NPS/003/008 – Technical Specification for Open Bushing, Air Insulated (AIS), 66kV and 132kV Circuit Breakers

1. Purpose

The purpose of this document is to define the technical performance requirements of 66kV and 132kV circuit breakers to be utilised 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/003/008	Technical Specification for Open Bushing, Air Insulated (AIS), 66kV and 132kV Circuit Breakers	4.1	July 2019

2. Scope

This specification details the technical requirements for 66kV and 132kV open terminal, live or dead tank circuit breakers to be utilised on the distribution networks of Northern Powergrid. Suppliers shall provide details of any periodic inspection and maintenance information requirements in Appendix 6: Maintenance and Inspection Requirements. It will also be necessary to consider and include any project specific requirements as detailed in Appendix 5: Addendum to Supplier Requirements.

The following appendices form part of this technical specification:

- Appendix 1: Schedule of Requirements for 66kV & 132kV Circuit Breakers
- Appendix 2: 66kV & 132kV Circuit Breaker Technical Specification and Declaration of Compliance
- Appendix 3: Summary Declaration of Technical Parameters
- Appendix 4: Self Certification Conformance Declaration of Conformance with ENA TS 41 37 Issue 2
- Appendix 5: Addendum to Supplier Requirements
- Appendix 6: Pre-commission testing, Routine Inspection and Maintenance Requirements
- Appendix 7: Technical Information Check List

2.1. Table of Contents

3. Technical Requirements

3.1. General

These circuit breakers shall be outdoor, open bushing (AIS) type, ganged 3 pole and suitable for use at nominal operating voltages of 66kV and 132kV, 50 Hz.

They shall comply with the requirements of the latest version of Energy Networks Association Technical Specification (ENA TS) 41-37.

These circuit breakers shall not use oil, or any other liquid, as the insulating or current interrupting medium.

Bushing insulators may be either porcelain or composite type but an option for composite type shall be available (with a minimum creepage of 25kV/mm).

Minimum distance from ground level or operating position, whichever is the most onerous, to exposed live conductors, shall be:

66kV: 3.25m = 0.7m basic electrical clearance + 0.3m safety factor + 2.25m personal reach per BS EN 61936-1

132kV: 3.65m = 1.1m basic electrical clearance + 0.3m safety factor + 2.25m personal reach per BS EN 61936-1

Minimum distance from ground level or operating position (whichever is the most onerous) to exposed insulators connected to live conductors, shall be:

66kV & 132kV: 2.55m = 0.3m safety factor + 2.25m personal reach

Circuit breaker ratings shall be as specified in Appendix 1 of this specification.

3.2. Compliance with other Specifications and Standards

All circuit breakers shall comply fully with the requirements of the latest version of Energy Network Association Technical Specification (ENA TS) 41-37.

Technical documents referenced within this specification refer to the latest versions of the relevant International Standards, British Standard Specifications and all relevant ENA Technical Specifications current at the time of supply.

The circuit breakers will preferably have been assessed by the ENA Switchgear Assessment Panel and have been awarded an ENA Notice of Conformity. Products that do not have an ENA Notice of Conformance that are judged to be technically acceptable shall undergo an equivalent assessment process undertaken by Northern Powergrid.

3.3. Current Transformers (CTs)

The circuit breaker shall have the option to accept, and be supplied with, up to 6 CTs per pole simultaneously; 3 on each side of the circuit breaker gap.

The ratings of the CTs, including thermal rating, short time withstand, etc., shall be equivalent to the ratings of the circuit breaker primary conductors.

3.4. Auxiliary Equipment

3.4.1. Secondary Wiring Terminals

Terminal blocks shall be rail mounted cage clamp type, with the exception of terminal blocks for SCADA wiring which shall be of the knife disconnecting type. Both types shall be equipped with 2.3mm test sockets.

Secondary terminals for CT wiring shall have shorting and disconnecting facilities.

Terminals which cannot be made dead by removing the panel fuses and links shall be shrouded to protection IP3XXD, in accordance with BS EN 60529, to prevent conductor strands making accidental contact with terminals when carrying out work on control and protection wiring.

3.4.2. Fuses and Links

Fuses and links shall be GEC type RS 20 or equivalent. Fuses and links shall have circuit labels positioned, preferably above the relevant fuse or link to prevent the installed wiring obscuring the labelling. The circuit label inscription shall include the fuse current rating.

3.4.3. Termination of Multicore and Multipair Cables

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

3.4.4. Gas and Vacuum Tightness: SF6 Gas Pressure Monitoring

The SF6 gas pressure of circuit breaker interrupters shall be monitored in two stages.

Stage 1 shall initiate a Stage 1 alarm.

Stage 2 shall initiate a Stage 2 alarm and inhibit circuit breaker operation, except in the case of bus section circuit breakers which shall auto-open at the stage 2 alarm level.

3.4.5. Labelling

In addition to the requirements of ENATS 41-37, all handles, tools and other devices supplied shall be clearly labelled with their function.

3.4.6. Maintenance and Disposal

Maintenance: The unit shall be designed as far as practical to minimise maintenance.

Operation and Maintenance procedures: Details of the recommended periodic inspection and maintenance requirements, including consumables and recommended spares stockholding, to be undertaken during the lifetime of the product shall be provided.

Disposal: Details of procedures required for disposal shall be provided.

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 (ENA TS) current at the time of supply.

4.1. External Documentation

Reference	Title
BS EN 62271-100	High-voltage switchgear and controlgear. Alternating current circuit-breakers
BS EN 60529	Degrees of protection provided by enclosures (IP code)
BS EN 61936 - 1	Power installations exceeding 1 kV a.c. Common rules
ENATS 41-37 Part 1	Switchgear for Use on 66kV to 132kV Distribution Systems (Common Clauses)
ENATS 41-37 Part 2	Switchgear for Use on 66kV to 132kV Distribution Systems
ENATS 41-37 Part 3	GIS Switchgear for Use on 66kV to 132kV Distribution Systems
ENATS 41-37 Part 4	Disconnectors and Earthing Switches for Use on 66kV to 132kV Distribution Systems

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
IMP/001/914	Code of Practice for the Economic Development of the 132kV System

4.3. Amendments from Previous Version

Reference	Description
Whole Document	Doc approved by email Paul Black 07/12/2023 Doc republished to grid and externally - LB 18/03/2024

5. Definitions

Reference	Definition
None	

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	18/03/2024

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	
Yes	**Period:** n/a	**Reason:** n/a
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Joseph Helm	Senior Policy and Standards Engineer	06/12/2016

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
David Blackledge	Senior Policy and Standards Engineer	06/12/2016

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	07/12/2023

Appendix 1 - Schedule of Requirements for 66kV & 132kV Circuit Breakers

The table below is not an exhaustive list of rating combinations, which will be set by the network requirements, but is intended to provide information on the most common combinations.

132kV Circuit Breakers with 2000A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
1.	2000A Tx Incomer	2000A	Circuit breakers shall be rated for 40kA at 45ms (14) AND shall be rated for 31.5kA at 120ms (37)	CTs: CT ratings shall be, at least, equal to the CB ratings.
2.	2000A Bus Section			
3.	2000A Bus Coupler			
4.	2000A Feeder	2000A		For switchgear with integral CTs (e.g. indoor GIS); CT ratings shall be, at least, equal to the CB ratings.
5.	1250A Feeder	1250A		For switchgear with externally mounted CTs (e.g. outdoor AIS); the CT ratings will be project specific depending on feeder ratings and load requirements.

132kV Circuit Breakers with 1250A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
6.	1250A Tx Incomer	1250A	Circuit breakers shall be rated for 40kA at 45ms (14) AND shall be rated for 31.5kA at 120ms (37)	CTs: CT ratings shall be, at least, equal to the CB ratings.
7.	1250A Bus Section			
8.	1250A Bus Coupler			
9.	1250A Feeder	1250A		For switchgear with integral CTs (e.g. indoor GIS); CT ratings shall be, at least, equal to the CB ratings. For switchgear with externally mounted CTs (e.g. outdoor AIS); the CT ratings will be project specific depending on feeder ratings and load requirements.

66kV Circuit Breakers with 2500A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
10.	2500A Tx Incomer At Grid Supply Point	2500A	Circuit breakers shall be rated for 40kA at 45ms (14) AND shall be rated for 31.5kA at 120ms (37)	CTs: CT ratings shall be, at least, equal to the CB ratings.
11.	2500A Bus Section At Grid Supply Point			
12.	2500A Bus Coupler At Grid Supply Point			
13.	2500A Feeder At Grid Supply Point	2500A		
14.	2000A Feeder At Grid Supply Point	2000A		
15.	1600A Feeder At Grid Supply Point	1600A		
16.	1250A Feeder At Grid Supply Point	1250A		
17.	800A Feeder At Grid Supply Point	800A		

66kV Circuit Breakers with 2000A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
18.	2000A Tx Incomer At Supply Point	2000A	25kA at 45ms (14)	CTs: CT ratings shall be, at least, equal to the CB ratings.
19.	2000A Bus Section At Supply Point			
20.	2000A Bus Coupler At Supply Point			
21.	2000A Feeder At Supply Point	2000A		For switchgear with integral CTs (e.g. indoor GIS); CT ratings shall be, at least, equal to the CB ratings. For switchgear with externally mounted CTs (e.g. outdoor AIS); the CT ratings will be project specific depending on feeder ratings and load requirements.
22.	1600A Feeder At Supply Point	1600A		
23.	1250A Feeder At Supply Point	1250A		
24.	800A Feeder At Supply Point	800A		
25.	400A Feeder At Supply Point	400A		

Note: 'Feeder' also includes metered supply to a customer and/or metered generation connection point.

66kV Circuit Breakers with 1600A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
26.	1600A Tx Incomer At Supply Point	1600A	25kA at 45ms (14)	CTs: CT ratings shall be, at least, equal to the CB ratings.
27.	1600A Bus Section At Supply Point			
28.	1600A Bus Coupler At Supply Point			
29.	1600A Feeder At Supply Point	1600A		For switchgear with integral CTs (e.g. indoor GIS); CT ratings shall be, at least, equal to the CB ratings. For switchgear with externally mounted CTs (e.g. outdoor AIS); the CT ratings will be project specific depending on feeder ratings and load requirements.
30.	1250A Feeder At Supply Point	1250A		
31.	800A Feeder At Supply Point	800A		
32.	400A Feeder At Supply Point	400A		

Note: 'Feeder' also includes metered supply to a customer and/or metered generation connection point.

66kV Circuit Breakers with 1250A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
33.	1250A Tx Incomer	1250A	25kA at 45ms (14)	CTs: CT ratings shall be, at least, equal to the CB ratings.
34.	1250A Bus Section			
35.	1250A Bus Coupler			
36.	1250A Feeder	1250A		For switchgear with integral CTs (e.g. indoor GIS); CT ratings shall be, at least, equal to the CB ratings. For switchgear with externally mounted CTs (e.g. outdoor AIS); the CT ratings will be project specific depending on feeder ratings and load requirements.
37.	800A Feeder	800A		
38.	400A Feeder	400A		

Note: 'Feeder' also includes metered supply to a customer and/or metered generation connection point.

66kV Circuit Breakers with 800A Busbar:

Item	Typical Usage	Circuit Breaker Minimum Rating	Fault Rating and Time Constant (X/R)	Comments
39.	800A Tx Incomer	800A	25kA at 45ms (14)	CTs: CT ratings shall be, at least, equal to the CB ratings.
40.	800A Bus Section			
41.	800A Bus Coupler			
42.	800A Feeder	800A		For switchgear with integral CTs (e.g. indoor GIS); CT ratings shall be, at least, equal to the CB ratings.
43.	400A Feeder	400A		For switchgear with externally mounted CTs (e.g. outdoor AIS); the CT ratings will be project specific depending on feeder ratings and load requirements.

Note: 'Feeder' also includes metered supply to a customer and/or metered generation connection point.

Northern Powergrid schedule of requirements for the unit(s) required, including project specific requirements

Criteria	Requirement *If none please state 'NONE', where applicable.*
Network Voltage *Specified as nominal phase to phase voltage of electrical network.*	
Fault Current *Default is as specified in the body text of NPS/003/025*	
Cable Connected (no exposed primary conductors) *Specify cable size and type and cable support arrangement required* **or** **Busbar/Overhead connected** *Specify conductor size & type and connection type*	
Rated supply voltage of closing, opening and auxiliary circuits	
Physical constraints *including height, width, depth, weight, etc.*	
Foundation/support/mounting arrangements	
Other	

Appendix 2 - 66kV & 132kV Circuit Breaker Technical Specification and Declaration of Compliance

The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes.
Where specifications are common across a range of units then a combined return may be completed for these units.

Conformance declaration codes

N/A = Clause is not applicable/ appropriate to the product
Cs1 = The product conforms fully with the requirements of this clause
Cs2 = The product conforms partially with the requirements of this clause
Cs3 = The product does NOT conform to the requirements of this clause
Cs4 = The product does NOT currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

For EVERY row; complete the Comments column with details of why/how the declared compliance code is applicable (including statement of default/actual values, options, etc.).

Manufacturer	Rated kV	Type Reference(s)

Required Circuit Breaker Characteristics	NPS/003/008 & *(ENATS 41-37)* References	Unit	Northern Powergrid Requirement	Conformance Code	Comments, Values & Details
Class – indoor/outdoor	3.1 *(Part 1 – 2.1)*	-	Outdoor		
Option for composite bushings	3.1	-			*State default bushing type, characteristics and option(s)*
Personal Safety clearances	3.1	m	3.1m		
CT accommodation	3.1		Option for up to 6 CTs		
Secondary terminals	3.4.1	-	IP3XXD on terminals		
Fuses & Links	3.4.2	-	GEC type RS20, or equivalent		
Fuses & Links	3.4.2	-	Circuit labels not obscured by wiring and label text has fuse current rating		
Secondary terminals	3.4.3	-	Cable work whilst equipment live.		
Gas monitor & alarm	3.4.4	-	Stage 1 alarm. Stage 2 alarm and inhibit (Stage 2 on bus section circuit breakers shall auto-open)		
Labelling	3.4.5	-	Labelling of supplied devices		
Maintenance	3.4.6	-	Minimise & supply details		
Instruction manuals	3.4.6	-	Supply details		

Required Circuit Breaker Characteristics	NPS/003/008 & *(ENATS 41-37)* References	Unit	Northern Powergrid Requirement	Conformance Code	Comments, Values & Details
Nominal supply voltage of opening and closing devices and auxiliary and control circuits.	*(Part 1 - 4.8)*	V	Closing & tripping, Indication and control all to be 110V DC		
Characteristics for short line faults	*(Part 3 - 4.105)*	kA	Manufacturer to state assigned rating		
Out of phase making and breaking.	*(Part 3 - 4.106)*	kA	Manufacturer to state assigned rating		
Rated capacitive switching currents : Rated cable-charging current.	*(Part 3 - 4.107)*	A	Manufacturer to state assigned rating ; but shall be at least Class 2		
Rated small inductive breaking current.	*(Part 3 - 4.108)*	A	Manufacturer to state assigned rating, if any.		

Required Circuit Breaker Characteristics	NPS/003/008 & *(ENATS 41-37)* References	Unit	Northern Powergrid Requirement	Conformance Code	Comments, Values & Details
Rated time quantities.	*(Part 3 - 4.109)*	ms	Manufacturer to state rated values assigned to the following time quantities: – opening time (no-load); – break-time; – closing time (no-load); – open-close time (no-load); – reclosing time (no-load); – close-open time (no-load); – pre-insertion time (no-load).		
Noise	*(Part 3 - 6.202)*	dB	Manufacturer to state maximum sound level		
Provision for key interlock	*(Part 3 - 5.11.100)*		Circuit breakers shall be supplied equipped with key interlock and one key.		

Appendix 3 - Summary Declaration of Technical Parameters

MANUFACTURER	
CIRCUIT BREAKER TYPE REFERENCE	
CIRCUIT BREAKER DESCRIPTION *(live tank, dead tank, compact hybrid, etc.)*	

	Unit	Comments, Values & Details
Mass of complete unit	kg	
Dimensions	m	
Closing mechanism type (give details).		
Arc interruption medium		
Insulation medium/media		
Type and total mass of gas in complete unit	kg	
Closing mechanism power consumption and duration of consumption	As	
Closing Coils Power consumption and duration of consumption	mAs	
Trip Coils Power consumption and duration of consumption	mAs	
Operating time – Close operation	ms	
Operating time – Open operation	ms	
Noise (during operation and/or activity)	dB	
Maximum dynamic floor/support loading(s)	kN	
AIS bushing details		

Gas Filled Compartments; complete one table for each gas-filled compartment type

	IEC 62271-1 clause	Unit	Comments, Values & Details
Compartment type/function/description and number of each of these compartments per circuit breaker variant		-	
Type of Gas		-	
Mass of Gas		kg	
Volume of Compartment		m^3	
Mass of gas that would be lost if gas leaked until compartment pressure equals the standard atmospheric conditions (+20°C and 101,3 kPa), without air entering the chamber.		kg	
Method(s) of monitoring pressure and achieving temperature compensation		-	
Rated filling pressure p_{re} (or density p_{re}) for insulation and/or switching	3.6.5.2	kPA AND Bar(g)	
Alarm pressure p_{ae} (or density p_{ae}) for insulation and/or switching	3.6.5.3	kPA AND Bar(g)	
Minimum functional pressure p_{me} (or density p_{me}) for insulation and/or switching	3.6.5.5	kPA AND Bar(g)	
Alarm pressure for operation p_{am} (or density p_{am})	3.6.5.4	kPA AND Bar(g)	
Minimum functional pressure for operation p_{mm} (or density p_{mm})	3.6.5.6	kPA AND Bar(g)	
Maximum compartment pressure when switchgear running continually at full load, under maximum ambient temperature, with received solar gain of 1000W/m^2		kPA AND Bar(g)	
Minimum compartment pressure to operate pressure relief device		kPA AND Bar(g)	
Minimum compartment pressure when switchgear not carrying any load, at minimum ambient temperature and without any solar gain.		kPA AND Bar(g)	

Appendix 4 - Self Certification Conformance Declaration of Conformance with ENA TS 41-37 Issue 2

Switchgear covered by ENATS 41-37 shall conform with the latest issues of the relevant International and British Standards. ENATS 41-37 is intended to amplify and/or clarify the requirements of those Standards.
This check sheet identifies the clauses in ENATS 41-37 - Part 1 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 product fully conforms with the requirements of this clause
Cs2 = the product partially conforms with the requirements of this clause
Cs3 = the product does not conform with the requirements of this clause
Cs4 = the product does not currently conform with the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Instructions for completion

- When Cs1 code is entered no remark is necessary
- When any other code is entered the reason for non-conformance shall be entered
- Prefix each remark with the relevant 'IEC' or 'ENATS' as appropriate

Manufacturer: **Rating:**

Product Reference:

Name: **Signature:** **Date:**

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
1	General		1.1	General		
2	Normal and special service conditions		2.1	Normal and special service conditions		
2.1	Normal service conditions		2.1	Normal service conditions		
2.1.1	Indoor switchgear and controlgear		2.1.1	Indoor switchgear and controlgear		
2.1.2	Outdoor switchgear and controlgear		2.1.2	Outdoor switchgear and controlgear		
3	Definitions		3	Definitions		
			3.201	Dependant manual operation		
			3.202	Independent manual operation		
			3.203	Independent power operation		
			3.204	Safety padlocking		
			3.205	Operational padlocking		
			3.206	Additional earths		
			3.207	Point of Isolation		
4	Ratings		4	Ratings		
4.1	Rated voltage		4.1	Rated voltage		
4.2	Rated insulation level		4.2	Rated insulation level		
4.3	Rated frequency		4.3	Rated frequency		
4.4	Rated normal current and temperature rise		4.4	Rated normal current and temperature rise		
4.5	Rated short-time withstand current		4.5	Rated short-time withstand current		
4.6	Rated peak withstand Current		4.6	Rated peak withstand current		
4.7	Rated duration of short circuit		4.7	Rated duration of short-circuit		
4.8	Rated supply voltage of closing and opening devices and of auxiliary and control ccts		4.8	Rated supply voltage of closing and opening devices and of auxiliary and control circuits		

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
4.9	Rated supply frequency of closing and opening devices and of auxiliary circuits		4.9	Rated supply frequency of closing and opening devices and of auxiliary circuits		
			4.101	Rated DC time constant		
5	Design and construction		5	Design and construction		
5.1	Requirements for liquids		5.1.	Requirements for liquids in switchgear and controlgear		
			5.1.101	Liquid level		
5.2	Requirements for gases in switchgear and controlgear			Requirements for gases in switchgear and controlgear		
			5.2.101	Gas in hydraulic system		
			5.2.102	Excessive running time alarm		
			5.2.103	Minimum gas density		
			5.2.104	Gas filling valve		
			5.2.104.1	Lockable gas service valves		
			5.2.104.2	Valve padlocking		
			5.2.105	Identification of pipe-work		
			5.2.106	Recycled SF6		
			5.2.107	Labelling of compartments		
5.3	Earthing of switchgear and controlgear		5.3	Earthing of switchgear and controlgear		
			5.3.201	Earthing conductors		
			5.3.202	Cable sheath earth		
			5.3.203	Earthing of relay and instrument metallic cases		

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
			5.3.205	Additional earths		
			5.3.206	Earthing of compartments and enclosures		
5.4	Auxiliary and control equipment		5.4	Auxiliary and control equipment		
			5.4.1.101	control selector switch		
			5.4.1.102	SCADA		
5.4.2.2	Accessibility of auxiliary and control equipment		5.4.2.2	Accessibility of auxiliary and control equipment		
5.4.4.5	Requirements for auxiliary and control components		5.4.4.5	Requirements for auxiliary and control components		
5.4.4.5.1	Cables and wiring		5.4.4.5.1	Cables and wiring		
			5.4.4.5.1. 101	Segregation (>125V).		
			5.4.4.5.1. 102	Securing of secondary wiring		
			5.4.4.5.1. 103	Micro switches		
			5.4.4.5.1. 104	Mechanical security of micro switches		
			5.1.105	Conductor size		
5.2	Terminals and terminations		5.2	Terminals and terminations		
			5.2.101	Electrical and mechanical durability		
			5.4.4.5.2. 102	Terminal blocks for current transformer circuits		
			5.4.4.5.2. 103	Terminal block shorting and isolating facilities		

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
5.5	Dependent power operation		5.5	Dependent power operation		
			5.5.101	Slow operation devices		
			5.5.102	**Simultaneous pole operation**		
5.6	Stored energy operation		5.6	Stored energy operation		
			5.6.101	Hand charging		
			5.6.102	Spring charging stored energy		
			5.6.103	Unambiguous indication of spring state		
			5.6.104	Loss of stored energy		
			5.6.105	Slow operation facility		
5.7	Independent manual operation		5.7.	Independent manual operation		
			5.7.101	Incomplete open/close operation		
			5.7.102	Operating handles for independent manually operated mechanisms		
			5.7.103	Dedicated operating handle		
			5.7.201	Dependant manual operation		
			5.7.201.1	Removal of handle		
5.8	Operation of releases		5.8	Operation of releases		
			5.8.101	Loss of control supply		
5.9	Low and high-pressure interlocking and monitoring devices.		5.9	Low and high-pressure interlocking and monitoring devices		
			5.9.101	Gas monitoring & Indication		
			5.9.101.2	Hydraulic/pneumatic single stage pressure monitoring		
			5.9.102	Hydraulic/pneumatic single stage pressure monitoring		
5.10	Nameplates		5.10.	Nameplates		

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
			5.10.101	Labelling		
			5.10.102	Phase identification		
			5.10.103	Circuit labels		
5.11	Interlocking devices and padlocking facilities		5.11	Interlocking devices and padlocking facilities		
			5.11.101	Interlocking devices		
			5.11.102	Padlocking facilities		
5.12	Position indication		5.12	Position indication		
			5.12.101	Positively driven mechanical indication		
			5.12.102	Visibility of indicating device		
5.13	Degrees of protection by enclosures and compartments		5.13	Degrees of protection by enclosures and compartments		
5.13.1	Hazardous parts/solid-foreign objects		5.13.1	Hazardous parts / solid foreign objects.		
5.13.2	Protection against ingress of water		5.13.2	Protection against ingress of water		
5.13.3	Mechanical impact		5.13.3	Mechanical impact		
5.14	Creepage distances		5.14	Creepage distances		
			5.14.101	Pollution performance		
5.15	Gas and vacuum tightness		5.15	Gas and vacuum tightness		
5.15.1	Closed pressure systems for gas		5.15.3	Closed pressure systems for gas		
			5.101	Ergonomics and access		
			5.102	Single person operation		
			5.103	Moving parts		

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
			5.104	Mechanism cabinets for outdoor switchgear		
			5.105	Lifting points		
			5.106	Surface preparation and coatings		
			5.107	Personal safety clearances		
			5.108	Air insulated bushings		
			5.109	Bushing gauges		
			5.110	Bushing terminals		
			5.111	Minimum expected life		
			5.112	Pressure relief		
6	Type tests		6	Type tests		
6.2	Dielectric tests		6.2	Dielectric tests		
6.2.9	Partial discharge tests		6.2.9	Partial discharge tests		
			6.101	Solar radiation		
			6.102	Type test matrix		
			6.103	Reduced gas density withstand.		
			6.104	Terminal and Terminal blocks		
			6.105	Additional mechanical operations test		
7	Routine tests		7	Routine tests		
8	Guide to the selection of switchgear and controlgear		8	Guide to the selection of switchgear and controlgear		
9	Information to be given with enquiries, tenders and orders		9	Information to be given with enquiries, tenders and orders		

IEC 0694 Clause/ sub clause	Requirement	Conformance code	ENATS 41-37 Part 1 Clause / Sub clause	Requirement	Conformance code	Remarks
10	Rules for transport, storage, installation, operation, maintenance		10	Rules for transport, storage, installation, operation, maintenance and disposal		
			10.101	Temporary labels		
			10.102	Manufacturer's handbook		
			10.103	Risk assessment		
			10.104	Bay extensions		
11	Safety		11	Safety		
12	Environmental aspects		12	Environmental aspects		
13	Commissioning tests		13	Commissioning tests		

IEC 60694,& IEC 62271-100				ENATS 41-37			
Clause / subclause		**Requirement**	**Conformance code**	**ENATS 41-37 Part 3 Clause / sub clause**	**Requirement**	**Conformance code**	**Remarks**
IEC62271-100	**IEC60694**						
2	2	Normal and special service conditions		2	Normal and special service conditions		
4	4	Ratings		4	Ratings		
				4.101	Rated short-circuit breaking current		
				4.102	TRV related to rated short-circuit breaking current		
				4.103	Rated short circuit making current		
				4.104	Operating sequence		
				4.105	Characteristics for short line faults		
				4.106	Rated out –of- phase making and breaking current		
				4.107	Rated capacitive switching currents		
				4.108	Small inductive breaking current		
				4.109	Rated DC time constant		
4.110	4.110	Number of mechanical operations		4.110	Number of mechanical operations		
5	5	Design and construction		5	Design and construction		
5.2	5.2	Requirements for gases		5.2	Requirements for gases in circuit-breakers		
5.3	5.3	Earthing of switchgear and control gear		5.3	Earthing of circuit-breakers		
5.4	5.4	Auxiliary and control equipment		5.4	Auxiliary and control equipment		
				5.4.101	Trip circuit supervision		
				5.4.102	Trip coil isolation		

IEC 60694,& IEC 62271-100				ENATS 41-37			
Clause / subclause		Requirement	Conformance code	ENATS 41-37 Part 3 Clause / sub clause	Requirement	Conformance code	Remarks
IEC62271-100	**IEC60694**						
				5.4 103	Forced opening		
5.5	5.5	Dependent power operation		5.5	Dependent power operation		
				5.5.101	Anti pumping		
				5.5.102	Operating systems interlocks		
				5.5.103	Circuit breakers with independent drive mechanisms		
				5.5.104	**Simultaneous pole operation**		
5.6	5.6	Stored energy operation		5.6	Stored energy closing		
				5.6.101	Three pole operation		
				5.6.102	Tripping Mechanism		
				5.7	Independent manual operation,		
5.8	5.8	Operation of releases		5.8	Operation of releases		
				5.8.201	Local manual operation		
				5.8.202	Slow closing and opening		
				5.8.203	Operations counter		
5.9	5.9	Low and high-pressure interlocking and monitoring devices		5.9	Low and high-pressure interlocking and monitoring devices		
				5.10	Nameplates		
				5.10.101	Trip and close isolation shall be labelled		
5.11	5.11	Interlocking devices		5.11	Interlocking devices and padlocking facilities		
				5.11.101	Mechanical key interlocking		
5.12	5.12	Position indications		5.12	Position indications		
				5.201	Structure mounted open terminal circuit-breakers		
				5.202	Circuit identification		

IEC 60694,& IEC 62271-100				ENATS 41-37			
Clause / subclause		**Requirement**	**Conformance code**	**ENATS 41-37 Part 3 Clause / sub clause**	**Requirement**	**Conformance code**	**Remarks**
IEC62271-100	**IEC60694**						
				5.203	Noise		
				5.204	CT labels		
6	6	Type tests		6	Type tests		
	6.104.2	Short circuit making current		6.104.2	Short-circuit making current		
	6.104.5.4	Test duty T30		6.104.5.4	Test duty T30		
	6.110	Out-of-phase condition		6.110	Out-of-phase condition		
				6.111	Capacitive current switching		
				6.201	Sound pressure measurement		
				6.202	Breaking test with asymmetrical current		
7	7	Routine tests		7	Routine tests		
8	8	Guide to the selection of switchgear and controlgear		8	Guide to the selection of circuit –breakers for service.		
9	9	Information to be given with enquiries, tenders and orders		9	Information to be given with enquiries, tenders and orders		
10	10	Rules for Transport, Storage, installation, operation and maintenance		10	Rules for transport, storage, installation, operation, maintenance and disposal		
11	11	Safety		11	Safety		
	12	Environmental Aspects		12	Environmental aspects		
				13	Commissioning tests		

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	Test Requirement	**Specification and Standards**	**Rated value**	**Test req'd Y or N**	**Conformance**	**Test value**	**Date of test**	**Test station Report / Cert No**	**Witness I, M or ENA****	**Remarks**
1	Dielectric	Sub clause 6.2. IEC 62271-100.								
2	Radio interference test	Sub clause 6.3 IEC 62271-100								
3	Measurement of the resistance of main circuit -	Sub clause 6.4 IEC 62271-100								
4	Temperature Rise	Sub clause 6.5, IEC 62271-100								
5	Short-time withstand current and peak withstand current tests -	Sub clause 6.6, IEC 62271-100								
6	Demonstration of arcing times	Sub clause 6.102.10, IEC 62271-100								
7	Three phase tests	Sub clause 6.102.10.1, IEC 62271-100								
8	Test duties T10,T30,T60,T100s(b).OP1 and OP2	Sub clause 6.102.10.1.1, IEC 62271-100								
10	Test duty T100a	Sub clause 6.102.1.2, IEC 62271-100								
11	Tightness test	Sub clause 6.8 IEC 62271-100								
12	EMC tests	Sub clause 6.9 IEC 62271-100								
13	Mechanical operation test at ambient temperature	Sub clause 6.6.101.2.1 to 6.101.2.3 IEC 62271-100								
14	Short-circuit current making and breaking tests	Sub clause 6.102 to 6.106 IEC 62271-100								
15	Capacitive current switching tests	Sub clause 6.111.5.1 IEC 62271-100								
16	Verification of protection	Sub clause 6.7, IEC 62271-100								
17	Low/high Temperature tests	Sub clause 6.101.3 IEC 62271-100								
18	Humidity test	Sub clause 6.101.4 IEC 62271-100								
19	Static terminal load test	Sub clause 6.101.6 IEC 62271-100								
20	Critical current test	Sub clause 6.107 IEC 62271-100								
21	Out-of-phase making and breaking test*	Sub clause 6.110 IEC 62271-100.								

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	Test Requirement	**Specification and Standards**	**Rated value**	**Test req'd Y or N**	**Conformance**	**Test value**	**Date of test**	**Test station Report / Cert No**	**Witness I, M or ENA****	**Remarks**
22	Tests to prove operation under severe ice conditions*	Sub clause 6.101.5 IEC 62271-100								
23	Single-phase and double earth fault tests*	Sub clause 6.108 IEC 62271-100								
24	Cable-charging current breaking test*	Sub clause 6.111,5.2 IEC 62271-100								
25	Single capacitor bank switching tests*	Sub clause 6.111.5.3 IEC 62271-100								
26	Back-to-back capacitor switching tests*	Sub clause 6.111.5.3 IEC 6271-100								
27	Additional tests on auxiliary and control circuits	Sub clause 6.10 IEC 60694								
28	Finish	Performance to ENATS 98-1								
29	Process Control	ISO 9000 ERG79 Parts 1 & 2a								
Note All type tests carried out using the number of test samples specified in 6.1.1 of IEC 60694 and in 6.102.2 circuit breakers with a rated voltage of 72.5kV and above tests marked by * an additional test sample is allowed for the marked test.										

Appendix 5 - Addendum to Supplier Requirements

Project specific installation and protection requirements will be provided by Northern Powergrid's Primary Engineering Projects department.

Appendix 6 - Pre-commission testing, Routine Inspection, Maintenance and Future Disposal 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 and methods of disposal at the end of the product's life.

Detailed inspection and maintenance instructions shall also be provided.

Appendix 7 - Technical Information Check List

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

Requirement	Provided (Y/N)
Full product descriptions and part number/reference	
Complete set of drawings for each variant	
Appendix 2 – 66kV & 132kV Circuit Breaker Technical Specification and Declaration of Compliance	
Appendix 3 – Self Certification Conformance Declaration of Conformance with ENA TS 41 37 Issue 2	
Appendix 5 – Details of Pre-commission testing, Routine Inspection and Maintenance Requirements	
Appendix 6: Pre-commission testing, Routine Inspection, Maintenance and Future Disposal Requirements	
Type test evidence	
Routine test plan (example)	
Pre-commissioning testing/inspection requirements	
Packaging/delivery information	