NPS/003/030 – Technical Specification for Transformer and Switchgear Cable Boxes and their associated Bushing Assemblies up to 36kV

1. Purpose

The purpose of this document is to detail the technical requirements of Northern Powergrid (the company) in relation to retrofit cable boxes for ground mounted distribution transformers or switchgear and associated bushings and gland plates.

This document supersedes the following documents, all copies of which should be destroyed;

Document Reference	Document Title	Version	Published Date
NPS/003/030	Technical Specification for Transformer and Switchgear Cable Boxes and their associated Bushing Assemblies	2.1	Aug 2015

2. Scope

This specification details the retrofit options available when, due to switchgear or transformer replacements at distribution substations, the existing paper insulated cables are replaced by XLPE products and are required to be terminated on plant that is to be retained in service within the same substation site.

This specification covers cable boxes with ratings ranging from LV up to, and including, 36kV.

Cable boxes shall be manufacture from steel and provide an earthed screen surround to the earth bonded cable terminations.

Many traditional HV cable terminations are bitumen or fluid insulated (filled). Where possible, these cable boxes shall be replaced with an air insulated arrangement with cable bushings designed to allow the terminations of XLPE single core cables. Where this is not possible, the alternative shall be to use a re-enterable resin filled arrangement that re-utilises the existing cable box or a suitably designed replacement filled cable box.

Since the insulation levels including BIL are governed by the distance between the bushings, increasing the size of the box will not the increase the interphase bushing distance and therefore insulation level, with exception to the outer phases and earth due to an increased distance.

NSP/002/100/001 - Overview of Indoor Cable Terminations up to 36kV will provide guidance on terminations used within cable boxes.

Technical documents referenced within this specification refer to the latest versions of the relevant International Standards, British Standard Specifications and all relevant Energy Networks Association Technical Specifications (ENATS) current at the time of supply.

The following appendices form part of this technical specification:-

- Appendix 1 - Schedule of Requirements,
- Appendix 2 - Addendum to Supplier Requirement,
- Appendix 3 - Typical Arrangements,
- Appendix 4 - Self Certification Conformance Declaration,

- Appendix 5 - Technical information check list, and,
- Appendix 6 – Logistical Requirements.

2.1. Table of Contents

3. Technical Requirements

3.1. High Voltage Cable Boxes - General

High voltage cable boxes are required as a replacement assembly for use on existing switchgear and transformers.
The cable boxes to be replaced might be bitumen or oil filled with existing paper insulated multi-core cables. The paper insulated cables will be replaced with XLPE single core cables, terminated with either separable connectors or standard cable terminations.

Boxes shall be suitable for indoor and outdoor applications.

On Northern Powergrid's HV networks up to 20kV, the Northern Powergrid standard for new cable connections is onto outside cone bushings Profile C1 up to and including 630A as per BS EN50180 / 50181. Porcelain bushings in accordance with BS 2562 will also be required where the age of the switchgear or transformer dictates this. This means that either standard cable terminations as detailed in Energy Network Association Technical Specification (ENATS) 12-11 figure B.5 or Separable connectors may be used for terminating XLPE HV cables.

Where possible, cable boxes shall be a dry unfilled type manufactured to BS 6435 on 11kV & 20kV equipment. Due to the age of the equipment this may not be possible and a filled box may have to be used. Where this is the case then the arrangement shall be in accordance with BS2562 or ENA TS 12-11 depending on type and age.

Cable boxes shall be designed for ease of access and termination of the cables by the installer. Minimum vertical distances from the centre line of the bushing to the gland plate in dry unfilled boxes are detailed in BS 6435, table 2.

Allowance shall be made for the provision of an internal earth connection to accept the cable screen wires using a crimped or bolted connector on a M12 stud. This shall be part of an insulated arrangement to terminate the earth screens inside the cable box and provide a rated earth path via an insulated bushing through the cable box casing to another M12 fastening outside the cable box, onto which the substation earth can be connected. This arrangement minimises the opportunity for earth fault current to be conducted through the body of the switchgear or transformer, cause damage to these units and give rise to hazardous touch and step potential and allows the option for onward routing of the earth path through an external, core-balance 60:1 CT that can be used in conjunction with a Fault Passage Indicator (FPI).

The box design shall provide an option for inverted installation.

Cable boxes shall be self-contained with the bushing mounting plate being an integral part of the enclosure.

To minimise the danger of fragmentation in the event of an electrical failure; cable boxes shall not be manufactured from cast iron.

External surfaces shall be finished with an exterior zinc based finish for outdoor use, in accordance with ENATS 98-1. Internal paint/surface finishes shall have anti-condensation properties.

To minimise condensation; appropriate drainage and ventilation shall be provided.

Service conditions are detailed in in ENATS 41-36, Clause 1.2.1 and referenced in ENATS 12-11 Clause 4 to BS EN 62271-1:2008+A1:2011.

Where single core cables enter the cable box through a common gland plate, steps shall be taken to minimise the effects of eddy currents.

Cable boxes shall be provided with appropriate replacement gaskets.

3.1.1. High Voltage Transformer & Ring Main Unit Tee Off Cable Boxes up to 24kV

Cable boxes shall be designed to fit transformers manufactured in compliance with ENA TS 35-1 and ENA TS 35-2. The transformer mounting arrangement is detailed in BS 2562 Figure 25, flange style:

- "E" at 11kV
- "J" at 20kV, and

Depending on the age of the switchgear or transformer that the cable box is intended for, they shall meet the requirements of either BS 6435 – "Unfilled enclosures for the dry termination of HV cables for transformers and reactors" for older equipment, and ENA TS 12-11 – "Enclosed unfilled terminations of cables with rated voltages 12, 24 and 36 kV" for newer equipment.

Clearance and creepage distances shall meet the requirements of BS 6435 Table 1 with all types of terminations meeting the "Fully Insulated" values.

Type tests and routine tests shall be in accordance with BS 6435 section 7 and section 8 respectively.

Standard 12-24kV, 630 Amp bushing assemblies are as detailed in BS EN 50181 table 2, interface type "C", to figure 1a) with an option to install separable connectors or standard cable terminations.

Standard Porcelain bushings may be used where this was an original feature of the transformer or switchgear design, and conversion to C Profile bushings is inefficient in terms of time, cost and engineering difficulty. These shall conform to BS 2562.

Replacement Tee off cable boxes and bushing assemblies for newer SF6 filled Ring Main Unit's shall wherever possible conform to the original manufacturers design types and standards in force at the time of original build. This may result in manufacturer proprietary designs being essential to maintain the Type test configuration of the Ring Main unit.

Cable entry shall be suitable for 185mm² single core cables with a solid Aluminium core and copper wire screens. The cable box shall be supplied equipped with a gland plate and three CE6 glands (or equivalent) suitable for use with single core cables, each of which shall enter the cable box vertically below its termination bushing, with an option for a bottom mounted gland plate with 100mm central tube gland as an alternative, to allow for site circumstances where it is necessary for all three phases to enter through a single gland.

3.1.2. Switchgear Ring Switch (Feeder) Cable Boxes – up to 24kV

The switchgear cable boxes shall be designed to meet the requirements of ENATS 12-11. Clearance and creepage distances shall meet the requirements of BS 6435 Table 1 with all types of terminations meeting the "Fully Insulated" values. Type and routine tests shall be as detailed in ENATS 12-11, section7. Boxes shall be suitable for indoor and outdoor applications.

Minimum spatial dimensions to allow termination of the cables is detailed in ENATS 12-11, section 6.9.

Standard 12-24kV, 630 Amp bushing assemblies are as detailed in BS EN 50181 table 2, interface type "C", to figure 1a) with an option to install separable connectors or standard cable terminations.

Standard Porcelain bushings may be used where this was an original feature of the transformer or switchgear design, and conversion to C Profile bushings is inefficient in terms of time, cost and engineering difficulty. These shall conform to BS 2562.

Replacement cable boxes and bushing assemblies for newer SF6 filled Ring Main Unit's shall wherever possible conform to the original manufacturers design types and standards in force at the time of original build. This may result in manufacturer proprietary designs being essential to maintain the Type test configuration of the Ring Main unit.

Cable entry shall be suitable for the range of cables detailed in ENATS 12-11, Table 1 – Cable Sizes.

3.1.3. 33kV CER & CMR Transformer High Voltage Cable Boxes

On Northern Powergrid's 33kV network, the standard for new cable connections is into plug-in type inside cone bushings with the interface being type 1, 2 or 3 depending on transformer rating as per BS EN50180.

However, an option for porcelain bushings in accordance with BS 2562 will also be required where the age of the switchgear or transformer dictates this.

Due to the irregularity of requiring replacement items, no specific provision has been included within the Schedule of Requirements Appendix 1. When a requirement arises, more site specific details will be supplied in addition to the following general specifications.

Cable boxes shall be designed to fit transformers manufactured in compliance with ENA TS 35-2 and ENA TS 35-3. The transformer mounting arrangement is detailed in BS 2562 Figure 25, flange style:

- "H" at 33kV

Depending on the age of the transformer that the cable box is intended for, they shall meet the requirements of;

- BS 2566 – Specification for Cable Boxes for Transformers and reactors (for filled boxes)
- BS 6435 – Unfilled enclosures for the dry termination of HV cables for transformers and reactors for older "air insulated" equipment
- ENA TS 12-11 – Enclosed unfilled terminations of cables with rated voltages 12, 24 and 36 kV for newer equipment

Clearance and creepage distances shall meet the requirements of BS 6435 Table 1 with all types of terminations meeting the "Fully Insulated" values.

Type tests and routine tests shall be in accordance with BS 6435 section 7 and section 8 respectively.

Standard Porcelain bushings may be used where this was an original feature of the transformer design. These shall conform to BS 2562.

Fully air insulated cable boxes shall have minimum clearances as specified in Table 7 of ENA TS 35-2.

3.2. Low Voltage Transformer Cable Boxes

Low voltage cable boxes shall be designed, manufactured and tested to BS 2562 – Cable Boxes for Transformers and Reactors and be capable of withstanding high voltage tests specific for the transformer. Clearances shall meet the minimum requirements of table 1 of BS 2562.

To minimise the danger of fragmentation in the event of an electrical failure; cable boxes shall not be manufactured from cast iron.

External surfaces shall be finished with an exterior zinc based finish for outdoor use, in accordance with ENATS 98-1 – Environmental classification and corrosion protection of structures, plant and equipment.

Internal paint/surface finishes shall have anti-condensation properties.

To minimise condensation; appropriate drainage and ventilation shall be provided.

The dimensional requirements for cable boxes shall ensure that normal jointing procedures can be carried out and that minimum electrical clearance comply with Table 1 of BS 2562. Type testing shall be carried out

in accordance with section 8 and routine testing to section 9 of BS 2562. Gland plates shall be manufactured from Aluminium plate and drilled with pilot holes for each cable to be connected.

Cable boxes shall be provided with appropriate gaskets.

Typical arrangements are shown in Appendix 3 of this specification.

For Distribution Substation or Primary Substation Auxiliary transformers there is a requirement for 4 way and 7 way low voltage air-insulated boxes. The through bushing assemblies for these shall be manufactured from cast resin. Porcelain bushing assemblies may be used only if these were present on the transformer originally, and this is formally agreed, in advance, with Northern Powergrid's Policy & Standards section.

Cast resin or porcelain bushings shall be designed to BS 2562, Sections 11 (porcelain) or 12 (cast resin). Detailed requirements including BS drawing reference numbers are listed in Appendix 1 – Schedule of Requirements.

4. References

4.1. External Documentation

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

Reference	Title
BS 2562: 1979 Dec 1979	Cable boxes for transformers and reactors
BS 6435: 1984 Jan 1984	Unfilled enclosures for dry termination of HV cables for transformers and reactors
BS EN 50180-1:2015	Bushings above 1 kV up to 52kV and from 250 A to 3,15 kA for liquid filled transformers
BS EN 50181:2010 Aug 2010	Plug-in type bushings above 1 kV up to 52 kV and from 250 A to 2,50 kA for equipment other than liquid filled transformers
BS EN 62271-1: 2008+A1	High-voltage switchgear and controlgear. Common specifications
ENATS 12-11 Issue 5 / 2018	Enclosed unfilled terminations of cables with rated voltages of 12, 24 and 36kV
ENATS 35-1: Part 1 Issue6/2014	Distribution transformers: Part 1 Common clauses
ENATS 35-1: Part 2 Issue 6/2014	Distribution transformers: Part 2 Ground mounted transformers – not close-coupled
ENATS 35-2: Issue 6/2014	Emergency rated system transformers 66/20.5kV, 66/11.5kV and 33/11.5kV delta/star and star/star connected.
ENATS 35-3: Issue 2/2014	Continuous Maximum Rated (CMR) system transformers (for use on systems up to and including 132kV)
ENATS 41-36 Issue 3 / 2012	Switchgear for service up to 36kV (cable and overhead conductor connected)
ENATS 98-1 Issue 2/ 2014	Environmental classification and corrosion protection of structures, plant and equipment

4.2. Internal Documentation

Reference	Title
NSP/002/100/001	Overview of Indoor Cable Terminations up to 36kV

4.3. Amendments from Previous Version

Reference	Description
2. Scope	Updated to clarify extended scope and make requirements clearer
3.1.1 - High Voltage Transformer & Ring Main Unit Tee Off Cable Boxes	Update and added information for extended scope up to 33kV. Addition of requirements for SF6 Filled Ring Main Units with proprietary boxes and bushings.
3.1.2 - Switchgear Ring Switch (Feeder) Cable Boxes	Clarification of preferences and addition of requirements for SF6 Filled Ring Main Units with proprietary boxes and bushings.
3.1.3 – 33kV CER & CMR Transformer High Voltage cable boxes	New added clause.
3.3 Technical Requirements – High	Clarification of preferences.

Voltage cable Boxes - General	
4.1 – External References	Updated to relevant current versions and stated within body document
All	Update document format
Title	Updates to extend the scope of the document

5. Definitions

Term	Definition
The company	Northern Powergrid
XLPE	Cross linked polyethylene

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	12/11/2020

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: Update will be dictated by contract renewal date or any significant changes in the specification or documents referenced**
Should this document be displayed on the Northern Powergrid external website?		Yes

		Date
Alan MacDonald	Policy and Standards Engineer	13/11/2020

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
David Gazda	Policy and Standards Engineer	13/11/2020
David Blackledge	Senior Policy & Standards Engineer	13/11/2020

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Greg Farrell	Head of System Engineering	29/12/2020

Appendix 1 – Schedule of Requirements

Item	Description	Northern Powergrid Drawing Number or BS Reference
166102	Bushing Assembly, Transformer, 800A Cast Resin, LV, as Detailed in Figure 16 of BS2562. Supplied with flange gasket.	BS 2562, Figure 16, 800 Amp
166117	Bushing Assembly, Transformer, 1400A Cast Resin, LV, as Detailed in Figure 16 of BS2562. Supplied with flange gasket.	BS 2562, Figure 16, 1400 Amp
166121	Bushing Assembly, Transformer, LV, Porcelain, comprising:- • 1 off Bushing Plate to match a BS 2562, Figure 25 flange plate Facing "F", with bushings arranged to match BS 2562, Figure 19 and 120mm PCD. • 3 off Double take off to BS 2562 Figure 7 (standard). • 1 off Single take off to BS 2562 Figure 7 (standard). • Supplied with gaskets.	BS 2562, Figures 7, 19 and 24
166122	Bushing Assembly, Transformer, LV, Porcelain, comprising:- • 1 off Bushing Plate to BS 2562, Figure 25, Facing "F", flange plate Facing "F", with bushings arranged to match BS 2562, Figure 19 and 120mm PCD 3 off Double take off to BS 2562 Figure 7 (standard). • 1 off Single take off to BS 2562 Figure 7 (alternative non-standard transformer side). • Supplied with gaskets.	BS 2562, Figures 7, 19 and 24
166155	Bushing Assembly, Transformer, LV, Porcelain, comprising:- • 1 off Bushing Plate to BS 2562, Figure 25, Facing "F". • 4 off Single take off to BS 2562 Figure 7 (alternative non-standard transformer side). • Supplied with gaskets.	BS 2562, Figures 7 and 19
166136	Transformer, 4 Way LV Air Box. Supplied with Gasket and Gland Plate Drilled with Pilot Holes to Drawing Number 113.110.0060 Sheet 1.	113.110.0060 Sheet 1
166140	Transformer 7 Way LV Air Box. Supplied with Gasket and Gland Plate Drilled with Pilot Holes to Drawing Number 113.110.0060 Sheet 2.	113.110.0060 Sheet 2
162898	11kV Transformer Air Box - Suitable for Standard Terminations. Supplied with Gasket to Drawing Number 113.110.0060 Sheet 3.	113.110.0060 Sheet 3
164592	20kV Transformer Air Box - Suitable for Standard Terminations. Supplied with Gasket to Drawing Number 113.110.0060 Sheet 4.	113.110.0060 Sheet 4
166150	11kV Transformer Air Box - Suitable for Separable Plug in Terminations. Supplied with Gasket to Drawing Number 113.110.0060 Sheet 3.	113.110.0060 Sheet 3
166151	20kV Transformer Air Box - Suitable for Separable Plug in Terminations. Supplied with Gasket to Drawing Number 113.110.0060 Sheet 4.	113.110.0060 Sheet 4

Appendix 2 – Addendum to Supplier Requirements

Suppliers shall provide supporting evidence of compliance with relevant type tests.

Suppliers may provide alternative tenders for items not complying with the above specification. This shall be clearly stated together with detailed descriptions of any variation from the specification, together with drawings and test results.

The supplier shall provide full technical details of the equipment offered and shall indicate any divergence from these standards or specifications.

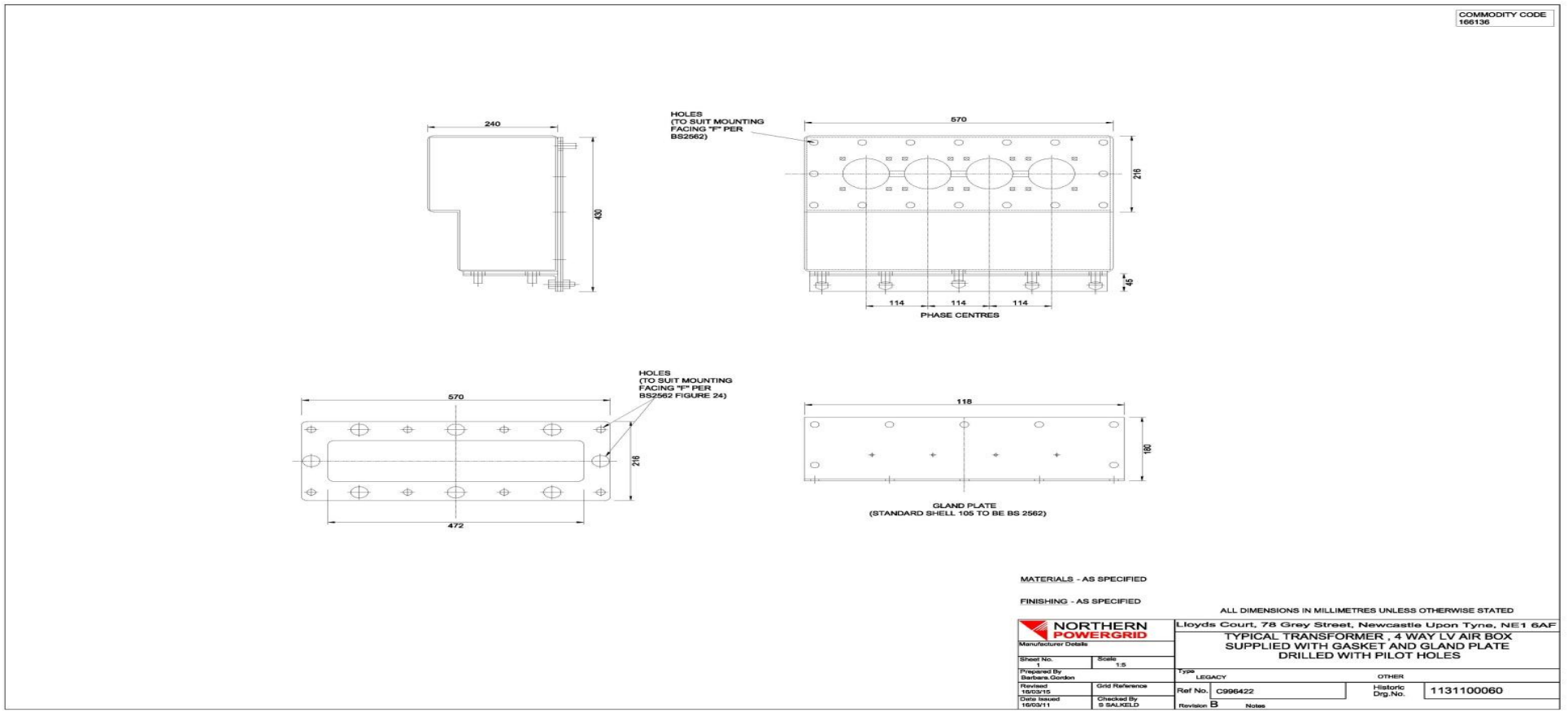
Maintenance and Inspection

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.

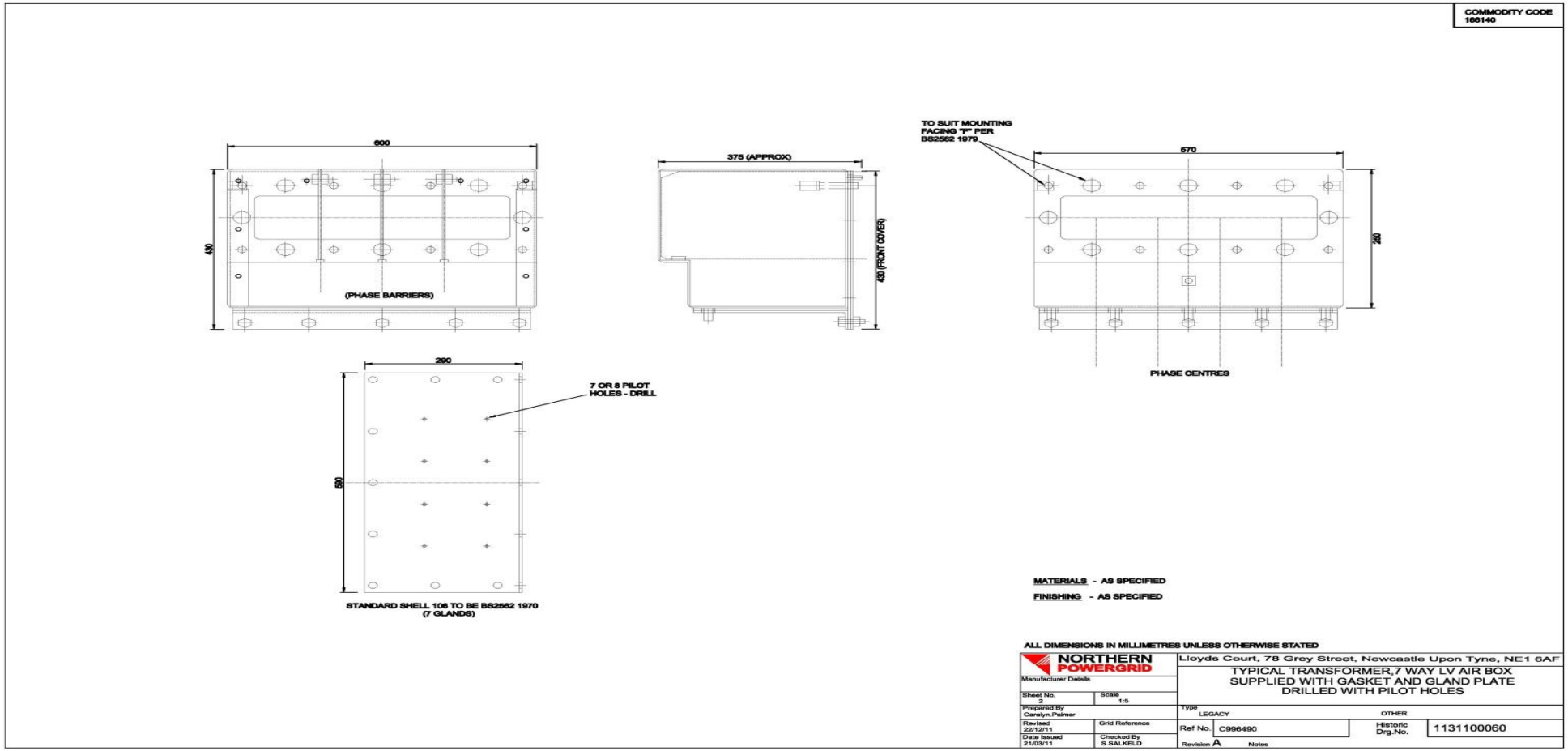
Appendix 3 – Typical Arrangements

Sheet 1



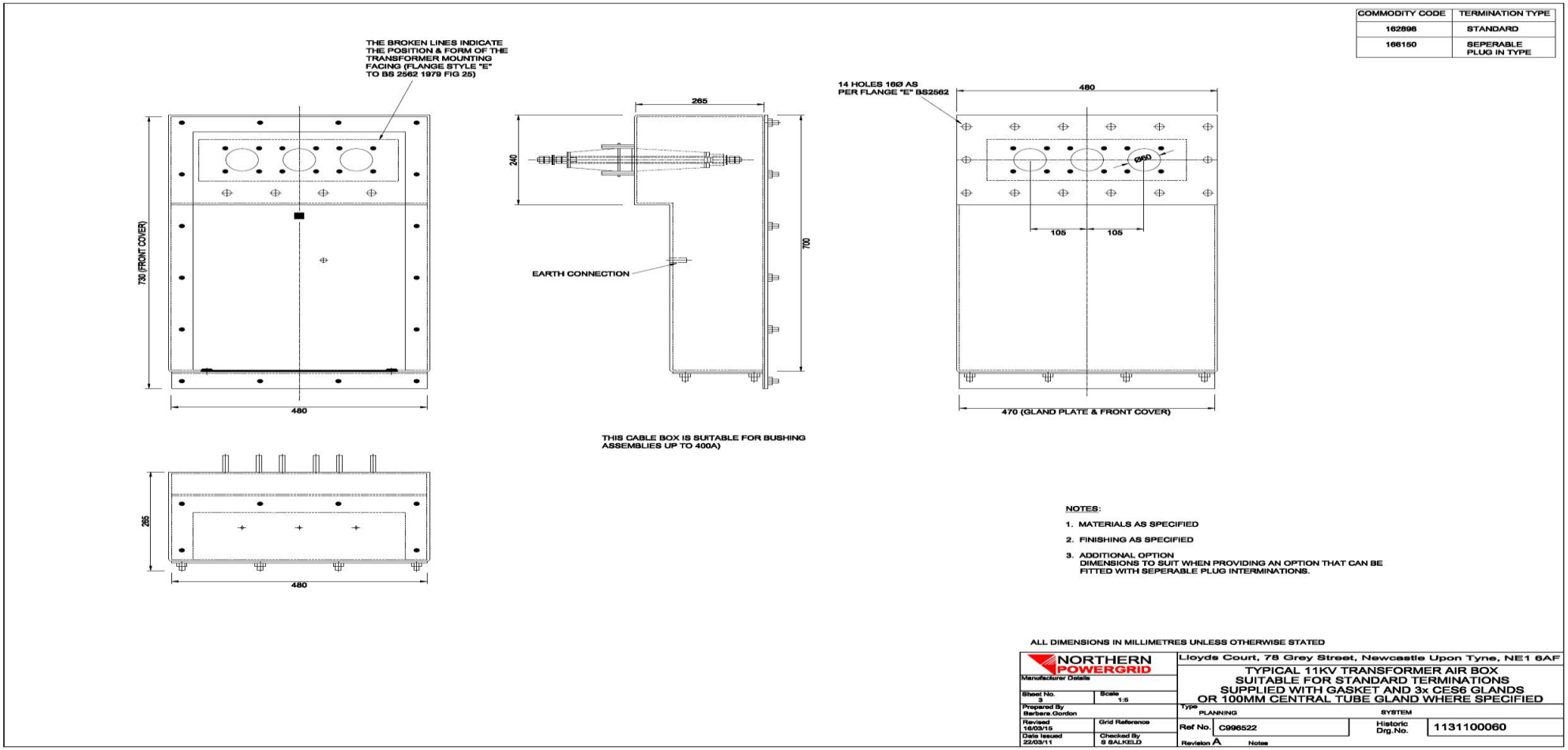
Appendix 3a – Typical Arrangements

Sheet 2



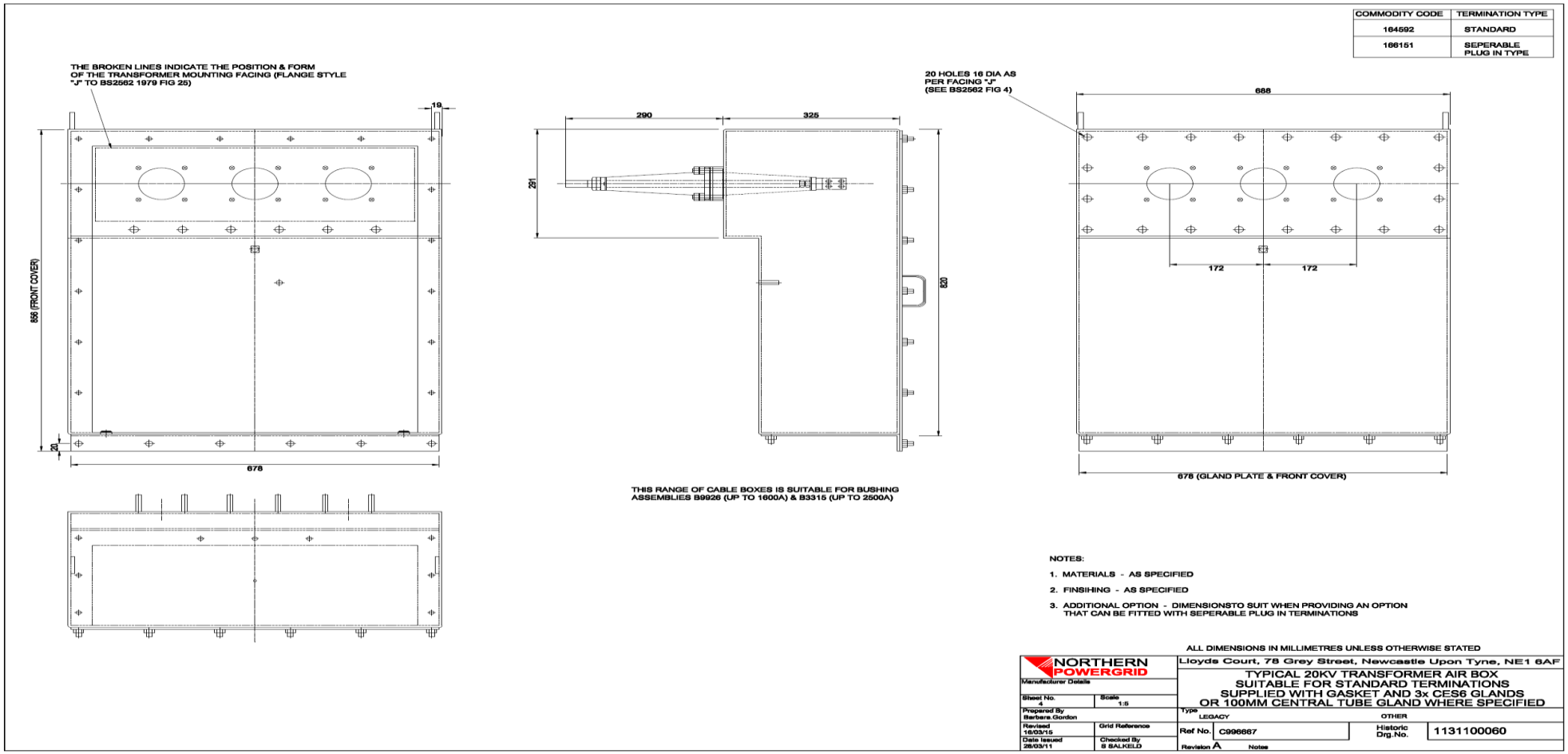
Appendix 3b – Typical Arrangements

Sheet 3



Appendix 3c – Typical Arrangements

Sheet 4



Appendix 4a – Self-Certification Conformance Declaration to ENATS and BS

Cable boxes and bushing assemblies shall comply with the latest issues of the relevant national and international standards, including ENATS 12-11, BS2562, BS6435, ENATS 41-36, ENATS 35-1, ENATS 35-2 & ENATS 35-3(where applicable). Additionally this technical specification is intended to amplify and/or clarify requirements relating to these Standards.

This self-declaration sheet identifies the clauses of the aforementioned standards relevant to switchgear and transformer cable boxes for use on the Northern Powergrid distribution network. 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 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.

Instructions for completion

- When Cs1 code is entered a remark is necessary to clarify how conformance is met.
- When any other code is entered the reason for non- conformance shall be entered.
- Prefix each remark with the relevant 'BS EN' 'IEC' or 'ENATS' as appropriate.

Manufacturer:

Product Reference:

Details of the cable type(s) designed to be used with:

Name:

Signature:

Date:

NOTE: One sheet shall be completed for each item or variant submitted.

ENATS 12-11 – Dry Cable Terminations in HV Switchgear for Service at Rated Voltages 12, 24 and 36kV			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
4	Normal service conditions		
5	Ratings		
6	Design and Construction		
7.1	Type Tests		
7.2	Routine Tests		

BS2562 – Cable Boxes for Transformers and Reactors (Low Voltage)			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
4	Electrical requirements and clearances		
5	Electromagnetic considerations		
6	Provision for receiving cables		
7	General design requirements		
8	Type tests		
9	Routine tests		

BS6435 – Unfilled Enclosures for Dry Termination of HV Cables for Transformers and Reactors			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
3	Electrical requirements and clearances		
4	Electromagnetic considerations		
5	Provision for receiving cables		
6	Design considerations		
7	Type tests		
8	Routine tests		
9	Basis of range of enclosures		
10	Bushings		
11	Termination of cables within enclosures		

ENATS 35-1 – Distribution Transformers (from 16kVA to 2000kVA) (Parts 2 & 3)			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
4.3	HV terminations		
4.4	LV terminations		

ENATS 35-2 – Continuous Emergency Rated (CER) system transformers (33/11.5°kV delta/star and star/star connected)			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
15.3.3	Plug-in separable connectors		
15.3.4	HV Terminals		
15.3.7	LV Termination		

ENATS 35-3 – Continuous Maximum Rated (CMR) system transformers (for use on systems up to and including 132 kV)			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
15.3	Terminals		
15.3.1	Cable boxes and unfilled cable enclosures		
15.3.1.1	Cable termination chambers		
15.3.3	Plug-in separable connectors		
15.3.6	LV terminations		

Appendix 4b – Self-Certification Conformance Declaration to NPS/003/030

This self-declaration sheet identifies the clauses of this Northern Powergrid NPS relevant to switchgear and transformer cable boxes for use on the Northern Powergrid distribution network. 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 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.

Instructions for completion

- When Cs1 code is entered a remark is necessary to clarify how conformance is met
- When any other code is entered the reason for non- conformance shall be entered.
- Prefix each remark with the relevant 'BS EN' 'IEC' or 'ENATS' as appropriate.

Manufacturer:

Product Reference:

Details of the cable type(s) designed to be used with:

Name:

Signature:

Date:

NOTE: One sheet shall be completed for each item or variant submitted.

NPS/003/030 - Technical Specification for Transformer and Switchgear Cable Boxes and their associated Bushing Assemblies up to 33kV			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
3.1 High Voltage Cable Boxes – General	Minimum vertical clearances to BS6435 Table 2		
3.1 High Voltage Cable Boxes – General	Provision for internal earth connection		
3.1 High Voltage Cable Boxes – General	Option for inverted installation		
3.1 High Voltage Cable Boxes – General	Cable boxes SHALL NOT be manufactured from cast iron.		
3.1 High Voltage Cable Boxes – General	External surfaces zinc based finish to ENATS 98-1		
3.1 High Voltage Cable Boxes – General	Internal surface finish anti-condensation with appropriate drainage and ventilation		
3.1 High Voltage Cable Boxes – General	Provided with appropriate new replacement gaskets		
3.1.1 High Voltage Transformer & Ring Main Unit Tee Off Cable boxes up to 24kV	Transformer mounting flanges to BS2562 Figure 25 • Facing E at 11kV • Facing J at 20kV		
3.1.1 High Voltage Transformer & Ring Main Unit Tee Off Cable boxes up to 24kV	Clearance and creepage distances meet fully insulated values in BS 6435 Table 1		

NPS/003/030 - Technical Specification for Transformer and Switchgear Cable Boxes and their associated Bushing Assemblies up to 33kV			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
3.1.1 High Voltage Transformer & Ring Main Unit Tee Off Cable boxes up to 24kV	Bushing type selection; • Porcelain Bushings to BS 2562, or • 630A outside cone type C to BS EN 50181		
3.1.1 High Voltage Transformer & Ring Main Unit Tee Off Cable boxes up to 24kV	Replacement Cable boxes for SF6 filled switchgear conform to original manufacturer design type / features for Type Test		
3.1.1 High Voltage Transformer & Ring Main Unit Tee Off Cable boxes up to 24kV	Cable entry for 185mm² triplex, 3 hole gland plate (CE6 or equivalent size) and option for 100mm central Tube gland as alternative		
3.1.2 Switchgear Ring Switch (Feeder) Cable boxes up to 24kV	Bushing type selection; • Porcelain Bushings to BS 2562, or • 630A outside cone type C to BS EN 50181		
3.1.2 Switchgear Ring Switch (Feeder) Cable boxes up to 24kV	Replacement Cable boxes for SF6 filled switchgear conform to original manufacturer design type / features for Type Test		
3.1.2 Switchgear Ring Switch (Feeder) Cable boxes up to 24kV	Cable entry for range in ENATS 12-11, Table 1		
3.1.3 33kV CER & CMR Transformer High Voltage Cable boxes.	Transformer mounting flanges to BS2562 Figure 25 • Facing H at 33Kv		
3.1.3 33kV CER & CMR Transformer High Voltage Cable boxes.	Clearance and creepage distances meet fully insulated values in BS 6435 Table 1		

NPS/003/030 - Technical Specification for Transformer and Switchgear Cable Boxes and their associated Bushing Assemblies up to 33kV			
Clause/Sub-clause	**Requirement**	**Conformance Code**	**Remarks**
3.1.3 33kV CER & CMR Transformer High Voltage Cable boxes.	Air Insulated cable boxes minimum clearances as per ENATS 35-2 Table 7.		
3.2. Low Voltage Transformer Cable Boxes	Transformer and reactor boxes capable of withstanding HV tests on the transformer or reactor		
3.2. Low Voltage Transformer Cable Boxes	Cable boxes SHALL NOT be manufactured from cast iron.		
3.2. Low Voltage Transformer Cable Boxes	External surfaces zinc based finish to ENATS 98-1		
3.2. Low Voltage Transformer Cable Boxes	Internal surface finish anti-condensation with appropriate drainage and ventilation		
3.2. Low Voltage Transformer Cable Boxes	Gland plates manufactured from Aluminium plate and supplied with pilot holes for cable holes to be drilled		
3.2. Low Voltage Transformer Cable Boxes	Provided with appropriate new replacement gaskets		

Appendix 5 – Technical Information Check List

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

Requirement	Provided (Y/N)
Full product descriptions and part number/reference	
Appendix 4 – completed self-certification conformance declarations	
Complete set of drawings for each item	
Type test evidence	
Manufacturing routine test plan	
Packaging information	
Instructions/Manuals for transportation & handling, installation, maintenance and disposal	
Spares availability list	
ISO:9001, ISO:14001 and ISO:18001 certificates	

Appendix 6 – Logistical Requirements

To enable Northern Powergrid to store the product(s) in accordance with the manufacturer's recommendations the Tenderer should provide details of the recommended storage environment with respect to each tendered product.

Details should be provided where relevant in respect to the minimum and maximum exposure levels, frequency of exposure and duration of exposure of the packaged item with respect to;

- Ambient temperature
- Humidity
- Water
- Dust
- Impact
- Vibration
- Atmospheric corrosion
- Solar radiation

The Tenderer shall ensure that each item is suitably packaged and protection to maintain the product and packaging as "fit for service" prior to installation taking account of the potential for an outdoor storage environment. All packaging shall be sufficiently durable giving regard to the function, reasonable use and contents of the packaging. Where product packages tendered are made up of sub packages all the sub packages shall unless varied by this specification, be supplied securely packaged together. Where items are provided in bagged/boxed form the material from which the bags are manufactured shall be capable of sustaining the package weight and resisting puncture by the materials within. Tenderer shall submit at the time of tendering the details of the proposed packaging (i.e. materials composition and structure) to be used for each product. Where the Tenderer is unable to provide packaging suitable for outdoor storage then this should be stated at the time of tender.

Palletised goods shall be supplied on standard 1200mm x 1000mm pallets.

Clearly legible, easily identifiable, durable and unambiguous labelling shall be applied to each individual and where relevant multiple package of like products. Where products packages tendered are made up of sub packages each sub packages shall be marked. As a minimum requirement the following shall be included;

- Manufacturer's trademark or name
- Supplier's trademark or name
- Description of item
- Date of packaging and/or batch number
- Northern Powergrid product code (where applicable)
- Weight

Tenderer shall submit at the time of tendering a sample of the proposed labelling for each product package type.