, as defined by BS EN 60529.

Maintenance

The unit shall be designed as far as practical to be low maintenance or zero maintenance. Operation and maintenance procedures shall be provided at tender stage to allow evaluation. Suppliers shall provide details of the recommended periodic inspection and maintenance requirements to be undertaken during the lifetime of their product. Detailed inspection and maintenance instructions shall be also be provided.

The rated short circuit breaking current (I_{sc}) shall be as shown in Tables 1 and 2, as expanded in Appendix 2 of this document. For installations requiring a 120ms time constant, the rated peak short circuit make current shall be 2.7 x the r.m.s value of the a.c. component of the rated short circuit breaking current.

Table 1: Normal Current and Short Circuit Break and Make Ratings

Application	33kV Switchgear	Rating			
		Device	Bus Bar	Break Rating	Make Rating (pk-pk)
Supply point substation with 120MVA transformers	Feeder Panel[1]	1250A	2500A	31.5kA (45ms) and 20kA (120ms)	78.75kA
	Transformer Panel	2500A	2500A		
	Bus Section Panel	2500A	2500A		
Supply point substation with 90MVA transformers	Feeder Panel	1250A	2000A	31.5kA (45ms) and 20kA (120ms)	78.75kA
	Transformer Panel	2000A	2000A		
	Bus Section Panel	2000A	2000A		
3-panel arrangement	Feeder Panel	1250A	1250A	31.5kA (45ms) and 20kA (120ms)	78.75kA
	Transformer Panel	1250A	1250A		
	'Bus End Panel' - non-automatic circuit breaker	1250A	1250A		
2 – panel arrangement	Incomer Panel (Non Automatic Breaker)	1250A	1250A	31.5kA (45ms) and 20kA (120ms)	78.75kA
	Feeder Panel	1250A	1250A		

Table 2: Short Circuit Break and Make Ratings at Remote Sites

The use of 25kA circuit breakers (at an X/R ratio of 14) may be acceptable provided that the installation is sufficiently remote from the source 132/EHV substation and the credible scenarios stated in IMP/001/913 can be met and is at the discretion of Assets Management.

Application	33kV Switchgear	Rating			
		Device	Bus Bar	Break Rating	Make Rating (pk-pk)
Remote 3 - panel arrangement	Feeder Panel	1250	1250	25kA (45ms) and 20kA (120ms)	62.5kA
	Transformer Panel	1250	1250		
Remote 2 - panel arrangement	'Bus End Panel' - non-automatic circuit breaker	1250	1250		
	Incomer Panel (Non Automatic Breaker)	1250A	1250A	25kA (45ms) and 20kA (120ms)	62.5kA
	Feeder Panel	1250A	1250A		

[1] Panel includes the circuit breaker, disconnector and earth switch

Rated Operating Sequence

The circuit breaker operating mechanism shall meet the operating cycle stated in Appendix 1 of this document. To ensure correct operation of all equipment in an auto re-closing scheme, the circuit breaker auxiliary switches should operate together without prolonged contact bounce. To achieve this practically, the time between the first switch commencing movement and the settling of the last switch shall not exceed 40ms.

Current Transformers

CTs shall have the same characteristics as the primary circuit (including thermal rating, short time withstand, etc.)

Voltage Transformers

The VT shall have all parts of its primary winding, including terminals, insulated from earth to a level corresponding to its rated phase to phase voltage. VTs shall be dry type, epoxy resin insulated, 3-phase star/star connected for protection, instrument and metering circuits. There shall also be an HV isolating device, LV fuses and test facility provided for the VT

The VT secondary winding shall be earthed on the yellow phase.

It is acceptable for VTs to be fixed but there must be a means of isolation on the HV side to facilitate easy disconnection during overvoltage testing of the associated HV circuit(s). The Northern Powergrid preference is for HV isolation via a padlock able device.

Secondary Output Protection and Isolation

The Northern Powergrid preference is for the LV output to be protected by miniature circuit breakers. The miniature circuit breakers and LV isolating links or LV fuses shall be padlock able with a Northern Powergrid standard padlock to prevent unauthorised de-isolation.

Voltage transformers shall meet the following specification:

Three Phase VT Specification			
Type 1	Primary Voltage Rating		*33000*
	Continuous Voltage Factor		*1.2*
	Short Time Voltage Factor		*1.9*
	No of Secondary Winding Output		*1*
	Output 1	Voltage Ratio	*33000/√3: 110/√3*
		Class (Protection)	*3P*
		Burden	*50VA/Phase*
Type 2	Primary Voltage Rating		*33000*
	No of Secondary Winding Output		*1*
	Continuous Voltage Factor		*1.2*
	Short Time Voltage Factor		*1.9*
	Output 1	Voltage Ratio	*33000/√3: 110/√3*
		Class (Protection)	*6P*
		Burden	*100VA/Phase*
Type 3	Primary Voltage Rating		*33000*
	No of Secondary Winding Output		*2*
	Continuous Voltage Factor		*1.2*
	Short Time Voltage Factor		*1.9*
	Output 1	Voltage Ratio	*33000/√3: 110/√3*
		Class (Metering)	*0.50*
		Burden	*50VA/Phase*
	Output 2	Voltage Ratio	*33000/√3: 110/√3*
		Class (Dual)	*3P/1.0*
		Burden	*50VA/Phase*
Type 4	Primary Voltage Rating		*33000*
	No of Secondary Winding Output		*3*
	Continuous Voltage Factor		*1.2*
	Short Time Voltage Factor		*1.9*
	Output 1	Voltage Ratio	*33000/√3: 110/√3*
		Class (Metering)	*0.50*
		Burden	*50VA/Phase*
	Output 2	Voltage Ratio	*33000/√3: 110/√3*
		Class (Dual)	*3P/1.0*
		Burden	*50VA/Phase*
	Output 3 (Open Delta)	Voltage Ratio	*33000/√3: 110/3*
		Class (Protection)	*3P*
		Burden	*50VA/Phase*

Single Phase VT Specification				
Type 1	Primary Voltage Rating			*33000*
	Continuous Voltage Factor			*1.2*
	Short Time Voltage Factor			*1.9*
	No of Secondary Winding Output			*3*
	Output 1		Voltage Ratio	*33000/√3: 110/√3*
			Class (Metering)	*0.50*
			Burden	*50VA/Phase*
	Output 2		Voltage Ratio	*33000/√3: 110/√3*
			Class (Dual)	*3P/1.0*
			Burden	*50VA/Phase*
	Output 3 (Open Delta)		Voltage Ratio	*33000/√3: 110/3*
			Class (Protection)	*3P*
			Burden	*50VA/Phase*
Type 2	Primary Voltage Rating			*33000*
	Continuous Voltage Factor			*1.2*
	Short Time Voltage Factor			*1.9*
	No of Secondary Winding Output			*1*
	Output 1		Voltage Ratio	*33000/√3: 110/√3*
			Class (Protection)	*3P*
			Burden	*50VA/Phase*

Voltage transformers shall be connected to the primary conductors by fuse links.

4. References

The products described within this specification shall comply with all current versions of the relevant International Standards, British Standard Specifications and all relevant Energy Networks Association Technical Specifications (ENATS) current at the time of supply.

4.1. External Documentation

Reference	Title
BS EN 50522:2010	Earthing of Power Installations Exceeding 1kV a.c
BS EN 60529	Degrees of protection provided by enclosures (IP Code)
BS EN 61936-1	Power Installations Exceeding 1kV a.c
BS7671	Requirement for Electrical Installation
ENATS 41-40 Issue 1	Ground Mounted Major Substation 12 to 36 kV Rated Indoor Fixed Pattern Switchgear
ENATS 50-18	Application of Ancillary Electrical Equipment
National Grid Technical Specification	TS 2.29 - Issue 2 – December 2018 Switchgear and Controlgear for use at Voltages up to 36kV

4.2. Internal documentation

Reference	Title
IMP 001 909	Code of Practice for Distribution System Parameters
IMP 001 913	Code of Practice for the Economic Development of the EHV System
NPS/002/016	Technical Specification for 33 kV Cable Joints and Terminations

4.3. Amendments from Previous Version

Reference	Description
Appendix 1, 2 & 3	Updated to reflect ENATS 41-40 Issue 1 2019 and current requirements.
Section 3.3	Updated to reflect ENATS 41-40 Issue 1 2019.
Table 1 & 2	Updated to reflect current requirements.

5. Definitions

Term	Definition
EHV	Extra High Voltage (33kV – 132kV).
HV	High Voltage (5.2kV – 20kV).
LV	Low Voltage
NGET	National Grid Electricity Transmission
NPg	Northern Powergrid
SCADA	System Control and Data Acquisition
SF6	Sulphur hexafluoride

6. Authority for issue

6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Liz Beat	Governance Administrator	29/01/2020

6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period;

Standard CDS review of 3 years?	Non Standard Review Period & Reason	
No	**Period:** 5 years	**Reason:** To align with procurement cycles
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Joe Helm	Policy & Standards Engineer	30/01/2020

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
Alan MacDonald	Policy &Standards Engineer	29/01/2020
Sunil Shrestha	Design and Specification Engineer	29/01/2020
Mick Emsley	Policy & Standards Manager	10/02/2020

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Greg Farrell	Head of System Engineering	25/02/2020

Appendix 1 – Technical Specification Sheet

MANUFACTURER	
CIRCUIT BREAKER TYPE REFERENCE	

	ENATS 41-40 ref	NPS/003/004 ref	Specified Value	Declared Value
PARTICULAR OF SYSTEM				
Nominal Voltage			33 kV	
Frequency			50 Hz	
Number of Phases			3	
Neutral Earthing (See BS EN 50522 for more info)			Solid	
CIRCUIT BREAKER CHARACTERISTICS				
ENATS Certificate of Conformance		3.3	Manufacturer to state	
Number of poles			3	
Class – indoor/outdoor	4.1.2		Indoor	
Insulation Medium		3.3	Not oil	
Arc extinguishing medium		3.3	Not oil	
Type reference of vacuum bottles (if applicable)			Manufacturer to state	
Type reference of interrupter (if applicable)			Manufacturer to state	
Rated voltage	5.3		36 kV	
Rated Insulation level. – Power frequency voltage – Lightning impulse voltage	5.3		70 kV (80kV across isolating distance) 170 kV (195 kV across isolating distance)	
Rated Frequency	5.4		50Hz	
			For joint NPg/NG sites, **TS 2.29** requires: – Functional performance between 47.5 Hz and	

	ENATS 41-40 ref	NPS/003/004 ref	Specified Value	Declared Value
			52.0Hz, and, – Operate at 47.0Hz and 47.5Hz for 20 seconds	
Rated Normal Currents	5.5	3.3 Table 1 & 2	Refer to Table 1 & 2 of this NPS document	
Rated Short-time withstand current	5.6		Shall equal the short circuit breaking current (I_{sc})	
Rated peak withstand current (I_p)	5.7	3.3	2.7 x rated short time withstand current (I_k)	
			For joint NPg/NG sites, TS 2.29 requires: 2.5pu @ 45ms 2.7pu@ 120ms 2.75pu @ 160ms	
Rated duration of short circuit	5.8		3 sec	
Rated supply voltage of opening and closing devices and auxiliary and control circuits. a) Closing and tripping b) Indication c) Control	5.9		a) 110 V DC b) 110 V DC/AC (supply point) 110 V AC primary/2 or 3 circuit development c) 24V DC (telecontrol indication)	
Rated supply frequency of closing and auxiliary circuits.	5.9		DC/50Hz	
Rated short-circuit breaking currents and X/R	5.300.101	3.3	Refer to Table 1 & 2 and Appendix 2 of this document	
Rated operating sequence.	5.300.104		O – 0.3s – CO – 15s – CO	
Rated capacitive switching currents. Rated cable charging breaking current: Rated line charging breaking current:	5.300.107		 50 A 10 A	
Classification of mechanical operations	*5.300.110*		*M2: 10000*	

	ENATS 41-40 ref	NPS/003/004 ref	Specified Value	Declared Value
M1 or M2				
Classification of electrical endurance + tested for autoreclose duty?	*5.330.111*		*Class E2 autoreclose*	
Gas monitoring devices. *1st Stage* *2nd Stage*	*6.10*		*2 stage:* *1st stage – Alarm.* *2nd stage – Trip inhibit + alarm + auto bus section disconnect*	
Voltage presence indicating system (VPIS) fitted	*6.103.203. 10*		*Provided - Manufacturer to state type*	
VPIS: location of capacitor bushing	*6.103.203. 10*		*Provided - Manufacturer to state location*	
Colour of Paint			*Light Neutral Grey*	
Power cable connection manufacturer / type			*Conform to NPS/002/016 - Manufacturer to state type*	
Power cable: max number, size of cables/phase			*630A: 1 x 400sq mm / phase* *800A: 2 x 300sq mm / phase* *1250A: up to 3 x 300sq mm / phase* *2000A: 3 x 630 sq. mm / phase* *2500A: 4 x 630 sq. mm / phase*	
OPERATING MECHANISM DETAILS				
Manufacturer and Type Reference			Manufacturer to state	
Closing Coils Number Type reference Power consumption			Manufacturer to state	Number Type reference Power consumption

	ENATS 41-40 ref	NPS/003/004 ref	Specified Value	Declared Value
Trip Coil Number Type reference Power consumption			Manufacturer to state	 Number Type reference Power consumption
Operating time – Close			Manufacturer to state	
Operating time – Open			Manufacturer to state	
Closing spring recharge time (motor driven); if applicable			Manufacturer to state	
Closing mechanism power consumption and time of operation			Manufacturer to state	
Closing mechanism type (manufacturer to give details).			Manufacturer to state	
Maximum dynamic floor loading			Manufacturer to state	
GAS DETAILS				
Gas Type			Manufacturer to state type, composition and GWP	
Operating pressure of pressure relief device			Manufacturer to state	
Filling pressure at 20^{o}C			Manufacturer to state	
Normal pressure at 20^{o}C			Manufacturer to state	
Interrupter gas Stage 1 alarm pressure			Manufacturer to state	
Interrupter gas Stage 2 alarm and operation inhibit pressure			Manufacturer to state	

	ENATS 41-40 ref	NPS/003/004 ref	Specified Value	Declared Value
Insulating gas alarm pressure			Manufacturer to state	
Quantity of gas (mass and volume) per compartment at normal pressure at 20°C Feeder Panel Busbar Compartment Feeder Panel Feeder Compartment Feeder Panel Interrupter Total Bus Section Compartment 1 Bus Section Compartment 2 Total			Manufacturer to state	 Feeder Panel Busbar Compartment Feeder Panel Feeder Compartment Feeder Panel Interrupter Total Bus Section Compartment 1 Bus Section Compartment 2 Total
Quantity of gas (mass and volume) per compartment at Stage 1 alarm pressure at 20°C Feeder Panel Busbar Compartment Feeder Panel Feeder Compartment Feeder Panel Interrupter Total Bus Section Compartment 1 Bus Section Compartment 2 Total				 Feeder Panel Busbar Compartment Feeder Panel Feeder Compartment Feeder Panel Interrupter Total Bus Section Compartment 1 Bus Section Compartment 2 Total
Method of monitoring pressure and temperature compensation			Manufacturer to state	

<table>
<tr><th></th><th>ENATS 41-40 ref</th><th>NPS/003/004 ref</th><th>Specified Value</th><th>Declared Value</th></tr>
<tr><td>DIMENSIONS AND WEIGHTS</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Incomer</td><td></td><td></td><td>Manufacturer to state</td><td><table><tr><td>/mm</td><td>1250A</td></tr><tr><td>Height</td><td></td></tr><tr><td>Width</td><td></td></tr><tr><td>Depth</td><td></td></tr><tr><td>Mass</td><td></td></tr></table></td></tr>
<tr><td>Transformer Panel</td><td></td><td></td><td>Manufacturer to state</td><td><table><tr><td>/mm</td><td>1250A</td><td>2000A</td><td>2500A</td></tr><tr><td>Height</td><td></td><td></td><td></td></tr><tr><td>Width</td><td></td><td></td><td></td></tr><tr><td>Depth</td><td></td><td></td><td></td></tr><tr><td>Mass</td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Bus Section Panel</td><td></td><td></td><td>Manufacturer to state</td><td><table><tr><td>/mm</td><td>1250A</td><td>2000A</td><td>2500A</td></tr><tr><td>Height</td><td></td><td></td><td></td></tr><tr><td>Width</td><td></td><td></td><td></td></tr><tr><td>Depth</td><td></td><td></td><td></td></tr><tr><td>Mass</td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Minimum housing dimensions and clearances around switchboard required to achieve internal arc performance</td><td></td><td></td><td>Manufacturer to state</td><td></td></tr>
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CT Specifications

Typical CT specifications are provided as a guide; a definitive specification will be provided with each switchboard ordered.

Panel Type	CT Application	Continuous Current	Ratio
Supply Point Transformer	Overall Biased Differential	2200A or 2750A	2000/1 Vk > (24Rct+48) Vk > 60V Ie < 6mA @ (4Rct+12)
	DOC	140%	2000/1A 5VA 5P10 CLASS 1 Rct < 6.7 ohm
	LDC/Voltage Control	150%	1575/1A 15VA CLASS 3
	Bus Zone CTs Discrim Zone	2200A or 2750A	1/1250T Vk > (40Rct+118) Ie < 10mA (20Rct +35) Rct < 3.2 ohm Class PX
	Bus Zone CTs Check Zone	2200A or 2750A	1/1250T Vk > (40Rct + 83) Vk > 125V. Ie < 5mA @ (20 Rct + 35). Rct< 3.2 ohm. Class PX
	Metering		To be specified if required
Bus Section	Bus Zone 1 Discrim	2200A or 2750A	As on Tx Panel
	Bus Zone 2 Discrim	2200A or 2750A	As on Tx Panel
Feeder: Unit Protection /OCIT	Unit Prot	1375A	1/600T Vk>(42ct+81). Ie<100mA @ Vk. Ie < 50mA @ 50V. Class PX
	IDMT	140%	1000/1 5VA 5P20 CLASS 1
	Bus Zone Discrim	1375A	As on Tx Panel
	Bus Zone Check	1375A	As on Tx Panel
Feeder: Dist/OCIT	Distance Prot.	1375A	1/1250T Vk > (22Rct + 13) Ie < 100mA @ Vk. Class PX
	IDMT	140%	1000/1 5VA 5P20 CLASS 1
	Bus Zone Discrim	1375A	As on Tx Panel
	Bus Zone Check	1375A	As on Tx Panel
Feeder: BEF Inst/OCIT (Inc. Metering if required)	HSOC/BEF	1375A	1/1250T Vk > (16Rct + 64) Ie < 20mA @ (2Rct + 25) Rct < 9 ohm. Class PX
	OC/E	140%	1000/1 5VA 5P20 CLASS 1
	Bus zone CTs Discrim. Zone	1375A	As on Tx Panel
	Bus Zone CTs Check Zone	1375A	As on Tx Panel
	Metering 1 (If required)		To be specified if required
	Metering 2 (If required)		To be specified if required

3 Circuit Development: Transformer Panel	BEF	1250A	1/1250T. Vk > (6Rct + 64). Ie < 20mA @ (2Rct + 25) Rct < 3.3 ohm Class PX
	Unit Prot	1375A	1/1250T. Vk > (42Rct + 81). Ie < 100mA @ Vk Ie < 17mA @ 50V. Class PX. (for up to 3 ct sets in parallel in this switchboard)
	Unit Prot	1375A	As above
3 Circuit Development: Y Panel (metered)	Unit Prot	1375A	1/600T. Vk > (42Rct + 81). Ie < 100mA @ Vk Ie < 15mA @ 50V. Class PX. (for up to 3 ct sets in parallel in this switchboard)
			Other CTs as specified
	Metering		To be specified if required
3 Circuit Development: Y Panel	Unit Prot	1375A	1/1250T. Vk > (42Rct + 81). Ie < 100mA @ Vk Ie < 17mA @ 50V. Class PX. (for up to 3 ct sets in parallel in this switchboard)
3 Circuit Development: X Panel	Unit Prot	1375A	1/1250T. Vk > (42Rct + 81). Ie < 100mA @ Vk Ie < 17mA @ 50V. Class PX. (for up to 3 ct sets in parallel in this switchboard)
33kV Neutral CT	REF	2200A or 2750A	1/2000T Vk > (24Rct+48) > 60V Ie < 6mA @ (4Rct+12). Class PX
	SBEF	100% (500% for 3 secs)	1000/1A 2.5VA 5P5

Appendix 2: Technical Schedules

The matrix below states the equipment required for each typical arrangement. In addition, the following shall be supplied: insulating gas (if applicable), auxiliary wiring, cable boxes, terminal boards, or steel panels for control boards and their supporting steelwork, panel wiring, fuses, interlocking gear, holding down bolts, screens guards, labels and necessary sundries whether specified in detail or not. The equipment offered shall be in accordance with ENATS 41.40. Erection on site, off-loading and pre delivery testing shall be included.

	Transformer Panel	Bus Section Panel	Feeder: Unit Protection + 2 OCIT/ EIT Panel	Feeder: Distance+ 2 OCIT/ EIT Panel	Feeder: BEF, INST + O/C, 2OCIT/EIT Panel	Feeder: BEF' INST + O/C, 2OCIT/EIT + metering	3 Circuit Development X Panel	3 Circuit Development Transformer T Panel	3 Circuit Development Y Panel	3 Circuit Development Y Panel + metering	Neutral CTs
Circuit breaker	√	√	√	√	√	√	√	√	√	√	
Disconnector	√	√ x 2	√	√	√	√	√	√	√	√	
Earth Switch	√	√ x 2	√	√	√	√	√	√	√	√	
CTs as Appendix 1	√	√	√	√	√	√	√	√	√	√	√
Voltage Transformer	√			√		√				√	
Cable Terminations	√		√	√	√	√	√	√	√	√	
Repeat relay DAR inhibit	√										

33kV circuit breakers for Supply Point substations

Item	Busbar rating (A)	Circuit Breaker Rating (A)	Fault Rating (kA)	X/R	Description
1	2500	2500	31.5	14	Transformer Incomer (At joint NGET/NPg sites, the switchgear shall also meet the requirements of NGET and ideally be Type Registered by NGET.)
2	2500	2500	31.5	14	Bus Section
3	2500	1250	31.5	14	Feeder Unit Protection & 2OCIT/EIT
4	2500	1250	31.5	14	Feeder Distance & 2OCIT/EIT
5	2500	1250	31.5	14	Feeder BEF INST O/C & 2OCIT/EIT
6	2500	1250	31.5	14	Feeder BEF INST O/C & 2OCIT/EIT & Metering
7	2000	2000	31.5	14	Transformer Incomer (At joint NGET/NPg sites, the switchgear shall also meet the requirements of NGET and ideally be Type Registered by NGET.)
8	2000	2000	31.5	14	Bus Section
9	2000	1250	31.5	14	Feeder Unit Protection & 2OCIT/EIT
10	2000	1250	31.5	14	Feeder Distance & 2OCIT/EIT
11	2000	1250	31.5	14	Feeder BEF INST O/C & 2OCIT/EIT
12	2000	1250	31.5	14	Feeder BEF INST O/C & 2OCIT/EIT & Metering

33kV circuit breakers for 3-panel arrangements

Item	Busbar rating (A)	Circuit Breaker Rating (A)	Fault Rating (kA)	X/R	Description
13	1250	1250	31.5	14	Transformer Incomer
14	1250	1250	31.5	14	Bus Section
15	1250	1250	31.5	14	Incomer “X” Circuit
16	1250	1250	31.5	14	Transformer “T” Circuit
17	1250	1250	31.5	14	Feeder “Y” Circuit with Metering
18	1250	1250	31.5	14	Feeder “Y” Circuit

33kV circuit breakers for 2-panel arrangements

Item	Busbar rating (A)	Circuit Breaker Rating (A)	Fault Rating (kA)	X/R	Description
19	1250	1250	31.5	14	Incomer "X" Circuit
20	1250	1250	31.5	14	Feeder "Y" Circuit with Metering
21	1250	1250	31.5	14	Feeder "Y" Circuit

33kV circuit breakers for 3-panel arrangements at Remote Sites

Note that the default fault rating is 31.5kA; switchgear with a fault rating of 25kA may only be specified if the criteria stated in IMP/001/913 are met and is at the discretion of Asset Management.

Item	Busbar rating (A)	Circuit Breaker Rating (A)	Fault Rating (kA)	X/R	Description
22	1250	1250	25	14	Transformer Incomer
23	1250	1250	25	14	Bus Section
24	1250	1250	25	14	Incomer "X" Circuit
25	1250	1250	25	14	Transformer "T" Circuit
26	1250	1250	25	14	Feeder "Y" Circuit with Metering
27	1250	1250	25	14	Feeder "Y" Circuit

33kV circuit breakers for 2-panel arrangements at Remote Sites

Note that the default fault rating is 31.5kA; switchgear with a fault rating of 25kA may only be specified if the criteria stated in IMP/001/913 are met and is at the discretion of Asset Management.

Item	Busbar rating (A)	Circuit Breaker Rating (A)	Fault Rating (kA)	X/R	Description
28	1250	1250	25	14	Incomer "X" Circuit
29	1250	1250	25	14	Feeder "Y" Circuit with Metering
30	1250	1250	25	14	Feeder "Y" Circuit

Appendix 3: Self-Declaration to ENATS 41-40

SELF CERTIFICATION CONFORMANCE DECLARATION - NOTE: One table to be completed for each item or variant offered.
CLAUSE BY CLAUSE CONFORMANCE WITH ENATS 41-40

Switchgear covered by ENATS 41-40 shall comply with the latest issues of the relevant International and British Standards. ENATS 41-40 is intended to amplify and/or clarify the requirements of those Standards.

This check sheet identifies the clauses in ENATS 41-40 and the clauses of the aforementioned Standards relevant to common specifications for high-voltage switchgear and control gear standards. The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes.

Conformance declaration codes

N/A = Clause is not applicable/appropriate to the product
Cs1 = The test conforms fully with the requirements of this clause
Cs2 = The test conforms partially with the requirements of this clause
Cs3 = The test does not conform to the requirements of this clause
Cs4 = Test not performed, but alternative evidence/ technical case offered

Manufacturer:		**ENA Reference:**
Product Reference:	**Ratings:**	
Name:	**Signature:**	**Date:**

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
1	Scope [BS EN 62271-1]			
2	Normative references			
3	Terms and definitions [BS EN 62271-1]			
4	Normal and special service conditions			
4.1	Normal service conditions [BS EN 62271-1]			
4.1.1	General			
4.1.2	Indoor switchgear and controlgear [BS EN 62271-1]			
5	Ratings			
5.1	General [BS EN 62271-1]			
5.3	Rated insulation level [BS EN 62271-1]			
5.4	Rated frequency [BS EN 62271-1]			
5.5	Rated continuous current [BS EN 62271-1]			
5.6	Rated short-time withstand current [BS EN 62271-1]			
5.6.201	Rated short-time withstand current of the earthing circuit (I_{ke})			
5.7	Rated peak withstand current [BS EN 62271-1]			
5.7.201	Rated peak withstand current of the earthing circuit (I_{pe})			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
5.8	Rated duration of short-circuit [BS EN 62271-1]			
5.8.201	Rated duration of short-circuit of the earthing circuit (t_{ke})			
5.9	Rated supply voltage of auxiliary and control circuits (U_a) [BS EN 62271-1]			
5.10	Rated supply frequency of auxiliary and control circuits [BS EN 62271-1]			
5.11	Rated pressure of compressed gas supply for controlled pressure systems [BS EN 62271-1]			
5.101	Rated internal arc classification (IAC) [BS EN 62271-200]			
5.101.1	General [BS EN 62271-200]			
5.101.2	Types of accessibility [BS EN 62271-200]			
5.101.3	Classified sides [BS EN 62271-200]			
5.101.4	Rated arc fault currents (I_A, I_{Ae}) [BS EN 62271-200]			
5.101.5	Rated arc fault duration (t_A, t_{Ae}) [BS EN 62271-200]			
5.102	Rated cable test access [BS EN 62271-200]			
5.102.1	General [BS EN 62271-200]			
5.102.2	Rated a.c. cable test voltage U_{ct} (a.c.) [BS EN 62271-200]			
5.102.3	Rated d.c. cable test voltage U_{ct} (d.c.) [BS EN 62271-200]			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
5.300	Circuit-breaker requirements [BS EN 62271-100]			
5.300.100	General circuit-breaker requirements			
5.300.101	Rated short-circuit breaking current (I_{sc}) [BS EN 62271-100]			
5.300.102	Transient recovery voltage related to the rated short-circuit breaking current [BS EN 62271-100]			
5.300.103	Rated short-circuit making current [BS EN 62271-100]			
5.300.104	Rated operating sequence [BS EN 62271-100]			
5.300.105	Characteristics for short-line faults [BS EN 62271-100]			
5.300.106	Rated out-of-phase making and breaking currents [BS EN 62271-100]			
5.300.107	Rated capacitive switching currents [BS EN 62271-100]			
5.300.108	Inductive load switching [BS EN 62271-100]			
5.300.110	Number of mechanical operations [BS EN 62271-100]			
5.300.111	Classification of circuit-breakers as a function of electrical endurance			
5.302	Disconnector requirements [BS EN 62271-102]			
5.302.102	Classification of earthing switches for short-circuit making [BS EN 62271-102]			
5.302.104	Rated values of the bus transfer current switching capability of disconnectors [BS EN 62271-102]			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
5.302.105	Classification of disconnectors for mechanical endurance [BS EN 62271-102]			
5.302.106	Classification of earthing switches for mechanical endurance [BS EN 62271-102]			
5.303	Switches and earth switch requirements [BS EN 62271-103]			
5.303.101	Rated mainly active load-breaking current (I_{load}) [BS EN 62271-103]			
5.303.102	Rated closed-loop breaking current (I_{loop}) [BS EN 62271-103]			
5.303.104	Rated cable-charging breaking current (I_{cc}) [BS EN 62271-103]			
5.303.105	Rated line-charging breaking current (I_{lc}) [BS EN 62271-103]			
5.303.111	Rated short-circuit making current (I_{ma}) [BS EN 62271-103]			
5.303.116	Type and classes for a general purpose switch [BS EN 62271-103]			
5.303.201	Rated mechanical endurance of switches			
6	Design and construction			
6	Design and construction requirements			
6.2	Requirements for gases in switchgear and controlgear [BS EN 62271-1]			
6.3	Earthing of switchgear and controlgear [BS EN 62271-1]			
6.4	Auxiliary and control equipment and circuits [BS EN 62271-1]			
6.4.1	Identification			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
6.4.2	Cables and wiring			
6.4.3	Terminals and terminations			
6.5	Dependent power operation [BS EN 62271-1]			
6.6	Stored energy operation [BS EN 62271-1]			
6.6.303	Stored energy switch operations [BS EN 62271-103]			
6.7	Independent unlatched operation (independent manual or power operation) [BS EN 62271-1]			
6.7.1	Independent manual or power operation (independent unlatched operation) [BS EN 62271-1]			
6.7.2	Dependent manual operation [BS EN 62271-1]			
6.8	Manually operated actuators [BS EN 62271-1]			
6.9	Operation of releases [BS EN 62271-1]			
6.9.300	Circuit-breaker [BS EN 62271-100]			
6.9.300.9	Operational releases circuit-breaker requirements [BS EN 62271-100]			
6.10	Pressure/level indication [BS EN 62271-1]			
6.11	Nameplates [BS EN 62271-1]			
6.11.201	Labelling			
6.11.201.1	General			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
6.11.201.2	Motorised disconnectors			
6.11.201.3	Phase identification			
6.11.201.4	Circuit labels			
6.11.202	Mimic diagrams			
6.11.302	Disconnector nameplates [BS EN 62271-102]			
6.11.303	Switch nameplates [BS EN 62271-103]			
6.12	Locking devices [BS EN 62271-1]			
6.12.201	Interlocking devices			
6.12.201.1	General			
6.12.201.2	3-position device			
6.12.201.2.1	Move before earth 3-position device			
6.12.201.3	Test access			
6.12.201.3.1	Test access covers including shutters			
6.12.201.4	Test devices			
6.12.202	Padlocking facilities			
6.12.202.1	Safety padlocking			
6.12.202.2	Operational padlocking			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
6.13	Position indication [BS EN 62271-1]			
6.14	Degrees of protection provided by enclosures [BS EN 62271-1]			
6.14.1	General			
6.14.2	Protection of persons against access to hazardous parts and protection of the equipment against ingress of solid foreign objects (IP coding) [BS EN 62271-1]			
6.14.3	Protection of equipment against mechanical impact under normal service conditions (IK coding) [BS EN 62271-1]			
6.16	Gas and vacuum tightness [BS EN 62271-1]			
6.20	X-ray emission [BS EN 62271-1]			
6.22	Filling levels for insulation, switching and/or operation [BS EN 62271-1]			
6.101	Internal arc fault [BS EN 62271-200]			
6.102	Enclosure [BS EN 62271-200]			
6.102.1	General [BS EN 62271-200]			
6.102.2	Covers and doors [BS EN 62271-200]			
6.102.2.201	Surface preparation and coating			
6.102.2.202	Foundation arrangements			
6.102.2.203	Heater			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
6.102.3	Partition or shutter being part of the enclosure [BS EN 62271-200]			
6.102.4	Inspection windows [BS EN 62271-200]			
6.102.5	Ventilating openings, vent outlets [BS EN 62271-200]			
6.103	High voltage compartments [BS EN 62271-200]			
6.103.1.1	Connection compartments [BS EN 62271-200]			
6.103.2	Fluid filled compartments (gas or liquid) [BS EN 62271-200]			
6.103.2.1	General [BS EN 62271-200]			
6.103.2.2	Design [BS EN 62271-200]			
6.103.2.3	Tightness [BS EN 62271-200]			
6.103.2.4	Pressure relief of fluid-filled compartments [BS EN 62271-200]			
6.103.3	Partitions and shutters [BS EN 62271-200]			
6.103.201	Busbars and busbar connections [BS EN 62271-200]			
6.103.202	Gas insulated equipment			
6.103.203	Requirements for combinations of switching devices			
6.103.202.1	General			
6.103.202.2	Facilities for disconnecting the circuit			
6.103.202.3	Facilities for earthing circuits and busbars			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
6.103.202.3.1	Facilities for earthing circuits			
6.103.202.3.2	Facilities for earthing busbars			
6.103.202.3.3	Facilities for testing primary circuits and busbars			
6.103.202.3.4	Facilities for checking and testing			
6.103.202.3.4.1	Testing via primary circuits			
6.103.202.3.4.4.1.1	For fixed equipment			
6.103.202.3.4.2	Testing via secondary circuits			
6.103.202.3.5	Fault location, voltage withstand and protection testing			
6.103.202.3.6	Facilities for checking voltage and phase identification			
6.103.202.3.7	Facilities for measuring voltage			
6.201	CT and VT general requirements			
6.201.1	CT requirements			
6.201.1.1.1	CT performance characteristics			
6.201.2	VT general requirements			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
6.201.2.1	VT performance characteristics			
6.201.2.2	VT general connections			
6.201.2.3	Star point connection			
6.201.3	Safety padlocking facilities			
6.202	Metering requirements			
6.203	Instrument requirements			
6.204	Fault passage indication			
6.302	Disconnector and earthing switch requirements [BS EN 62271-102]			
6.302.104	Operation of disconnectors and earthing switches			
6.8	Height for force of operation and inspection			
7	Type tests			
7.0	Type test requirements			
7.1	General [BS EN 62271-1]			
7.2	Dielectric tests [BS EN 62271-1]			
7.2.1	Dielectric type test for cable connected equipment with a.c. test voltages [BS EN 62271-1]			
7.2.2	Test facilities [BS EN 62271-1]			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
7.11	X-radiation test procedures for vacuum interrupters [BS EN 62271-1]			
7.101	Verification of making and breaking capacities [BS EN 62271-200]			
7.102	Mechanical operation tests [BS EN 62271-200]			
7.102.0	General mechanical operation tests			
7.102.1	Mechanical operation type test for interlocks [BS EN 62271-200]			
7.201	Voltage transformer type tests			
7.300	Circuit-breaker requirements [BS EN 62271-100]			
7.300.111	Capacitive switching type tests [BS EN 62271-100]			
7.302	Disconnector type tests [BS EN 62271-102]			
7.303	Switch type tests [BS EN 62271-103]			
7.303.101	Making and breaking tests			
7.303.102	Mechanical endurance type test [BS EN 62271-103]			
8	Routine tests			
8.1	General [BS EN 62271-1]			
8.101	Partial discharge measurement [BS EN 62271-200]			
9	Guide to the selection of switchgear and controlgear			
9.103	Selection of design and construction [BS EN 62271-200]			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
9.105	Summary of technical requirements, ratings and optional tests [BS EN 62271-200]			
11	Transport, storage, installation, operating instructions and maintenance [BS EN 62271-1]			
11.2	Conditions during transport, storage and installation [BS EN 62271-1]			
11.4	Operation [BS EN 62271-1]			
11.5	Maintenance [BS EN 62271-1]			
11.201	Extension limitations			
11.202	Disposal			
12	Safety			
12.1	General safety			
12.101	Procedures [BS EN 62271-200]			
12.102	Internal arc aspects [BS EN 62271-200]			
13	Influence of the product on the environment [BS EN 62271-1]			
Annex A (informative)	Explanatory notes			
A.1	Test devices			
A.2	Small inductive breaking current			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
A.2.1	Circuit-breakers			
A.2.1.1	General			
A.2.1.2	Transformer magnetising current for circuit-breakers with rated voltage of 100kV and above			
A.2.1.3	Transformer magnetising current for circuit-breakers with rated voltage below 100kV			
A.2.2	Switches			
A.3	Mimic diagrams and symbols			
Annex B	Self Certification Conformance Declaration			
Annex C	Symbols for mimic diagrams			
C.1	Position indication			
C.1.1	Position indication for circuit-breaker, disconnector and earthing switch			
C.1.2	Position indication for switch-disconnector / earthing switch			
C.1.3	Position indication of earthing switch when integral earth star point is removed for testing purposes			
C.2	Graphical symbols for equipment			
C.2.1	VT symbol - IEC 60617-6 symbol No. 06-13-01A			
C.2.2	VT with VT HV disconnector - IEC 60617-7 symbol no. 07-13-06			

Clause	Requirement	ENATS 41-40 code	BS EN Code	Remarks
C.2.3	Primary test point			
C.2.4	Capacitively coupled test point			
C.3	Typical pictogram for busbar earthing			
Annex D	Standard labels			

Appendix 4: Addendum to Supplier Requirements

Project specific requirements

Appendix 5: Pre-Commission Testing, Routine Inspection and Maintenance Requirements

Suppliers shall provide details of the recommended pre-commission testing and inspection required.

They shall also provide information regarding periodic inspection and maintenance requirements to be undertaken during the lifetime of their product.

Detailed inspection and maintenance instructions shall be also be provided.

Appendix 6: Technical Information Check List

The following information shall be provided by the supplier for technical review by Northern Powergrid. Additional information shall be provided if requested.

Requirement	Provided (Y/N)
Full product descriptions and part number/reference	
Completed technical schedules (Appendix 2)	
Completed ENATS 41-40 Schedule Part 1 – COMMON CLAUSES (Appendix 3)	
Complete set of drawings for each variant	
Type test evidence (required for products without an ENA Notice of Conformance)	
Routine test plan (example)	
Pre-commissioning testing/inspection requirements (Appendix 5)	
Recommended periodical inspection and maintenance requirements (Appendix 5)	
Packaging/delivery information	