NPS/001/006 – Technical Specification for Insulators for Overhead Lines up to and including 132kV

1. Purpose

The purpose of this document is to specify the technical requirements for insulators and insulator assemblies to be installed on overhead lines located in the Northern Powergrid distribution network operating up to and including 132KV.

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

Document Reference	Document Title	Version	Published Date
NPS/001/006	Technical Specification for Insulators for Overhead Lines up to and including 132kV	3.0	February 2019

2. Scope

This document applies to insulators and insulator assemblies containing porcelain, glass or composite insulators for use on overhead lines located on the Northern Powergrid distribution network.

For details about the application of insulators onto the Northern Powergrid distribution system see **NSP/004/127** ***"Guidance on the selection and application of insulators"*** and **NSP/004/104** ***"Guidance on the Types and Installation Requirements for Stays"***.

The range of insulators specified within this document includes LV and service insulators rated at 650V and HV and EHV insulators rated up to and including 132kV. All Insulators shall generally be in accordance with ENA TS 43-93.

Insulators supplied for EHV applications will be supplied as complete assemblies including all insulator protection devices.

2.1 Contents

3. Technical Requirements

4.1 General

Insulators shall be designed and tested to fully comply with ENA TS 43-93 unless varied by this specification.

Wherever practicable it is the policy of Northern Powergrid to specify the use of composite or thermoplastic insulation materials over the traditional Glass and Porcelain variants.

4.2 Variances and Clarifications to ENATS 43-93

Where appropriate, the following variations, additions and clarifications to ENA TS 43-93 are referenced to the clause numbers in that document.

3.1.1 Marking

All insulators shall be marked to ensure traceability; in addition, where practicable the marking shall include a manufacturer's product code or a Northern Powergrid commodity code. Marking shall be legible and indelible in accordance with the requirements of BS EN 60383-1. In addition to these requirements, composite string insulators shall be marked in accordance with IEC 61466-1.

3.1.2 Composite Insulation Materials

Composite Insulators shall have a design life of a minimum of 40 years when installed in an outdoor environment in the North East of England.

Insulators manufactured from composite insulation materials and their metal fittings shall, as far as practicable, be designed so that the insulator may be used as a direct replacement for conventional glass and porcelain insulators in common use.

Insulators shall be resistant to the influence of outdoor climatic conditions including ultraviolet (UV) rays and shall be resistant to atmospheric pollutants and be capable of satisfactory performance when subjected to the specified pollution conditions. All composite insulator units shall conform to the requirements of IEC 62217 and the appropriate standard for the insulator type (IEC 61109, IEC 61952) and should normally be grey in colour.

The composite insulator shall comprise an electrical grade corrosion resistant, low seed count (ECR) glass-fibre reinforced polymer core onto which is bonded a silicon rubber housing that provides both environmental protection of the rod and electrical performance characteristic of the insulator. The housing shall be effectively bonded to the core along its entire length and provide unbroken coverage. The insulator shed formation shall meet the requirements of IEC/TS 60815-1.

Electric fields shall be effectively managed by the use of appropriate grading rings or combined corona arcing devices, as and where required - dependant on the system voltage.

3.1.3 Composite Insulator – End Fittings

Sealing of the interface between metallic end fittings, sheath and core is critical to prevent moisture ingress.

Sealing by compression only is not considered adequate to provide a long-term sealing solution. Adequate redundancy shall be built into the design of such interface.

The design of end fittings shall have due regard for electric field stresses and the avoidance of electrical discharge of the metallic components. The over-moulding of metal end fittings to provide a sealing interface should be limited to insulators up to 66 kV.

End fittings will be attached onto the rod by a compression process (coaxial or hexagonal compression method), which does not damage the individual fibres of the rod. Crimp control shall be monitored by using acoustic emission devices. All end fittings shall be fully in accordance with IEC 60120 and BS 3288

Part 3 (Ball socket fittings). The die penetration type test within IEC 61109 shall be utilised to prove the integrity of the end fittings.

3.1.3.1 Composite Insulator – Housing and sheds

The housing is the external insulating part of an insulator which provides the necessary creepage and protects the core from the weather.

Unless specified otherwise within this specification all composite insulators shall be manufactured from Silicon Rubber. Due to the variations in the make-up of silicon rubber materials and the potential effects this may have on the long-term performance of such a material to provide the following properties:

- UV resistance
- Tracking resistance
- Hydrophobicity

The following range of good practice characteristic values have been included within this specification

Material Composition	Minimum % per weight
Silicone Polymer (Polydimethylsiloxane) (PDMS)	30%
Filler (ATH Aluminium tri hydrate and fumed silica)	64%
Additional parts (pigments, crosslinkers)	1%

Where manufactures differ from this characteristic composition, they shall provide supporting evidence about the long-term experience of their product formulation.

The following table provides a list of characteristic properties that result from the above formulation.

Manufacturers shall provide details of their characteristic properties for consideration.

Minimum acceptable values are detailed below:

Property	Minimum Value
Density	1.5g/ccm
Passing Voltage level of IEC 60587	4.5kV
Flammability class of IEC 60695-11-10 of 3mm specimen	V0
Tensile Strength (Din 53504-S1)	6 N/mm^2
Break Elongation (Din 53504-S1)	300%
UV resistance - @ 300nm the energy of UV wave length equates to a molecular energy breakdown level of 398kJ/mole *	445 kJ/mole

* Assumed wavelength of UV light (sun) 290 – 350nm

All silicon rubber insulators shall be manufactured using the HTV (high temperature vulcanising) and shall ensure that the interface between the housing and the core is chemically bonded.

To reduce long straight axial mould lines on insulators that are manufactured using the direct moulding technique, consideration shall be given to rotating the mould line by 60° for every metre of housing length. Irrespective of the above statement, the flash or mould lines shall not exceed 1mm in height.

All rods shall be covered by a minimum insulation thickness of 3mm with a proven method for maintaining the concentricity of the silicon rubber over the rod.

All insulator components including the polymeric materials used in the manufacture of insulators shall be traceable from the raw material supplier through the manufacturing process as required under quality assurance procedures.

The polymeric material will be described by the manufacturer in defined terms. The use of a generic term such as silicone rubber is not acceptable. Manufacturers shall complete appendix 2 with details about the material.

3.1.3.2 Composite Insulator – Tolerances

The permitted tolerances shall meet the requirements of IEC 61109. In accordance with those standards the following tolerances are permitted for all dimensions without prior special agreement with Northern Powergrid.

± (0.04 x L + 1.5) when L ≤ 300mm

± (0.025 x L + 6) when L > 300mm, limited to 50mm

For creepage distance, no negative tolerance is permitted.

3.1.4 High Voltage Insulators

3.1.4.1 General

Insulator design and dimensions shall be specified by the manufacturer/supplier. The specific creepage distance for the insulator shall be based on the recommendations in Clause 3.7 of this specification.

For tension and post insulators, the manufacturer/supplier shall complete appendix 3 of this document to provide details of insulator length and dry arc distance, in accordance with Figure 1, of ENA TS 43-93.

3.1.4.2 11-20kV Pin Insulators

Pin Insulators for use on HV overhead lines with nominal system voltages up to and including 20kV shall be manufactured from HDPE thermoplastic material as detailed in ENA TS 43-93 issue 5, clause 4.5 with dimensional and electrical properties as detailed in Appendix 1 & 4

3.1.4.3 11-20KV Tension Insulators

Tension Insulators for use on HV overhead lines with nominal system voltages up to and including 20kV shall be manufactured from Silicon Rubber Composite material as detailed in clause 3.4 of this specification with dimensional and electrical properties as detailed in Appendix 1 & 4

3.1.4.4 33kV Pin Insulators

Pin Insulators for use on overhead lines with nominal system voltages of 33kV shall be manufactured from Porcelain or HDPE thermoplastic material as detailed in ENA TS 43-93, clause 4.2.1 & 4.2.2 for porcelain or clause 4.5 for thermoplastic material with dimensional and electrical properties as detailed in Appendix 1 & 4

3.1.4.5 33kV Tension Insulators

Tension Insulators for use on HV overhead lines with nominal system voltages of 33kV shall be manufactured from Silicon Rubber Composite material as detailed in clause 3.4 of this specification with dimensional and electrical properties as detailed in Appendix 1 & 4

3.1.4.6 33kV – 132kV Post Insulators

All Line post insulators and support stools for use on 33-132kV lines shall have mechanical ratings of 21kN SCL and should conform generally to ENATS 43-93 Figure 11a or 11c, unless otherwise specified by this specification.

All post insulators shall be manufactured from composite silicon rubber materials as detailed in clause 4.4 of this specification with all dimensional and electrical properties as detailed in Appendix 1 & 4

For vertical line post insulators, the fixing holes in the top and bottom end fittings and shall be based on a 127mm PCD in accordance with ENATS 43-93 Figure 11a. If the specified cantilever load of the insulator is only permissible in one direction, the fixing holes in the end fittings shall be orientated about that direction, and the direction of the load shall be clearly indicated on the top end of the insulator.

Vertical Stool or flange type end fittings shall have clearance holes and be provided with 4 x M16 x 65mm bolts. All fixings shall be grade 8.8 and supplied c/w fixing bolts, nuts, washers and spring washers. Alternatively in the case of 132kV Insulators they shall be designed with solid end fittings that have tapped holes with a threaded depth of 20 mm.

Horizontal Post Insulators and horizontal stool top end fittings shall be provided with 4 x M16 x 65mm bolts pre-installed in the 127mm PCD flanges. The lower end fittings of the stools shall be provided with 2 x M22 x 160mm bolts pre-installed into the flags that interface with the pole bendable base units. All fixings shall be grade 8.8 and supplied c/w fixing bolts, nuts, washers and spring washers.

3.1.5 Post Insulator Clamp Tops

The 132 kV vertical and horizontal line post insulators shall be supplied complete with trunnion style conductor clamps and clamp adapters to fit the top end fittings. The 33/66kV Universal Vertical/Horizontal Line Post Insulators require a variation in this trunnion design such that the trunnion clamp bracket and trunnion clamp allows both side and top mounting.

As a default, all trunnion clamps shall be supplied to allow the insulators to be used with 200mm2 AAAC conductor although they shall be designed to accommodate smaller copper and aluminium conductor sizes through the use of alternative clamps. An example of the typical conductor clamping ranges can be seen in Northern Powergrid drawing 1091010487 sht 6.

A typical conductor clamp is shown in ENA TS 43-93 Figure 13 and the clamp shall be so designed that the following requirements listed below are satisfied: -

a) The effects of vibration and conductor swing, both on the conductor and fitting itself, are minimised.

b) Secure clamping of the conductor is achieved without causing kinking or any undue deformation of the conductor stranding. To assist in this requirement the clamps shall be designed to accommodate a wrap of copper or aluminium chaffing tape installed as appropriate to match the conductor types.

c) If manufactured from metal other than aluminium alloy, the clamp shall incorporate an aluminium liner when used on aluminium conductors.

d) Aluminium based clamps shall not be used with copper conductors.

e) At pivot points, adjustable pins with a locking arrangement shall be provided to ensure that the bearing depths of pins called for in ENA TS 43-93 Figure 13 are achieved.

3.1.6 33-132KV String Insulators

In general, all new Insulator strings shall be provided as composite string insulators as detailed in ENA TS 43-93 clause 5.7 however where traditional glass or porcelain string insulators are still required for specific purposes, mainly emergency repair functions on existing strings, then they shall comply with the following requirements.

These units shall be nominally 255mm diameter disc insulators with 140mm or 178mm centres. All ball and socket couplings shall be in accordance with the requirements of BS 3288 Part 3 designation 16B, 20 or 24. The design of these interfaces shall meet the requirements of ENA TS 43-93 clause 5.6

Appendix 1 lists the range of insulators required with detailed drawings shown in Appendix 4.

The string insulators may be used in the horizontal disposition at section or terminal positions or in a vertical disposition forming part of a suspension insulator set.

The specific creepage distance for each unit, when multiplied by the total number of units in a string, shall be sufficient to achieve the total minimum creepage distances detailed in Clause 7 of this specification.

Note:

Additional discs may be required in strings to meet exceptional pollution conditions, thus extending creepage distances.

Typically, they are configured as detailed below:

i. 11kV – one units (unearthed supports) – (two units at earthed supports)

ii. 20kV – two units

iii. 33kV – three units

iv. 66kV – five units

v. 132kv – Horizontal disposition – 9 units

vi. 132kV – Vertical disposition – 11 units (option to utilise 9 unit variant)

3.1.7 Composite String Insulators

Composite string insulators shall be designed for use on overhead lines with a nominal system voltage up to and including 132 kV. The string insulators may be used in the horizontal disposition at section or terminal positions, or in a vertical disposition forming part of suspension insulator sets. The specified mechanical load class and end fittings shall be in accordance with the schedules in appendix 1 of this specification and BS EN 61466-1. The specific creepage distance for the string insulator shall be based on Clause 7 of this specification.

Composite string insulators shall be designed with the intention that they may be used as a direct replacement to conventional insulator strings which were made up from multiple disc insulators and based on 127mm, 140mm, 171mm or 178mm centres.

NOTE: Conventional ratings and couplings are described in BS EN 61466-2.

For 132 kV insulators, it is not considered practical to install separate corona rings and arcing horns. Consequently, combined corona arcing devices shall be installed on the energized end of 132kV composite line insulators to both limit the e-field intensity (provide electrical grading) and provide a stable path for overvoltage flashovers and potential power arcs.

Manufactures shall quote for insulator lengths as detailed in the schedules in Appendix 1 of this specification to achieve compliance with existing string lengths but are encouraged to offer shorter alternatives for consideration providing they still meet all electrical parameters.

Composite tension and suspension insulators are generally specified as complete assemblies, hence manufactures shall include for required end to end fittings e.g., all shackles and arcing horns as specified in clause 3.5 and or Appendix 1 or the drawings in Appendix 4.

The Specified Mechanical Load class and end fittings type shall be in accordance with IEC 61466-1. Ball and socket couplings shall be in accordance with BS 3288 Part 3 or IEC60120 as appropriate to the specified rating.

3.1.8 Insulator Overvoltage Protective Devices (Arcing Horns)

Where specified within the descriptions in Appendix 1, 66 and 132kV insulators shall be supplied with overvoltage protection devices in the form of arcing horns. Manufactures shall provide a compatible set of overvoltage protective devices designed so as to prevent any arc current flowing through the end fittings of the insulator, all protective devices shall attach to the hardware at each end of the insulator.

The design of the protective devices will be required to take into account the following requirements: -

a) Shall effectively protect the insulator units and the fittings from damage from power arcs

b) Shall effectively improve the voltage distribution along the insulator string

c) Shall effectively improve the corona performance of the insulator set

d) Shall effectively inhibit the formation of dry band arcing on composite insulators adjacent to end fittings.

Required Arc Gaps for Standard Insulator sets				
Voltage	Approach Set (First 1.6km)		Normal Set	
	Non-Composite Strings	Composite Strings	Non-Composite Strings	Composite Strings
132 kV Tension	1000mm (39”)	1000mm	1120mm (23.5”)	1175mm
66 kV	453mm (18”)	440mm	570mm (22.5”)	540mm
33 kV	* Not Required	* Not Required	* Not Required	*Not Required
132kV Reduced clearance suspension strings based on 9 x 140mm discs				
132 kV	851mm (provides a calculated impulse value of 555kV	925mm	851mm min	1025mm (provides a calculated impulse value of 565kV)

Notes:

- Lab tests have shown that composite insulators have a lower electrical withstand breakdown than traditional ceramic insulators, a traditional “Normal Set” gap of 1120mm breaks down at approximately 620kV and hence needs to be increased to 1175mm to achieve 650kV withstand.
- The “Approach Set” gap on the 66kV needs to be reduced from 453mm to 440m to maintain the 325kV ratings without compromising the dry arc gap.
- It is assumed that surge arrestors will always be installed on 33kV Cable terminations
- Where 275kV or 400kV lines are operated at 132kV, extended arcing horns shall be used for the first 1.6km from substations or sealing ends to obtain a 1000mm arc gap.

3.1.9 Test Requirements

3.1.9.1 General

The design of the insulators shall be such that the electrical withstand voltages in Table 1 are achieved.

Atmospheric correction factors shall be applied in accordance with IEC 60060-1.

The tests shall be performed in accordance with:

· IEC 60383-1 for insulator units, line post insulators and pin insulators;

· IEC 60383-2 for insulator strings and sets;

· IEC 61109 for composite string insulators and;

· IEC 61952 for composite line post insulators.

Table 1—Electrical withstand voltages

Nominal System Voltage (Minimum)	11 kV Earthed & Unearthed	20 kV Unearthed	20 kV (Earthed	33 kV	66 kV	132 kV
Wet 1 min power frequency withstand voltage (kV)	50	50	70	90	140	275
Dry impulse withstand voltage (kV)	95	125	125	200	325	650

Design, type, sample, and routine tests shall be undertaken where appropriate in accordance with the requirements of ENA TS 43-93, IEC 60383, BS EN 60437, BS EN 60507, IEC 62217, IEC 61109, and IEC 61952, where applicable.

For guidance, a summary of the type and sample test requirements is given ENA TS 43-93 Annex A

3.1.9.2 Pollution Performance

The insulators detailed in this specification have been designed to conform to the requirements ENA TS 43-93 clause 7 and IEC/TS 60815-1 "*Definitions, information and general principles",* IEC/TS 60815-2 "Ceramic and glass insulators for a.c. systems*"*), and IEC/TS 60815-3 "Polymer insulators for a.c. systems".

The insulator design and the associated SCD (Specific Creepage Distance) have been determined by past experience, as described in IEC/TS 60815-1, Approach 1 using values based generally around the following: -

<= 33kV – (20 mm/kV (system voltage) for vertical insulators & 14 mm/kV for insulators in the horizontal plane)

>= 66kV – (25 mm/kV (system voltage) for vertical insulators & 20 mm/kV for insulators in the horizontal plane)

In accordance with IEC/TS 60815-, Approach 1 the above SCD values correspond to the USCD as follows:

SCD (Specific Creepage Distance) for three phase A.C. systems	USCD (Unified Specific Creepage Distance)	SPS Class (Site Pollution Severity)
20	34.7	(C) Medium
25	43.3	(D) Heavy

Unless specified otherwise the minimum creepage distances for high voltage insulators and insulator sets shall be as defined in the following table which is based on ENA TS 43-93 Table 4

Site Pollution Class IEC/6018	Minimum creepage distance (mm)									
	11kV		20kV		33kV		66kV		132kV	
	Vert. (Pin, Post, Susp.)	Horiz. (Tension)	Vert. (Pin, Post, Susp.)	Horiz. (Tension)	Vert. (Pin, Post, Susp.)	Horiz. (Tension)	Vert. (Pin, Post, Susp.)	Horiz. (Tension)	Vert. (Pin, Post, Susp.)	Horiz. (Tension)
Medium	240mm	168mm	480mm	336mm	660mm	462mm	n/a	n/a	n/a	n/a
Heavy	n/a	n/a	n/a	n/a	n/a	n/a	1813mm	1268mm	3625mm	2538mm

3.1.9.3 Mechanical Performance

The required mechanical ratings of insulators are given below. All tests shall be carried out in accordance with IEC 60383-1, BS EN 61109 or IEC 61952 as appropriate.

- The SCL (or minimum mechanical failing load) of pin insulators and line post insulators, shall be not less than 10 kN, for lines up to 33 kV.
- The SCL (or minimum mechanical failing load) for line post insulators shall be not less than 21 kN, for 33, 66 and 132 kV lines.
- The SCL (or minimum mechanical failing load) of pilot post insulators shall be not less than 8 kN
- The SML (or minimum mechanical failing load) of suspension string insulator units shall be 70 kN.
- The SML (or minimum mechanical failing load) of tension string insulator units shall be 70 kN,125kN or 190kN depending upon the application.

The required mechanical performance of insulators have been specified for each insulator in the schedules of Appendix 1

3.1.9.4 Triggered Spark Gap

Triggered spark gaps are a porcelain insulator assembly used to provide over voltage protection on 11, 20 and 33kV wood pole overhead lines. The unit shall be supplied with two sets of arcing horns to facilitate an early flashover of high over voltages. The arc gap dimensions are detailed below. Designs using composite material may be considered providing manufacturers can provide evidence of composite materials working in similar working conditions

Voltage (kV)	Triggered Gap (mm)	Main Arc Gap (mm)	Drawing Number
11	3	25	1.09.101.0603 Sheet 1
20	10	35 - 38	1.09.101.0603 Sheet 2
33	10	45 - 48	1.09.101.0603 Sheet 2

Appendix 1 lists the range of spark gaps required with detailed drawings shown in Appendix 4.

3.1.9.5 Stay Insulators

Stay insulators shall be manufactured in accordance with the electrical and mechanical loadings detailed in ENA TS 43-91. See NSP/004/104 for detail arrangements and selections.

3.1.9.6 LV – 33kV Stay Insulators

Shall be manufactured from porcelain and designed to comply with the dimensions of type 1 and type 2 arrangements as shown in figure 3 of ENA TS 43-91.

3.1.9.7 66 – 132kV Stay Insulators (earthed assemblies)

Shall be manufactured from porcelain and be designed to be in compliance with ENA TS 43-91 fig 3 type 1.

3.1.9.8 66 – 132kV Stay Insulators (unearthed assemblies)

Shall be single composite insulator assemblies complete with overvoltage protection arcing horns that comply with clause 5.8. The assemblies shall be designed to comply with ENA TS 41-91, IEC 61109 and IEC 61466. See drawing 1091010372 sht 2 for more details.

4. References

4.1 External Documentation

Reference	Title
ENA TS 43-93	Technical Specification for Line Insulators
ENA TS 41-91	Technical Specification for Stay Strands and Stay Fittings for Overhead Lines
IEC 60120 :2020	Ball and socket couplings of string insulator units — Dimensions
BS EN 60383 – 1	Insulators for overhead lines with nominal voltage above 1 kV — Part 1: Ceramic or glass insulator units for a.c. systems — Definitions, test methods and acceptance criteria
BS EN 60383 – 2	Insulators for overhead lines with a nominal voltage above 1000 V — Part 2: Insulator strings and insulator sets for a.c. systems — Definitions, test methods and acceptance criteria
BS EN 60372	Locking devices for ball and socket couplings of string insulator units – Dimensions and tests
IEC 60060-1	High-voltage test techniques. Part 1: General definitions and test requirements
BS 3288 – 2	Insulator and conductor fittings for overhead power lines – Part 2: Specification for a range of fittings.
BS 3288 – 3	Insulator and conductor fittings for overhead power lines – Part 3: Dimensions of ball and socket couplings of string insulator units
IEC/TS 60815-1	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions. Definitions, information and general principles
IEC/TS 60815-2	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions. Ceramic and glass insulators for a.c. systems
IEC/TS 60815-3	Selection and dimensioning of high-voltage insulators intended for use in polluted conditions. Polymer insulators for a.c. systems
IEC 61109	Insulators for overhead lines. Composite suspension and tension insulators for a.c. systems with a nominal voltage greater than 1000 V. Definitions, test methods and acceptance criteria
BS EN 61466 – 1	Composite string insulator units for overhead lines with a nominal voltage greater than 1000 V. Part 1: Standard strength classes and end fittings
BS EN 61466 – 2	Composite string insulator units for overhead lines with a nominal voltage greater than 1 000 V. Part 2: Dimensional and electrical characteristics
IEC 62217	Polymeric HV insulators for indoor and outdoor use. General definitions, test methods and acceptance criteria

4.2 Internal Documentation

Reference	Title
NSP/004/104	(OHI 4) Guidance on the Types and Installation Requirements for Stays
NSP/004/127	(OHI 27) Guidance on the selection and application of insulators

4.3 Amendments from Previous Version

Reference	Description
Entire document	Reference document number and clause updated
3.1.4 High Voltage Insulator	Corrected clause number and Appendix number
3.3 33-132kV String Insulators	Updated reference standards to BS3288-3 instead of HD 474 S1
3.10.2 66-132kV Stay Insulator (earthed assemblies)	Corrected the type of insulator to “Type 1”
Appendix 1 Schedule of items	Wording aligned with commodity description Descriptions updated Update item 251542 Added item 251555
Appendix 4 Typical Insulator Drawings	Added drawings: 1000439305 1091010428 sht 7,8,9,10,11,12,13 1091010484 sht 2 1091010487 sht 6 1091010488 sht 8

5. Definitions

Term	Definition
Brittle fracture	Brittle fracture is a failure mode where stress-corrosion cracking (SCC) of glass-reinforced polymer (GRP) can result in total mechanical failure of the insulator
Type ECR or E-CR	Electrolytic Corrosion Resistant (Low or boron free glass)
Seed Count	Seeds are gaseous inclusions (voids) inside the fibres left from the glass fibre manufacturing process
Type E	Electrical Grade Glass
Earthed	Earthed Assemblies are wood poles or steel structures where the crossarm steelwork is electrically connected to earth and hence provides a lower BIL
Unearthed	Unearthed structures generally provide a higher BIL as they are insulated from earth
BIL	Basic Insulation Level
EVA material	Is a co-polymer of Ethylene and Ethylene Vinyl Acetate
Dry Lightning Withstand Voltage	The lightning voltage which the insulator withstands dry, under the prescribed conditions of test
Wet Power Frequency Withstand Voltage	The power frequency voltage which the insulator withstands wet, under the prescribed conditions of test
Puncture Voltage	The voltage which causes puncture of a string insulator unit or rigid insulator under the prescribed conditions of test
Dry Arc Distance	Shortest distance in the air at which a puncture voltage can cause an arc to travel between two conductive parts which normally have the operating voltage between them
Creepage Distance	Shortest distance or the sum of the shortest distances along the surface of an insulator between two conductive parts which normally have the operating voltage between them
Specific Creepage Distance (SCD)	Specific Creepage Distance for three phase AC systems as defined in IEC/TS 60815
Unified Specific Creepage Distance (USCD)	Creepage distance of an insulator divided by the r.m.s. value of the highest operating voltage across the insulator as defined in IEC/TS 60815
Site Pollution Severity (SPS)	Site Pollution Severity as defined in IEC/TS 60815
Maximum Design Cantilever Load (MDCL)	Load level above which damage to the **core** begins to occur and which is the ultimate limit for service loads
Specified Cantilever Load (SCL)	Cantilever load which can be withstood by the insulator at the line end fitting when tested under the prescribed conditions
Specified Mechanical Load (SML)	Load, specified by the manufacturer, which is used for mechanical tests
Mechanical Failing Load (MFL)	Maximum load reached when tested under the prescribed conditions of test

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
Deb Dovinson	Governance Administrator	27/03/2024

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	
No	Period: 5 years	Reason: Update will be dictated by contact 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
Aaron Chung	Policy & Standards Engineer	02/04/2024

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
Ged Hammel	Lead Policy & Standards Engineer	27/03/2024
Steve Salkeld	Policy & Standards Engineer	25/06/2024

6.4 Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	22/05/2024

Appendix 1 – Schedule of Items

Pin Insulators – (11- 33kV Wood Pole Lines)

Cat. No.	Description	Drawing Number
253833	11/20kV HDPE Pin Insulator, 10kN SML, 70kV Wet Withstand, 125kV Dry Lightning Withstand, 78mm Neck Dia & 25mm Groove for **use on all 11 and 20kV supports**.	1091010486 sht. 13 ENA TS 43-93 fig2
253423	33kV Brown Porcelain or HDPE Pin Insulator, 10kN SML, 90kV Wet Withstand, 200kV Dry Lightning Withstand, 120mm Neck & 25mm Groove for **use on 33kV supports.**	1091010486 sht4 ENA TS 43-93 Fig. 6

Composite String Insulators – (11 – 33kV Wood Pole Lines)

Cat. No	Description	Drawing Number
253706	11/20kV Composite Tension Insulator. 70KN SML, 70kV Wet Withstand, 125kV Dry Lightning Withstand, 280mm spacing, 16mm ball/socket end fittings for **use on all 11 and 20kV supports.**	1091010487 sht. 24 & ENA TS 43-93 Fig. 4
216135	11kV Composite Flying Section Insulator. 70kN SML, 50kV Wet Withstand, 95kVDry Lightning Withstand, 280mm spacing, 16mm ball/ball end fittings **for use on 11kV supports.**	1091010485 sht. 10 & ENA TS 43-93 Fig. 5
247412	20kV Composite Flying Section Insulator. 70kN SML, 70kV Wet Withstand, 125kV Dry Lightning Withstand, 420mm spacing, 16mm ball/ball end fitting **for use on 20kV supports.**	1091010485 sht. 11 & ENA TS 43-93 Fig. 5
216150	33kV Composite Tension Insulator. 70kN SML, 90kV Wet Withstand, 200kV Dry Lightning Withstand, 420mm spacing, 16mm ball/socket end fittings for **use on 33kV (43-40 Tension, CE/C/37 Suspension) supports**	1091010487 sht. 23 & ENA TS 43-93 Fig. 7
251546	33kV Composite Tension Insulator. 125kN SML, 90kV Wet Withstand, 200kV Dry Lightning Withstand, based on (3x178mm) or 534mm spacing, 462mm min creep, 20mm ball/socket end fittings for **use on (CE/C/37 and OHL9/10 Tension Supports)**	ENA TS 43-93 Fig. 9
Info Only	33kV Composite Tension Insulator. 125kN SML, 90kV Wet Withstand, 200kV Dry Lightning Withstand, based on (4x178mm) or 712mm spacing, 462mm min creep, 20mm ball/socket end fittings for **use on (CE/C/37 Tension Supports) (refer to cat number** 216218**)**	1091010487 sht.27& ENA TS 43-93 Fig. 9

Composite Post Insulators – (33, 66 & 132kV OHL9/10 Wood Pole Lines)

Cat. No	Description	Drawing Number
346405	33kV Universal Vertical/Horizontal Composite Line Post Insulator. 21kN SCL, 600mm high mounted on 127mm PCD flange, 90kV Wet withstand, 200kV Dry Lightning Withstand complete with universal trunnion clamp bracket and trunnion clamp that allows both side and top mounting for use on 33kV OHL9/OHL10 Intermediate supports.	1091010487 sht.37
346406	33kV Vertical Stool for use with 33kV Composite Line Post Insulator. 976mm long mounting stool. For use with cat 346405.	1091010487 sht.40

346407	33kV Horizontal Stool for use with 33kV Composite Line Post Insulator. 1000mm long mounting stool. For use with cat 346405.	1091010487 sht.41
346402	66kV Universal Vertical/Horizontal Composite Line Post Insulator. 21kN SCL, 930mm high mounted on 127mm PCD flange, 140kV Wet withstand, 325kV Dry Lightning Withstand complete with universal trunnion clamp bracket and trunnion clamp that allows both side and top mounting for use on 66kV OHL9/OHL10 Intermediate supports.	1091010487 sht.36
346403	66kV Vertical Stool for use with 33kV Composite Line Post Insulator. 646mm long mounting stool. For use with cat 346402.	1091010487 sht.38
346404	66kV Horizontal Stool for use with 33kV Composite Line Post Insulator. 670mm long mounting stool. For use with cat 346402.	1091010487 sht.39
251551	132kV Vertical Composite Line Post Insulator. 21kN SCL, 1584mm high mounted on 127mm PCD flange, 375kV Wet withstand, 650kV Dry Lightning Withstand complete with trunnion clamp for use on 132kV OHL9/OHL10 Intermediate supports	1091010487 sht.18
251550	Stool 132kV Vertical (Pilot Insulator) Stool for use with 132kV Composite Line Post Insulator. 300mm long mounting stool. For use with cat 251551.	1091010487 sht.34
251548	132kV Horizontal Composite Line Post Insulator. 21kN SCL, 1616mm long, 375kV Wet withstand, 650kV Dry Lightning Withstand complete with trunnion clamp and designed for mounting into a bendable pole base or directly into pole top steelwork for use on 132kV OHL9/OHL10 Intermediate supports	1091010487 sht.16 item 1
251549	Bendable base for 33-132kV Horizontal Composite Line Post Insulators. Designed to mount and orientate 33,66 or 132kV horizontal line post insulators 17° above the horizontal.	1091010487 sht.16 item 2
253702	66kV Composite Pilot Post Insulator. 10kN SCL, 795mm high, 140kV Wet withstand, 325kV Dry Lightning Withstand, with trunnion clamp c/w with Single 50mm Mounting Stud.	1091010487 Sht.12

Composite Suspension String Insulators – 66kV (OHL4 - CE/C/37 Specifications)

Cat. No	Description	Drawing Number
Info Only	33KV Composite Suspension Insulator Assembly for OHL4 or CE/C/37 construction see cat **216150**	1091010487 sht. 23 1091010488 sht. 6
251542	66kV Composite Suspension Insulator Assembly for OHL4 or CE/C/37 construction. 70kN SML, based on (5x140mm) 700mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide an **Approach Arc Gap** of 440mm. **Note for Normal/Unearthed sites the top arcing horn is not required, hence former use of cat 251541 satisfied by this item**	1091010487 sht. 20 1091010488 sht. 6
251555	66kV Composite Suspension Insulator Assembly for OHL4 or CE/C/37 construction. 70kN SML, based on (5x127mm) 635mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide an **Approach Arc Gap** of 440mm.	TBA

Composite Tension String Insulators – (33, 66 &132kV) for use on OHL4 / CE/C/37 & OHL9/10 Specifications

Cat. No	Description	Drawing Number
Info Only	33kV Composite Tension Insulator. 125kN SML, for use on (CE/C/37 Tension and OHL9/10 Tension Supports (All situations) – see cat 251546	TBA
251539	66kV Composite Tension Insulator Assembly for (CE/C/37, OHL9/10 & OHL4) construction, 120kN SML, based on (5x178mm) 890mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 20mm ball/socket end fittings supplied c/w ball ended eye link fitting (fig 13 ref28/30), socket tongue (fig 26, ref 28/36B) and arcing horns to provide an **Approach Arc Gap** of 440mm	1091010487 sht. 21 1091010488 sht. 9
251536	66kV Composite Tension Insulator Assembly for (CE/C/37, OHL9/10 & OHL4) construction, 120kN SML, based on (5x178mm) 890mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 20mm ball/socket end fittings supplied c/w ball ended eye link fitting (fig 13 ref28/30), socket tongue (fig 26, ref 28/36B) and arcing horns to provide an **Normal Arc Gap** of 540mm	1091010487 sht. 21 1091010488 sht. 9
251559	66kV Composite Tension Insulator Assembly for (CE/C/37, OHL9/10 & OHL4) construction, 70kN SML, based on (5x140mm) 700mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 16mm ball/socket end fittings supplied c/w ball ended eye link fitting (fig 13 ref 15/30), socket tongue (fig 26, ref 15/35) and arcing horns to provide an **Approach Arc Gap** of 440mm	1091010487 sht. 20 1091010488 sht. 8
251560	66kV Composite Tension Insulator Assembly for (CE/C/37, OHL9/10 & OHL4) construction, 70kN SML, based on (5x140mm) 700mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 16mm ball/socket end fittings supplied c/w ball ended eye link fitting (fig 13 ref 15/30), socket tongue (fig 26, ref 15/35) and arcing horns to provide an **Normal Arc Gap** of 540mm	1091010487 sht. 20 1091010488 sht. 8
251553	132kV Composite Tension Insulator Assembly for (OHL9/10) construction, 120kN SML, based on (9x178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from Earth End Shackle to Live End socket tongue, including arcing horns for **Approach Arc gap** (1000mm gap) but excluding compression terms	1091010487 sht. 29 1091010487 sht. 31
251552	132kV Composite Tension Insulator Assembly for (OHL9/10) construction, 125kN SML, based on (9x178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from Earth End Shackle to Live End socket tongue, including arcing horns for **Normal Arc gap** (1175mm gap) but excluding compression terms	1091010487 sht. 29 1091010487 sht. 30

Composite Post Insulators Arcing Horn Kits (66 – 132kV Wood Pole Lines)

Cat. No	Description	Drawing Number
Info Only	Arcing Horn Kit and extension Arc Horn for application onto item insulator drawing (1091010487 sht. 18) Vertical Line Post Insulators in approach zones only (Excludes Insulator) as per arrangement drawing **(refer to cat number** 346397**)**	1091010487 sht.32
Info Only	Arcing Horn Kit and extension Arc Horn for application onto insulator drawing (1091010487 sht.16) Horizontal Line Post Insulators in approach zones only (Excludes Insulator) as per arrangement drawing **(refer to cat number** 346398**)**	1091010487 sht.33

Suspension Insulator String Assemblies – (66 -132kV Tower/Mast Lines)

Cat. No	Description	Drawing Number
251535	66kV Composite Suspension Insulator Assembly (Towers). 70kN SML, based on (5x140mm) 700mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide an **Approach Arc Gap** of 440mm.	1091010487 sht. 20 1091010428 sht. 7
251534	66kV Composite Suspension Insulator Assembly (Towers). 70kN SML, based on (5x140mm) 700mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide a **Normal Arc Gap** of 540mm.	1091010487 sht. 20 1091010428 sht. 7
251533	132kV Composite Suspension Insulator Assembly (Towers). 70kN SML, based on (11x140mm) 1540mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 3625mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide an **Approach Arc Gap** of 1000mm.	1091010428 sht. 7
251561	132kV Composite Suspension Insulator Assembly (Towers). 70kN SML, based on (11x140mm) 1540mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 3625mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide a **Normal Arc Gap** of 1175mm.	1091010428 sht. 7
251562	132kV Composite Suspension Insulator Assembly **Reduced Clearance** (Towers). 70kN SML, based on (9x140mm) 1260mm spacing, 275kV Wet Withstand, 555kV Dry Lightning Withstand, 3625mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide an **Approach Arc Gap** of 925mm.	1091010428 sht. 7
251531	132kV Composite Suspension Insulator Assembly **Reduced Clearance** (Towers). 70kN SML, based on (9x140mm) 1260mm spacing, 275kV Wet Withstand, 555kV Dry Lightning Withstand, 3625mm min. creep, 16mm ball/socket end fittings supplied c/w ball ended hook (fig 11 ref 15/32), socket clevis (fig21 Ref 15/31A) and arcing horns to provide a **Normal Arc Gap** of 1025mm.	1091010428 sht. 7

Tension Insulator String Assemblies – (66 -132kV Tower/Mast Lines)

Cat. No.	Purpose for Insulator assembly	Drawing Number
251530	66kV Composite Tension Insulator Assembly for Tower Lines. 120kN SML, based on (5 x 178mm) 890mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from Earth End Shackle to Live End Socket Tongue, including arcing horns to provide for **Approach Arc Gap** of 440mm. Excluding sag adjusters	1091010428 sht. 8 66kV version
251563	66kV Composite Tension Insulator Assembly for Tower Lines. 120kN SML, based on (5 x 178mm) 890mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from Earth End Shackle to Live End Socket Tongue, including arcing horns to provide for **Normal Arc Gap** of 540mm. Excluding sag adjusters.	1091010428 sht. 8 66kV version
251528	132kV Composite Tension Insulator Assembly for Tower Lines. 120kN, based on (9 x 178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from Earth End Shackle to Live End Socket Tongue, including arcing horns to provide for **Approach Arc Gap** of 1000mm. Excluding sag adjusters.	1091010428 sht. 8
251564	132kV Composite Tension Insulator Assembly for Tower Lines. 120kN, based on (9 x 178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings c/w all fittings from Earth End Shackle to Live End Socket Tongue, including arcing horns to provide for **Normal Arc Gap** of 1175mm. Excluding sag adjusters.	1091010428 sht. 8

Low Duty Downleads (66/132kV Tower/Mast Lines)

Cat. No.	Purpose for Insulator assembly	Drawing Number
251526	66kV Composite Low Duty Insulator Downlead Assemblies. To include for both upright and inverted sets - 70kN SML, based on 2 x (5 x 140mm) 700mm spacing, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 16mm ball/socket end fittings supplied c/w all fittings from ball ended eye link to Socket Clevis, including arcing horns to provide for **Approach Arc Gap** of 440mm.	1091010428 sht9 66kV version
251525	132kV Composite Low Duty Insulator Downlead Assemblies. To include both upright and inverted sets - 70kN SML, based on, 2 x (11 x 140mm) 1540mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 16mm ball/socket end fittings supplied c/w all fittings from ball ended eye link to Socket Clevis, including arcing horns to provide for **Approach Arc Gap** of 1000mm.	1091010428 sht9

Composite Insulator String Assemblies – (132kV Tower Lines – L3 / L7 Construction)

Cat No.	Purpose for Insulator assembly	Drawing Number
251524	132kV Composite Tension Insulator Assembly – (Twin Lynx Tower Lines) - 120kN SML, based on 2 x (9 x 178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings c/w all fittings from earth end shackle to live end socket Tongue, including arcing horns to provide for **Approach Arc Gap** of 1000mm. Excluding sag adjusters	1091010428 sht10
251523	132kV Composite Tension Insulator Assembly – (Twin Lynx Tower Lines) - 120kN SML, based on 2 x (9 x 178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings c/w all fittings from earth end shackle to live end socket Tongue, including arcing horns to provide for **Normal Arc Gap** of 1175mm. Excluding sag adjusters	1091010428 sht10
251522	132kV Composite Suspension Insulator Assembly – (Twin Lynx or single large conductor Tower Line) 120kN SML, based on (11 x 171mm) 1881mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings c/w all fittings from earth end shackle to live end socket clevis, including arcing horns to provide an **Approach Arc Gap** of 1000mm.	1091010428 sht. 11
251521	132kV Composite Suspension Insulator Assembly – (Twin Lynx or single large conductor Tower Line) 120kN SML, based on (11 x 171mm) 1881mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings c/w all fittings from earth end shackle to live end socket clevis, including arcing horns to provide for **Normal Arc Gap** of 1175mm.	1091010428 sht. 11
251520	132kV Composite Low Duty Downlead Insulator Assembly – (Twin Lynx or single large conductor Tower Line) 120kN SML, based on (11 x 171mm) 1881mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings c/w all fittings from ball ended eye link to Socket Clevis for both upright and inverted insulator assemblies, including arcing horns to provide for **Approach Arc Gap** of 1000mm.	1091010428 sht. 12
251519	132kV Composite Tension Insulator Assembly – (Single large Conductor 190kN) - 190kN SML, based on (9 x 178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 24mm ball/socket end fittings c/w all fittings from earth end shackle to live end socket Tongue, including arcing horns to provide for **Approach Arc Gap** of 1000mm. Excluding sag adjusters	1091010428 sht13
251565	132kV Composite Tension Insulator Assembly – (Single large Conductor 190kN) - 190kN SML, based on (9 x 178mm) 1602mm spacing, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 24mm ball/socket end fittings c/w all fittings from earth end shackle to live end socket Tongue, including arcing horns to provide for **Normal Arc Gap** of 1175mm. Excluding sag adjusters.	1091010428 sht13

Glass and Porcelain Discs – as detailed in ENA TS 43-93 Fig. 5.6

Cat No.	Purpose for Insulator assembly	Drawing Number
250529	Glass Disk 254mm x 140mm, 70kN SML with 16mm Ball/Socket coupling	1091010484 Sht. 2 and ENA TS 43-93 fig 14a
253476	Glass (Anti-Fog) Disc 254mm x 140mm, 70kN SML, with 16mm Ball/Socket Couplings	1091010485 sht. 3 and ENA TS 43-93 fig 14b
253616	Porcelain Disc 285mm x 140mm, 70kN SML, Standard, Anti-Fog suspension with 16mm Ball/Socket coupling (66/132kv lines)	1091010485 sht. 4 and and ENA TS 43-93 fig 14b
253584	Grey Porcelain Tension Disc 292mm x 178mm, 125kN SML with 20mm Ball/Socket coupling	1091010485 sht. 8 and ENA TS 43-93 fig 14c
253438	Glass Tension Disc 280mm x 178mm, 125kN SML, with 20mm Ball/Socket couplings (66/132kv lines)	1091010485 sht. 2
216911	Brown Porcelain Disc 318mm x 171mm, 125kN SML, Low Duty suspension disc with 20mm Ball/Socket Couplings (66/132kv lines)	Y707L0707
216820	Glass Tension Disc 305mm x 200mm, 190kN SML, (132kV Zebra or Rubas lines)	Y707L0703

Stay Insulators – All Voltages

Cat. No	System Voltage (kV)	Description	Drawing Number
248232	0.24 to 20 Unearthed All voltage Earthed	Stay Insulator Porcelain designed in accordance with ENA TS 43-91 Type 1 (Brown)	ENA TS 43-91 Fig.3 Type 1 or 1000439107 Sheet 1-Item 1.
253743	33 to 66 Unearthed	Stay Insulator Porcelain designed in accordance with ENA TS 43-91 Type 2 (Brown)	ENA TS 43-91 Fig.3 Type 2 or 1000439107 Sheet 1-Item 2
346596	66kV Unearthed	66kV Composite Tension Stay Insulator (Unearthed Supports), 120kN SML, based on 1610mm long, 140kV Wet Withstand, 325kV Dry Lightning Withstand, 1268mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from the earthed end 90° Shackle to the live end shackle including arcing horns as shown on drawing 1091010372 sht2.	1091010372 sht2. Item 2
251547	132kV Unearthed	66kV Composite Tension Stay Insulator (Unearthed Supports), 120kN SML, based on 890mm long, 275kV Wet Withstand, 650kV Dry Lightning Withstand, 2538mm min creep, 20mm ball/socket end fittings supplied c/w all fittings from the earthed end 90° Shackle to the live end shackle including arcing horns as shown on drawing 1091010372 sht2.	1091010372 sht 2, Item 1

Low Voltage Line and Service Insulators

Cat. No	Description	Drawing Number
253917	Low Voltage Reel Insulator, Brown Porcelain or MDPE Material	1000439304 or ENA TS 43-93 Fig.16
253866	Low Voltage Coach Screw Service Insulator, Brown Porcelain or MDPE Material	1000439305 or ENA TS 43-93 Fig. 17

Triggered Spark Gap

Cat. No	System Voltage (kV)	Triggered Gap (mm)	Main Arc Gap (mm)	Drawing Number
242471	11	3	25	1091010603 Sht. 1
242537	20 and 33	10	35 - 48	1091010603 Sht. 2

Appendix 2 - Material Composition

Northern Powergrid Commodity Code	

Material Composition	Minimum % per weight	Supplier of Materials
Silicon Polymer		
Filler		
Additional Pigments		
Type of Glass Rod		

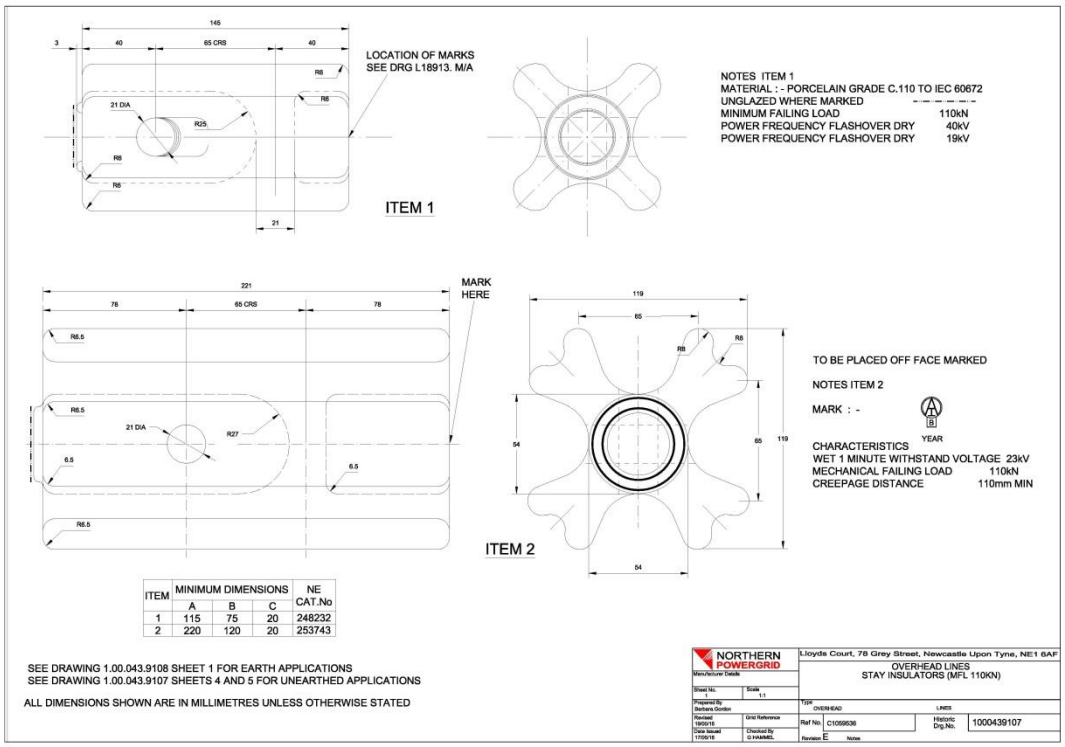
**** Appendix 2 must be completed by all Suppliers ****

Appendix 3 – Insulator Technical Details

Manufacturers Product Ref	
Northern Powergrid Commodity Code	
Insulator Type (Post / Tension / Suspension) etc	
Insulator Material	
Insulator Mechanical Rating (SML or SCL) kN	
Insulator Length (mm)	
Insulator Wet Power frequency Withstand (kV)	
Insulator Dry Lightning Impulse Withstand (kV)	
Insulator Dry Arcing distance (mm)	
Insulator Creepage distance (mm)	
Post or Rod Insulator Core Diameter (mm)	
Insulator Colour	
No of sheds	
Insulator Ball/Socket Coupling Size (mm)	
Insulator Weight (kg)	
Manufacturing Location	

The above schedule shall be completed for each insulator being supplied

Appendix 4 – Typical Insulator Drawings



ITEM	MINIMUM DIMENSIONS			NE CAT.No
	A	B	C	
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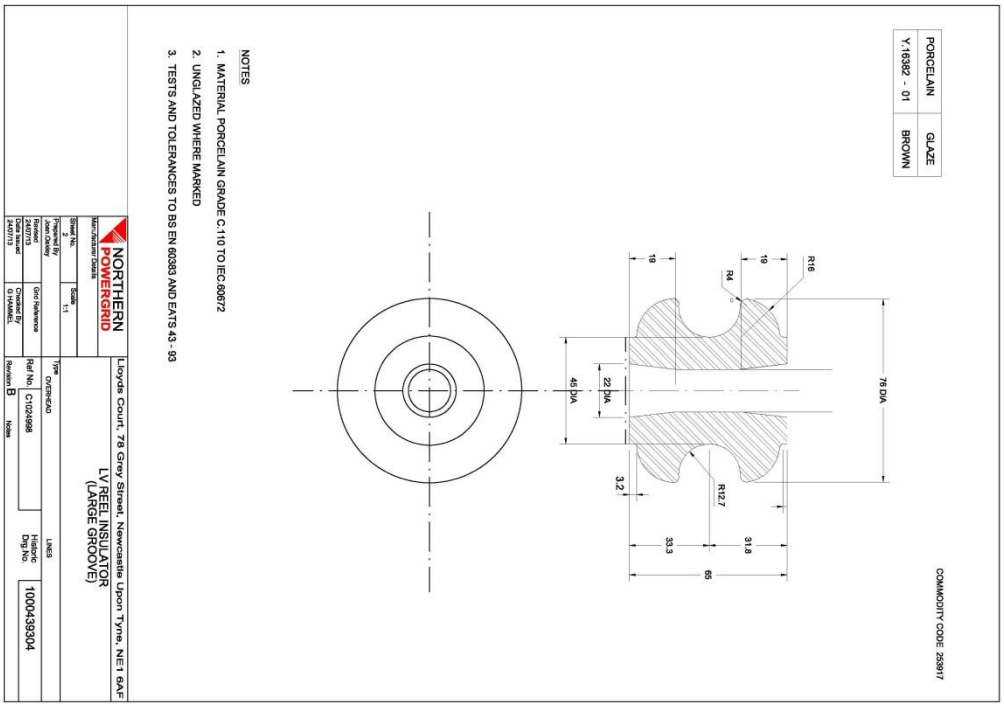
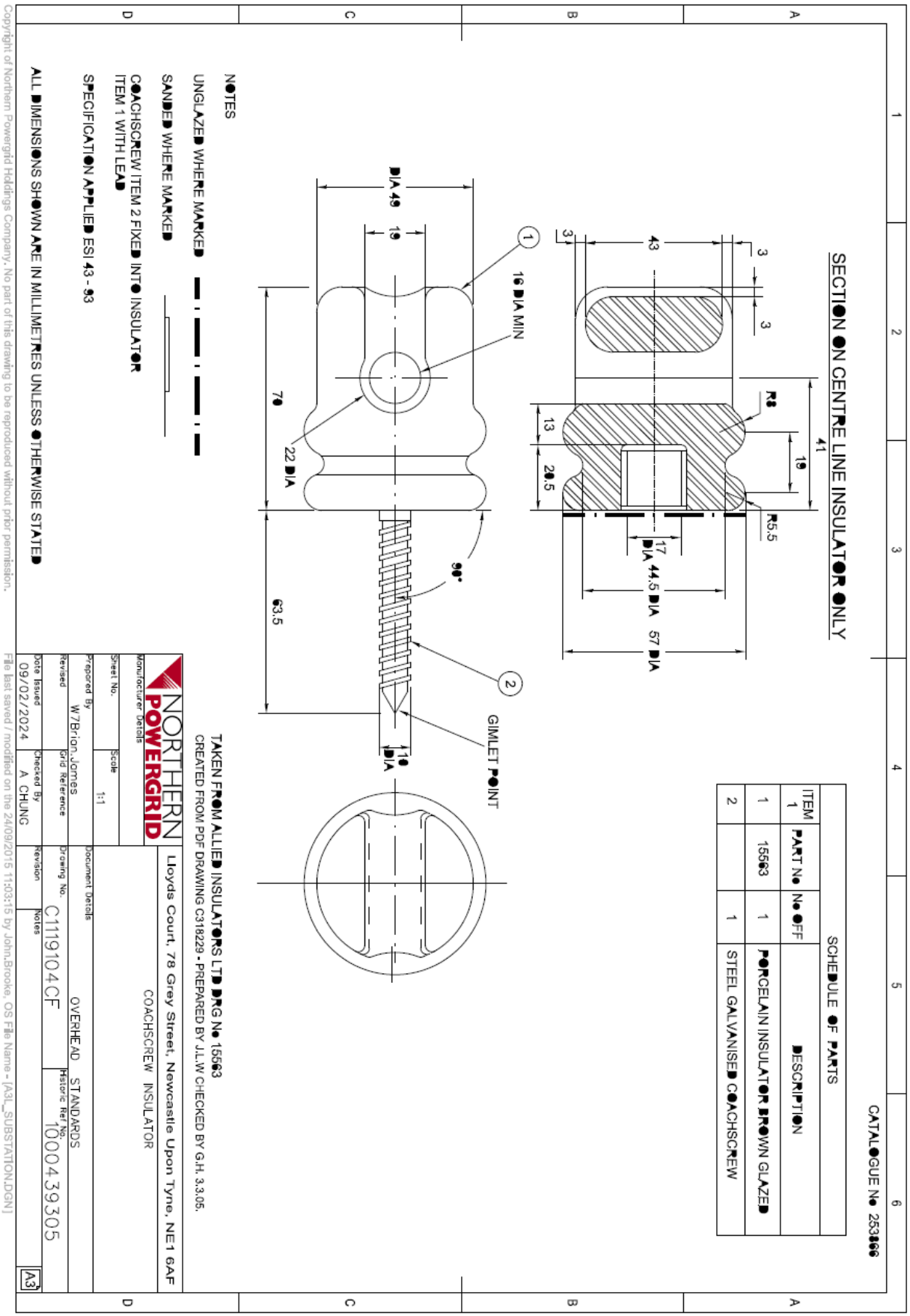
2	220	120	20	253743




SECTION ON CENTRE LINE INSULATOR ONLY
CATALOGUE No 253866
SCHEDULE OF PARTS
ITEM 1 | PART No | No OFF | DESCRIPTION
1 | 15563 | 1 | PORCELAIN INSULATOR BROWN GLAZED
2 | | 1 | STEEL GALVANISED COACHSCREW
NOTES
UNGLAZED WHERE MARKED
SANDED WHERE MARKED
COACHSCREW ITEM 2 FIXED INTO INSULATOR ITEM 1 WITH LEAD
SPECIFICATION APPLIED ESI 43 - 93
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
TAKEN FROM ALLIED INSULATORS LTD DRG No 15563
CREATED FROM PDF DRAWING C318229 - PREPARED BY J.L.W CHECKED BY G.H. 3.3.05.
GIMLET POINT
90°
63.5
16 DIA MIN
DIA 4.9
19
70
22 DIA
11.9 DIA
43
41
19
13
20.5
R8
R5.5
17 DIA
44.5 DIA
57 DIA
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
COACHSCREW INSULATOR
Sheet No.
Scale 1:1
Prepared By W7Brion.Jones
Revised
Grid Reference
Date Issued 09/02/2024
Checked By A CHUNG
Document Details
OVERHEAD STANDARDS
Drawing No. C1119104CF
Historic Ref No. 10004 39305
Revision
Notes
A3
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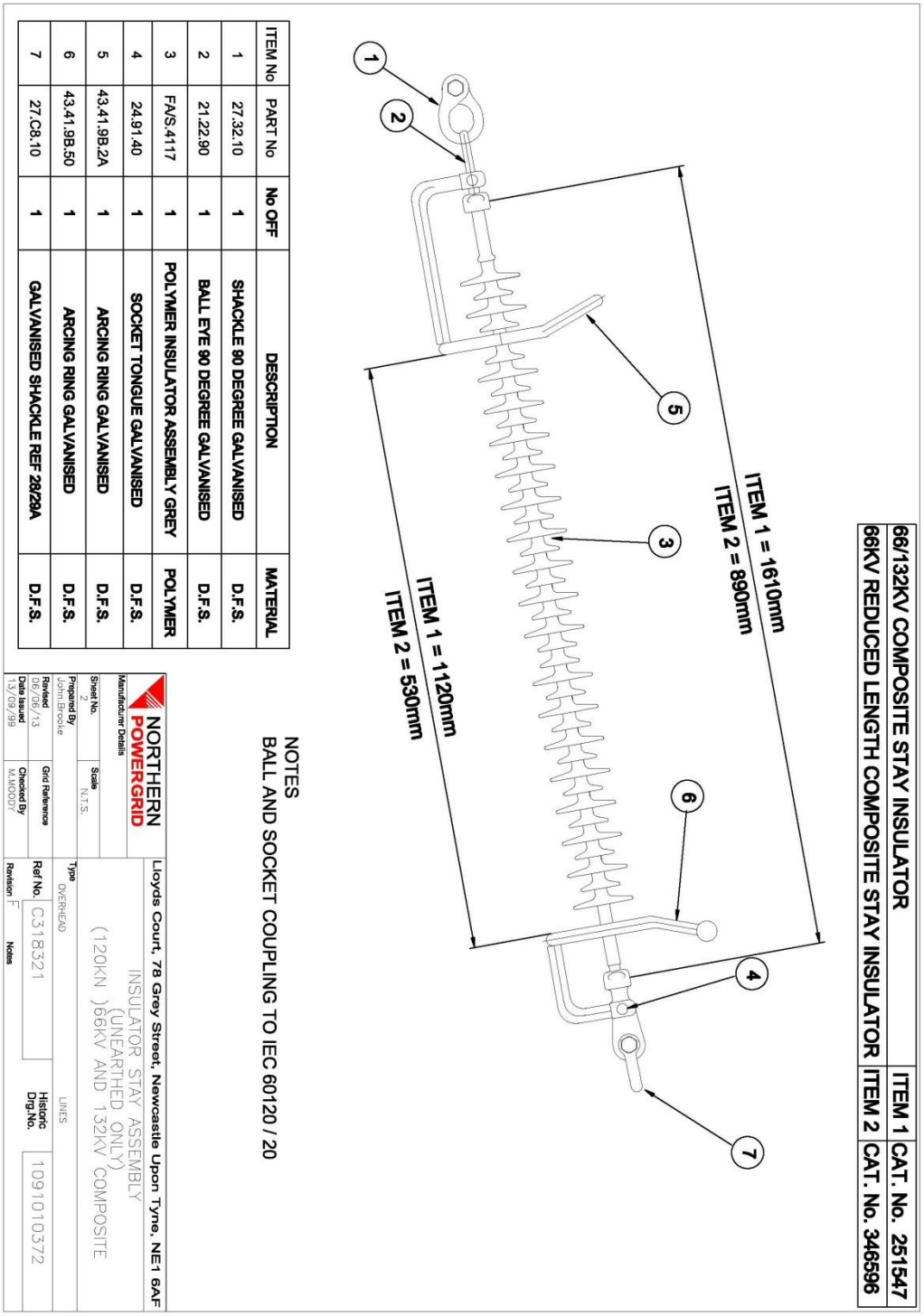
File last saved / modified on the 24/09/2015 11:03:15 by John.Brooke. OS File Name - [A3L_SUBSTATION.DGN]



ITEM No	PART No	No OFF	DESCRIPTION	MATERIAL
1	27.32.10	1	SHACKLE 90 DEGREE GALVANISED	D.F.S.
2	21.22.90	1	BALL EYE 90 DEGREE GALVANISED	D.F.S.
3	FA/S.4117	1	POLYMER INSULATOR ASSEMBLY GREY	POLYMER
4	24.91.40	1	SOCKET TONGUE GALVANISED	D.F.S.
5	43.41.9B.2A	1	ARCING RING GALVANISED	D.F.S.
6	43.41.9B.50	1	ARCING RING GALVANISED	D.F.S.
7	27.C8.10	1	GALVANISED SHACKLE REF 28/29A	D.F.S.

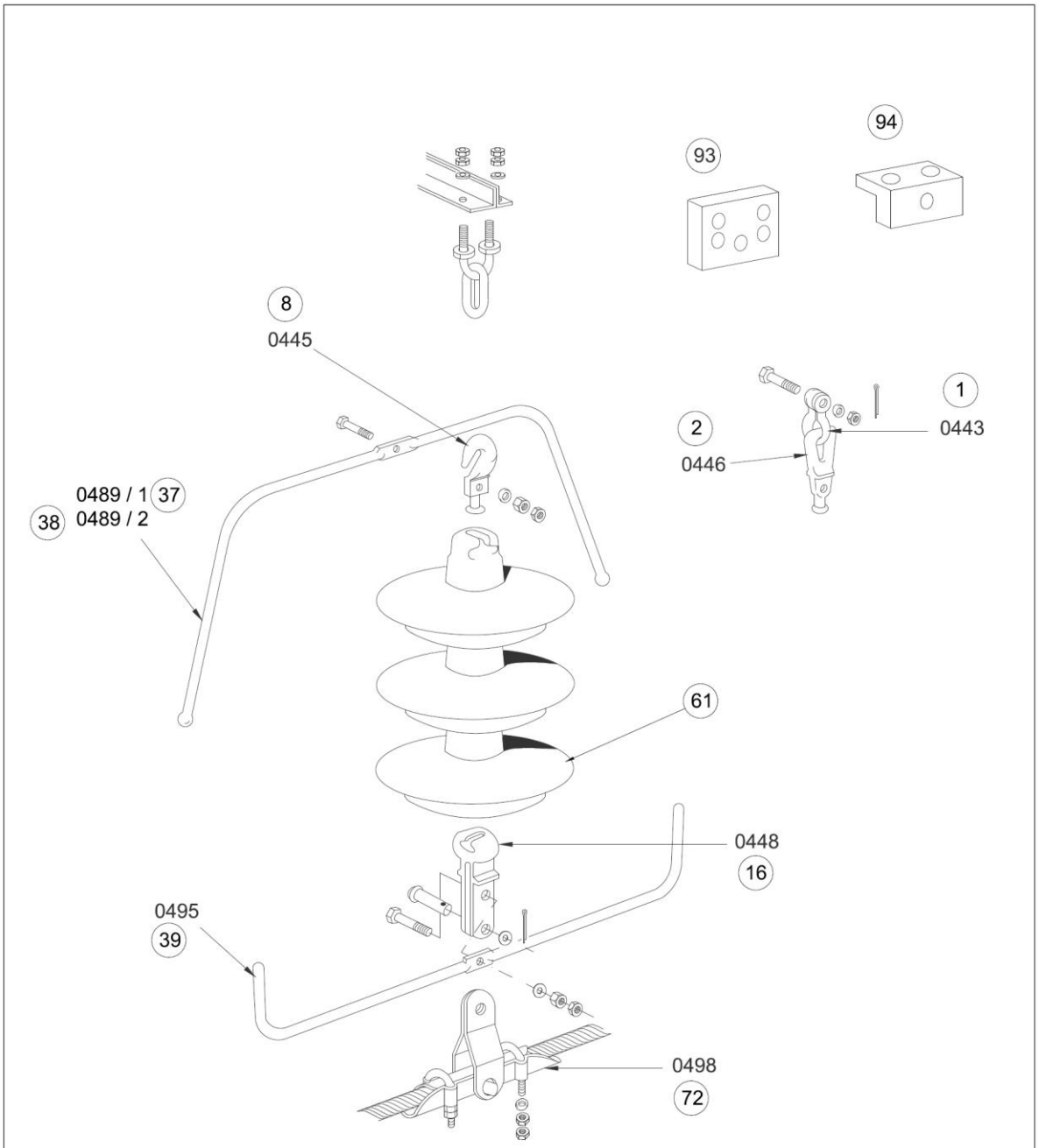
NOTES
BALL AND SOCKET COUPLING TO IEC 60120 / 20

NORTHERN POWERGRID

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

INSULATOR STAY ASSEMBLY
(UNEARTHED ONLY)
(120KN)66KV AND 132KV COMPOSITE

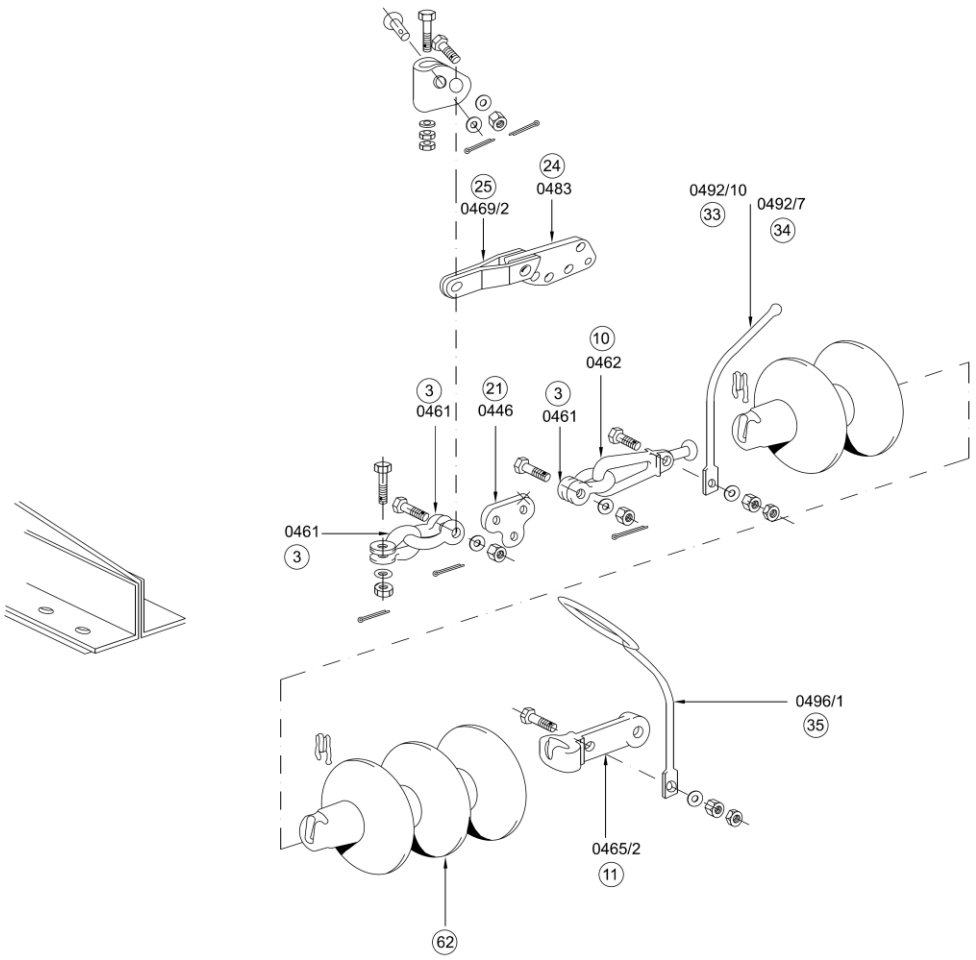
Manufacturer Details
Sheet No. 2
Scale N.T.S.
Prepared By John.Brooke
Revised 06/06/13
Date Issued 13/09/99
Grid Reference
Checked By M.MOODY
Type OVERHEAD LINES
Ref No. C318321
Revision F
Notes
Historic Drg.No. 1091010372



ITEM NoS REFER TO 1.09.101 SERIES OF COMPONENT DRAWINGS
(WHERE AVAILABLE)

FORMERLY DRAWING Y707L0704

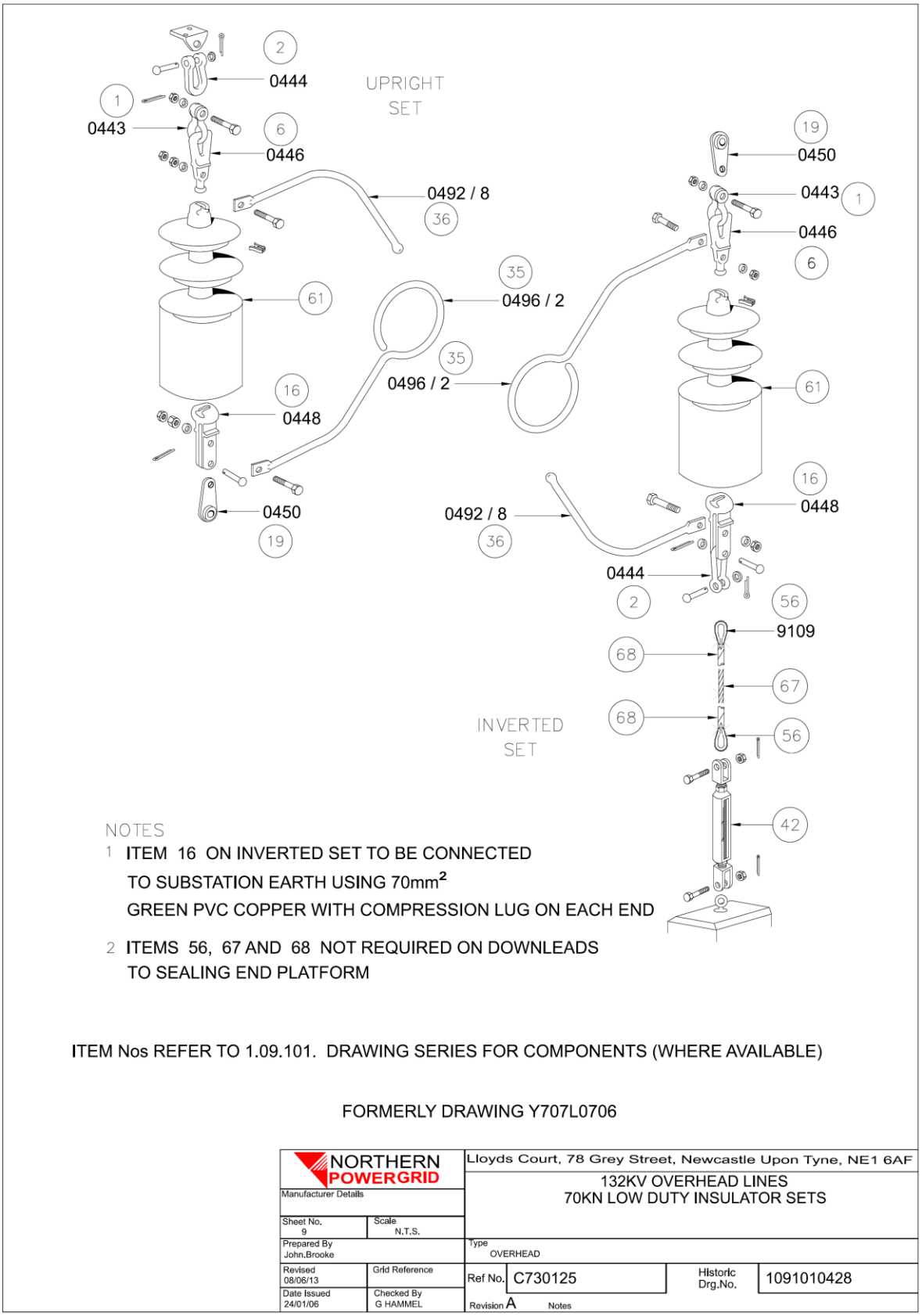
NORTHERN POWERGRID Manufacturer Details	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF 132KV OVERHEAD LINES 70KN SUSPENSION INSULATOR SET
Sheet No. 7 / Scale N.T.S.	
Prepared By John.Brooke	Type OVERHEAD
Revised 08/06/13 / Grid Reference	Ref No. C729204 / Historic Drg.No. 1091010428
Date Issued 24/01/06 / Checked By	Revision A Notes

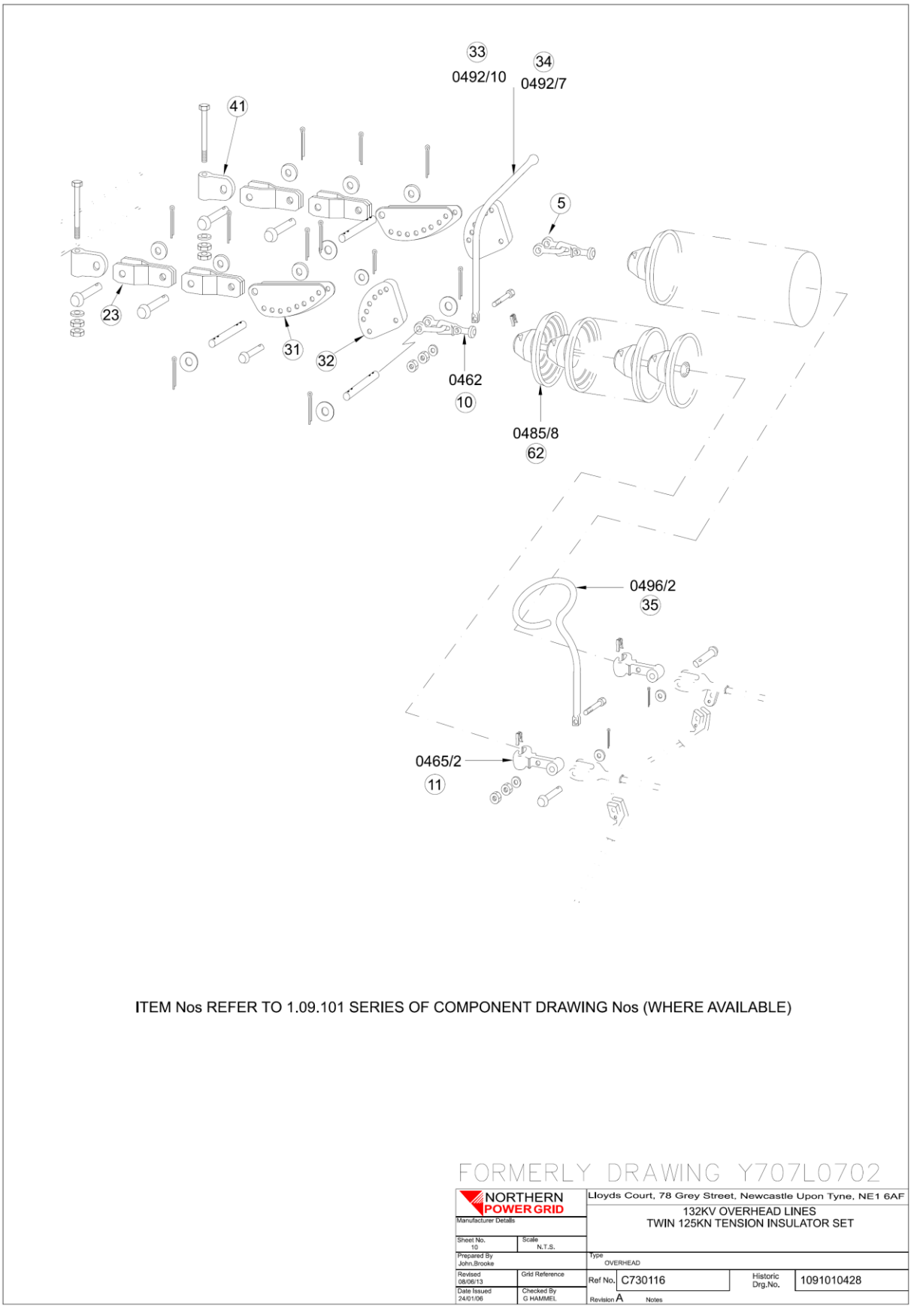


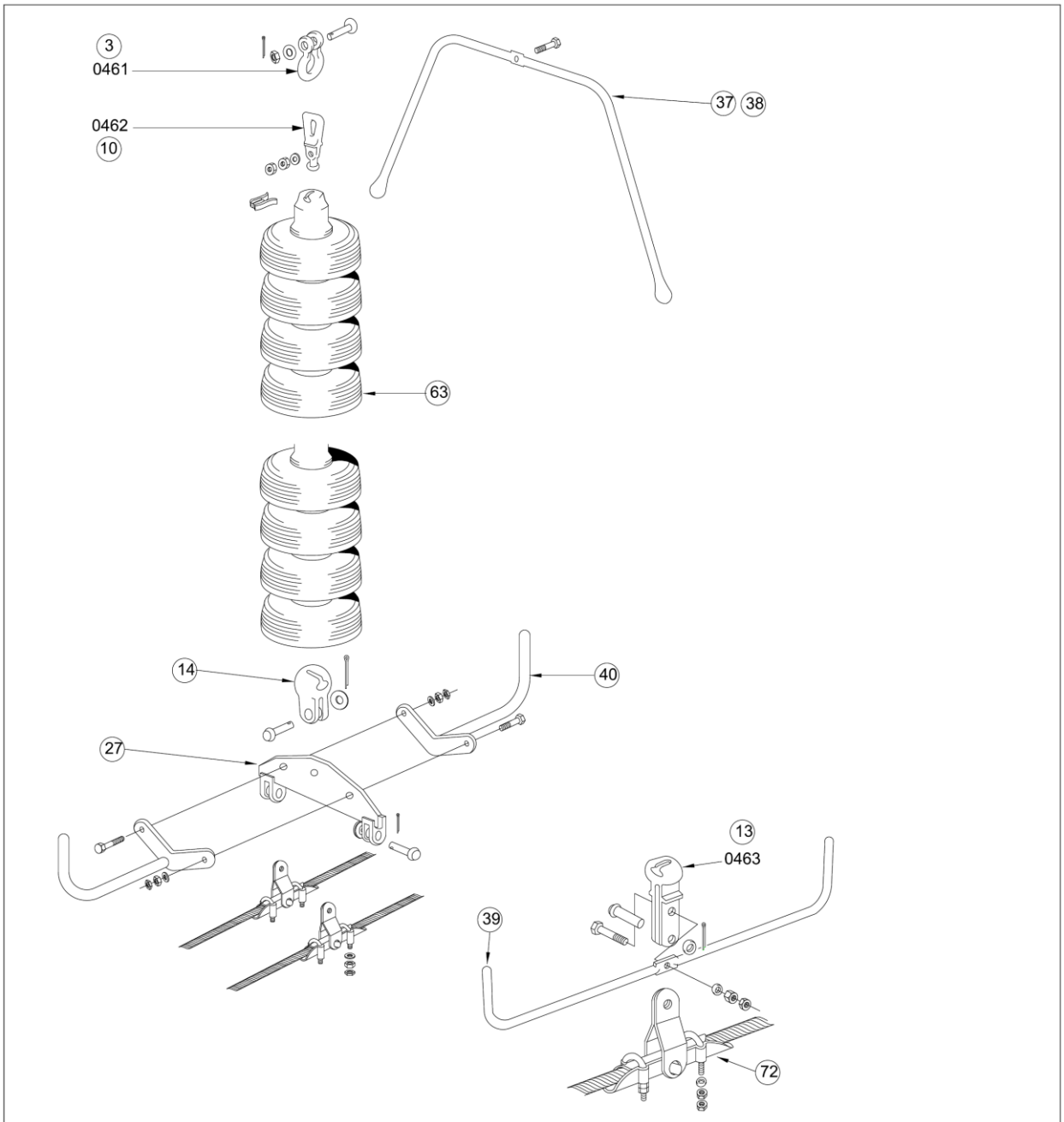
ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DRAWINGS (WHERE AVAILABLE)

FORMERLY DRAWING Y707L0701

NORTHERN POWERGRID Manufacturer Details	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF 132KV OVERHEAD LINES 125KN TENSION INSULATOR SET
Sheet No. 8 / Scale N.T.S.	
Prepared By John.Brooke	Type OVERHEAD
Revised 08/06/13 / Grid Reference	Ref No. C730115 / Historic Drg.No. 1091010428
Date Issued 24/01/06 / Checked By G HAMMEL	Revision A Notes


UPRIGHT SET
INVERTED SET
0444
0443
0446
0492 / 8
0496 / 2
0448
0450
9109
NOTES
1 ITEM 16 ON INVERTED SET TO BE CONNECTED TO SUBSTATION EARTH USING 70mm² GREEN PVC COPPER WITH COMPRESSION LUG ON EACH END
2 ITEMS 56, 67 AND 68 NOT REQUIRED ON DOWNLEADS TO SEALING END PLATFORM
ITEM Nos REFER TO 1.09.101. DRAWING SERIES FOR COMPONENTS (WHERE AVAILABLE)
FORMERLY DRAWING Y707L0706
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
70KN LOW DUTY INSULATOR SETS
Sheet No. 9
Scale N.T.S.
Prepared By John.Brooke
Type OVERHEAD
Revised 08/06/13
Grid Reference
Ref No. C730125
Historic Drg.No. 1091010428
Date Issued 24/01/06
Checked By G HAMMEL
Revision A
Notes

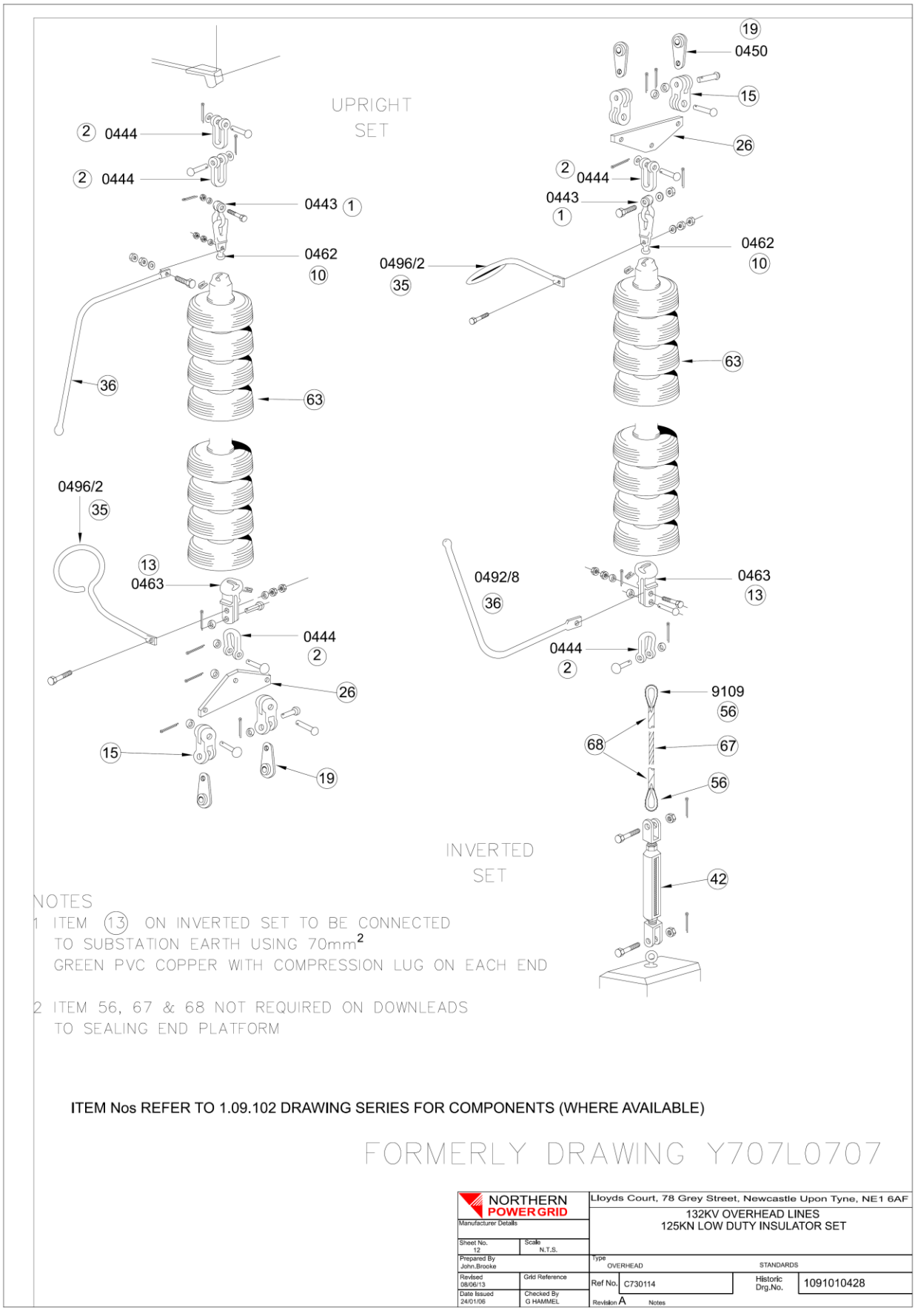

33
0492/10
34
0492/7
41
5
23
31
32
0462
10
0485/8
62
0496/2
35
0465/2
11
ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DRAWING Nos (WHERE AVAILABLE)
FORMERLY DRAWING Y707L0702
NORTHERN POWER GRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
TWIN 125KN TENSION INSULATOR SET
Sheet No. 10
Scale N.T.S.
Prepared By John.Brooke
Type OVERHEAD
Revised 08/06/13
Grid Reference
Ref No. C730116
Historic Drg.No. 1091010428
Date Issued 24/01/06
Checked By G HAMMEL
Revision A
Notes

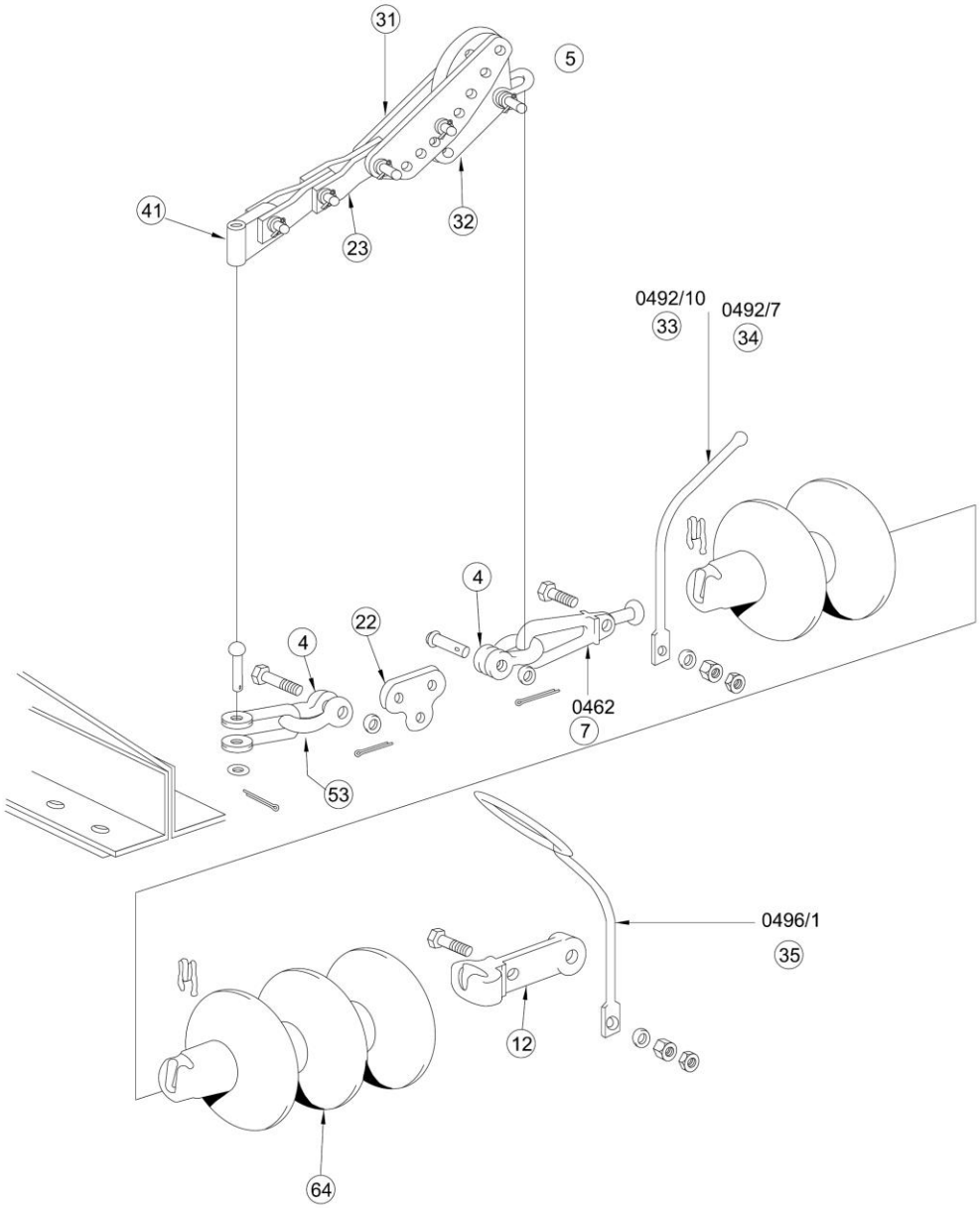


ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DRAWINGS (WHERE AVAILABLE)

FORMERLY DRAWING Y707L0705

NORTHERN POWER GRID Manufacturer Details	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF 132KV OVERHEAD LINES 125KN SUSPENSION INSULATOR SET
Sheet No. 11 / Scale N.T.S.	
Prepared By John.Brooke	Type OVERHEAD
Revised 08/06/13 / Grid Reference	Ref No. C730124 / Historic Drg.No. 1091010428
Date Issued 24/01/06 / Checked By G HAMMEL	Revision A Notes

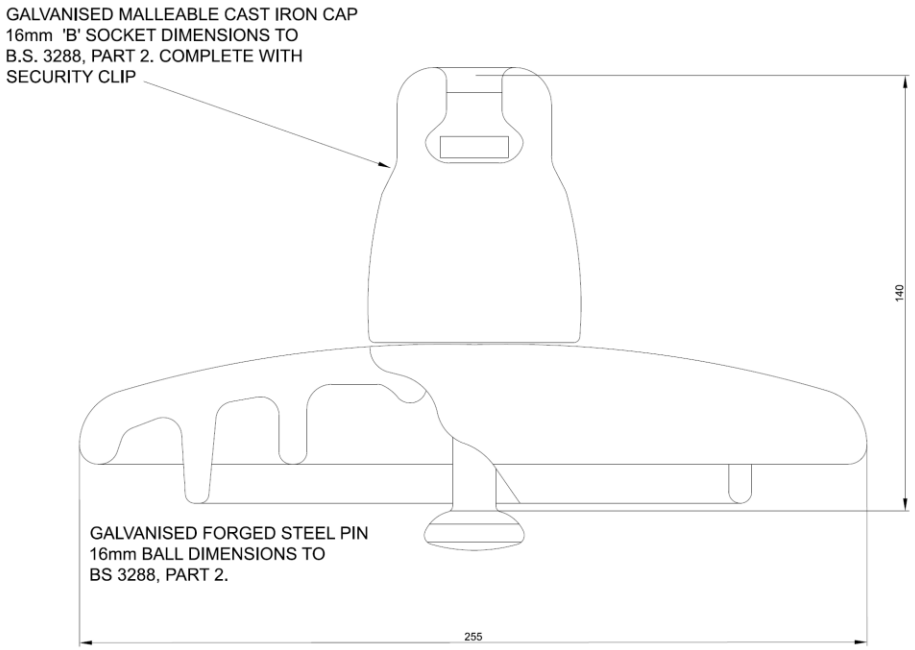

UPRIGHT SET
2 0444
2 0444
0443 1
0462 10
36
63
0496/2 35
13 0463
0444 2
26
15
19
INVERTED SET
19 0450
15
26
2 0444
0443 1
0462 10
0496/2 35
63
0492/8 36
0463 13
0444 2
9109 56
68
67
56
42
NOTES
1 ITEM 13 ON INVERTED SET TO BE CONNECTED TO SUBSTATION EARTH USING 70mm² GREEN PVC COPPER WITH COMPRESSION LUG ON EACH END
2 ITEM 56, 67 & 68 NOT REQUIRED ON DOWNLEADS TO SEALING END PLATFORM
ITEM Nos REFER TO 1.09.102 DRAWING SERIES FOR COMPONENTS (WHERE AVAILABLE)
FORMERLY DRAWING Y707L0707
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
125KN LOW DUTY INSULATOR SET
Sheet No. 12
Scale N.T.S.
Prepared By John.Brooke
Type OVERHEAD
STANDARDS
Revised 08/06/13
Grid Reference
Ref No. C730114
Historic Drg.No. 1091010428
Date Issued 24/01/06
Checked By G HAMMEL
Revision A
Notes



ITEM Nos REFER TO 1.09.101 SERIES OF COMPONENT DGNS (WHERE AVAILABLE)

FORMERLY DRAWING Y707L0703

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF 132KV OVERHEAD LINES 190KN TENSION INSULATOR SET
Sheet No. 13	Scale N.T.S.	
Prepared By John.Brooke		Type OVERHEAD
Revised 08/06/13	Grid Reference	Ref No. C730123 / Historic Drg.No. 1091010428
Date Issued 24/01/06	Checked By G HAMMEL	Revision A Notes



TYPICAL PROFILE BASED ON DRG No DK 10001

NOTES

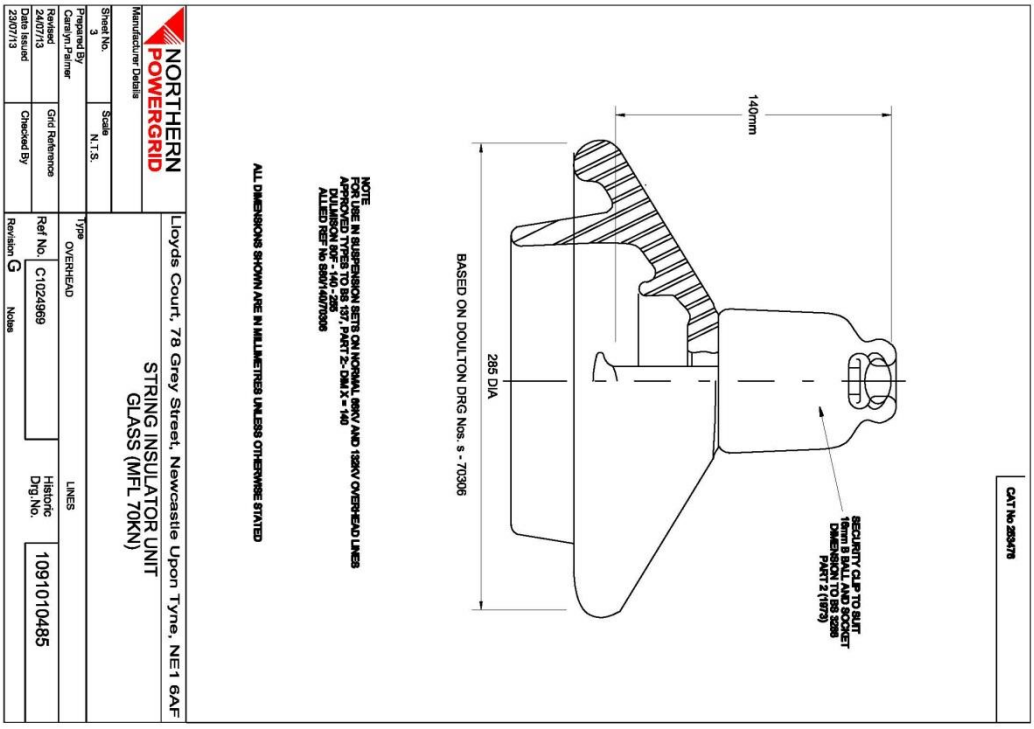
1. FOR USE IN NORMAL SITUATIONS ON 11kV, 20kV, 33kV AND 66kV TENSION OVERHEAD LINES

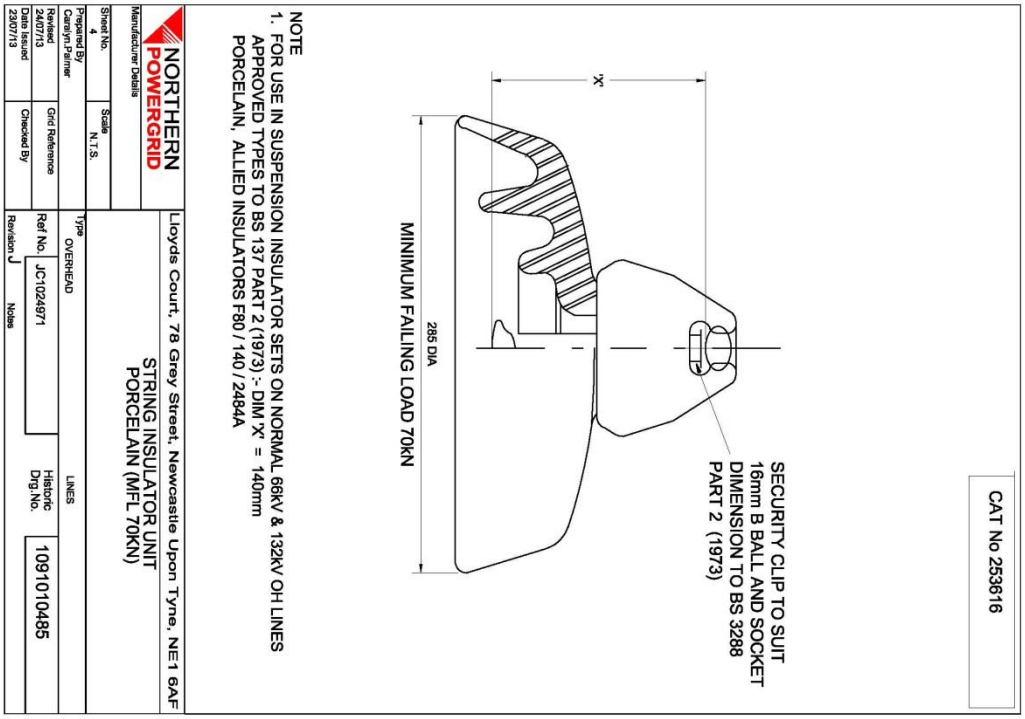
2. APPROVED TYPES TO BS 137, PART 2. GLASS ALLIED T70 / 140 / 70309
   GLASS DULMISION 80N - 140 - 255 (DRG No DK.10001)

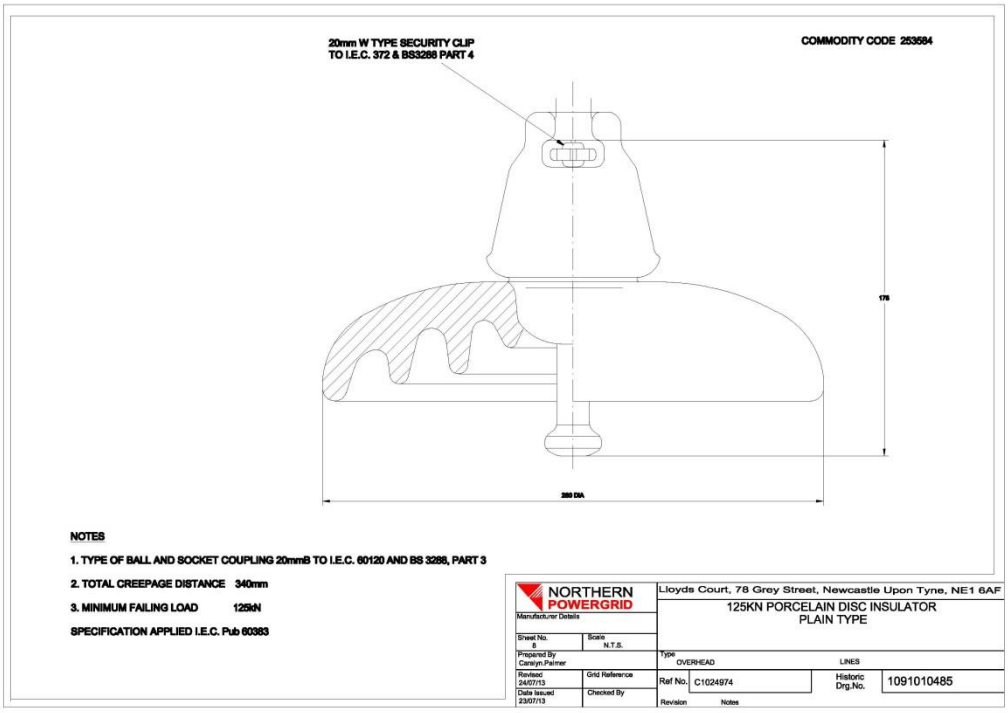
3. SUPERCEDES DOULTON P70G / 140

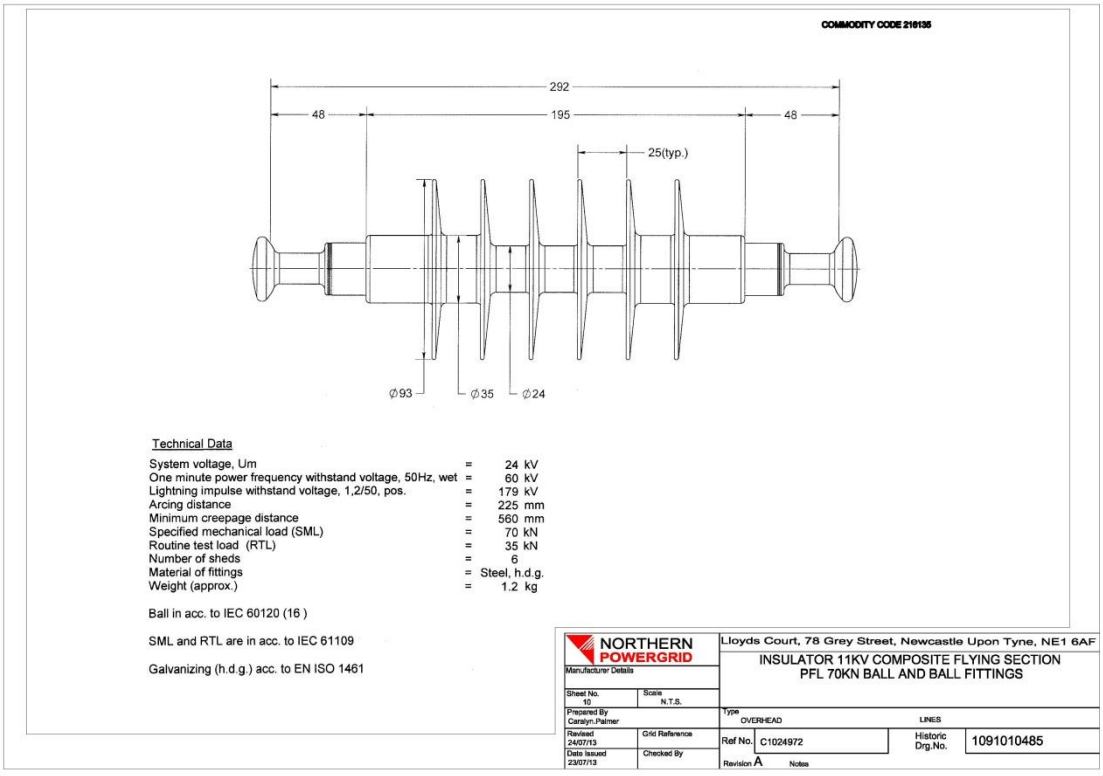
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

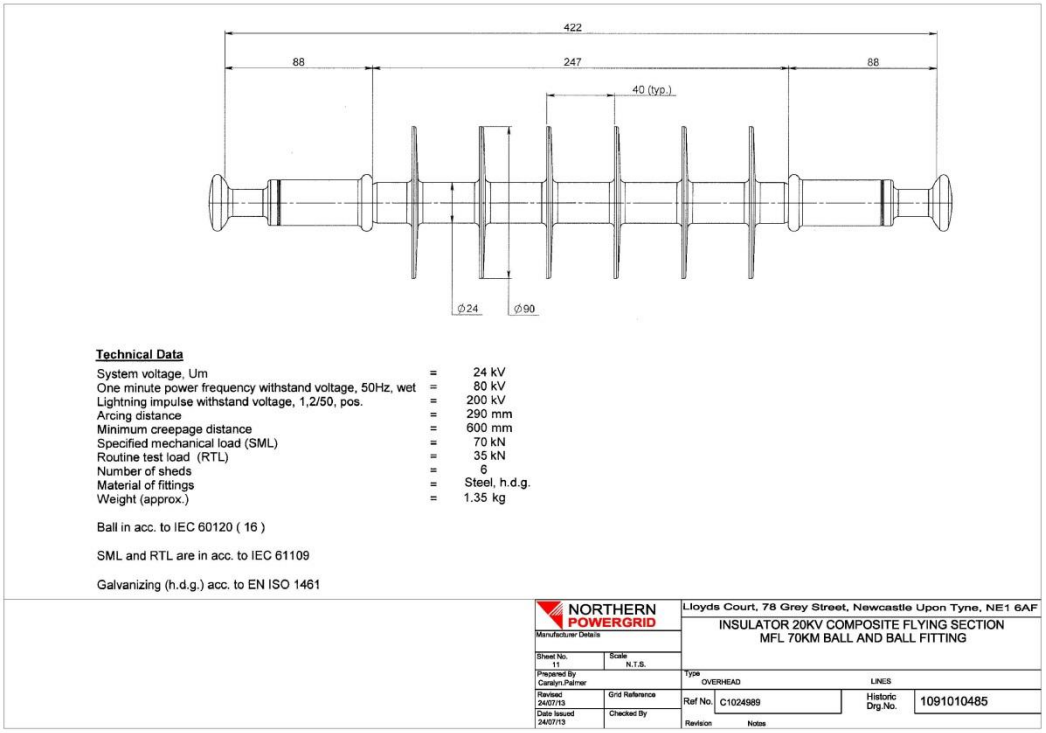
NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF STRING INSULATOR UNIT (140MM SPACING) GLASS MFL 70KN
Sheet No. 2	Scale 1:1	
Prepared By Caralyn.Palmer		Type OVERHEAD LINES
Revised 24/07/13	Grid Reference	Ref No. C1025007 / Historic Drg.No. 1091010484
Date Issued 24/07/13	Checked By	Revision G Notes


CAT No 253616
140mm
285 DIA
BASED ON DOULTON DRG Nos. s - 70306
SECURITY CLIP TO SUIT
16mm B BALL AND SOCKET
DIMENSION TO BS 3288
PART 2 (1973)
NOTE
FOR USE IN SUSPENSION SETS ON NORMAL 66KV AND 132KV OVERHEAD LINES
APPROVED TYPES TO BS 137, PART 2:- DIM X = 140
ALLIED PORCELAIN
ALLIED REF No 6407/40/3006
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
NORTHERN POWERGRID
Manufacturer Details
Street No. 3
Scale N.T.S.
Prepared By Carolyn Palmer
Grid Reference
Revised 24/07/13
Checked By
Date Issued 23/07/13
Revision G
Notes
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
STRING INSULATOR UNIT
GLASS (MFL 70KN)
Type OVERHEAD LINES
Ref No. C1024969
Historic Drg No. 1091010485


CAT No 253616
SECURITY CLIP TO SUIT
16mm B BALL AND SOCKET
DIMENSION TO BS 3288
PART 2 (1973)
'X'
285 DIA
MINIMUM FAILING LOAD 70kN
NOTE
1. FOR USE IN SUSPENSION INSULATOR SETS ON NORMAL 66kV & 132kV OH LINES
APPROVED TYPES TO BS 137 PART 2 (1973) :- DIM 'X' = 140mm
PORCELAIN, ALLIED INSULATORS F80 / 140 / 2484A
NORTHERN POWERGRID
Manufacturer Details
Street No. 1
Scale N.T.S.
Prepared By Carolyn Palmer
Grid Reference
Revised 24/07/13
Checked By
Date Issued 23/07/13
Revision J
Notes
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
STRING INSULATOR UNIT
PORCELAIN (MFL 70KN)
Type OVERHEAD LINES
Ref No. JC1024971
Historic Drg.No. 1091010485


20mm W TYPE SECURITY CLIP
TO I.E.C. 372 & BS3288 PART 4
COMMODITY CODE 253584
NOTES
1. TYPE OF BALL AND SOCKET COUPLING 20mmB TO I.E.C. 60120 AND BS 3288, PART 3
2. TOTAL CREEPAGE DISTANCE 340mm
3. MINIMUM FAILING LOAD 125kN
SPECIFICATION APPLIED I.E.C. Pub 60383
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
125KN PORCELAIN DISC INSULATOR
PLAIN TYPE
Type OVERHEAD LINES
Ref No. C1024974
Historic Drg.No. 1091010485


COMMODITY CODE 210135
292
48
195
48
25(typ.)
Ø93
Ø35
Ø24
Technical Data
System voltage, Um = 24 kV
One minute power frequency withstand voltage, 50Hz, wet = 60 kV
Lightning impulse withstand voltage, 1,2/50, pos. = 179 kV
Arcing distance = 225 mm
Minimum creepage distance = 560 mm
Specified mechanical load (SML) = 70 kN
Routine test load (RTL) = 35 kN
Number of sheds = 6
Material of fittings = Steel, h.d.g.
Weight (approx.) = 1.2 kg
Ball in acc. to IEC 60120 (16)
SML and RTL are in acc. to IEC 61109
Galvanizing (h.d.g.) acc. to EN ISO 1461
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR 11KV COMPOSITE FLYING SECTION
PFL 70KN BALL AND BALL FITTINGS
Type OVERHEAD LINES
Ref No. C1024972
Historic Drg.No. 1091010485
Revision A



Technical Data

System voltage, Um	=	24 kV
One minute power frequency withstand voltage, 50Hz, wet	=	80 kV
Lightning impulse withstand voltage, 1,2/50, pos.	=	200 kV
Arcing distance	=	290 mm
Minimum creepage distance	=	600 mm
Specified mechanical load (SML)	=	70 kN
Routine test load (RTL)	=	35 kN
Number of sheds	=	6
Material of fittings	=	Steel, h.d.g.
Weight (approx.)	=	1.35 kg

Ball in acc. to IEC 60120 (16)

SML and RTL are in acc. to IEC 61109

Galvanizing (h.d.g.) acc. to EN ISO 1461

NORTHERN POWERGRID — Manufacturer Details

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

INSULATOR 20KV COMPOSITE FLYING SECTION
MFL 70KM BALL AND BALL FITTING

Sheet No. 11	Scale N.T.S.	Type OVERHEAD LINES	
Prepared By Carolyn.Palmer			
Revised 24/07/13	Grid Reference	Ref No. C1024989	Historic Drg.No. 1091010485
Date Issued 24/07/13	Checked By	Revision	Notes

FIG 1: CLAMP

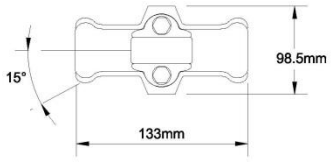


FIG 2 : CLAMP

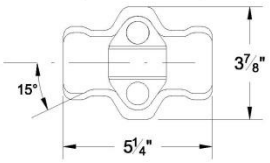
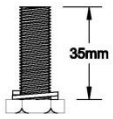
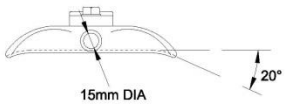
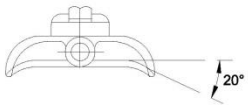


FIG 3 :
PEDESTAL BASE INSULATOR
FIXING BOLT



5/8" UNC Bolt Grade 8.8
C/W Spring Washer





Clamptop clamps can be mounted directly on Hi*Lite XL 300 posts
if the posts are ordered with the horizontal or vertical clamptop option.

MANUFACTURERS NUMBER	FIG.	BODY AND KEEPER MATERIAL	CLAMPING RANGE INCHES (mm)	ULTIMATE BODY STRENGTH Lbs (kN)	NORTHERN ELECTRIC CAT No
270660-3002	1	356-T6 Al	0.25 - 0.57 (6.3 - 14.4)	2800 (1.273)	346469
270661-3002	1	356-T6 Al	0.50 - 1.06 (12.7 - 26.9)	2800 (1.273)	346632
270662-3002	1	356-T6 Al	1.00 - 1.50 (25.4 - 38.1)	2800 (1.273)	346702
	2	TSC - 86	0.35 - 0.86 (8.8 - 21.8)	2800 (1.270)	346471
PEDESTAL BOLT	3				239892

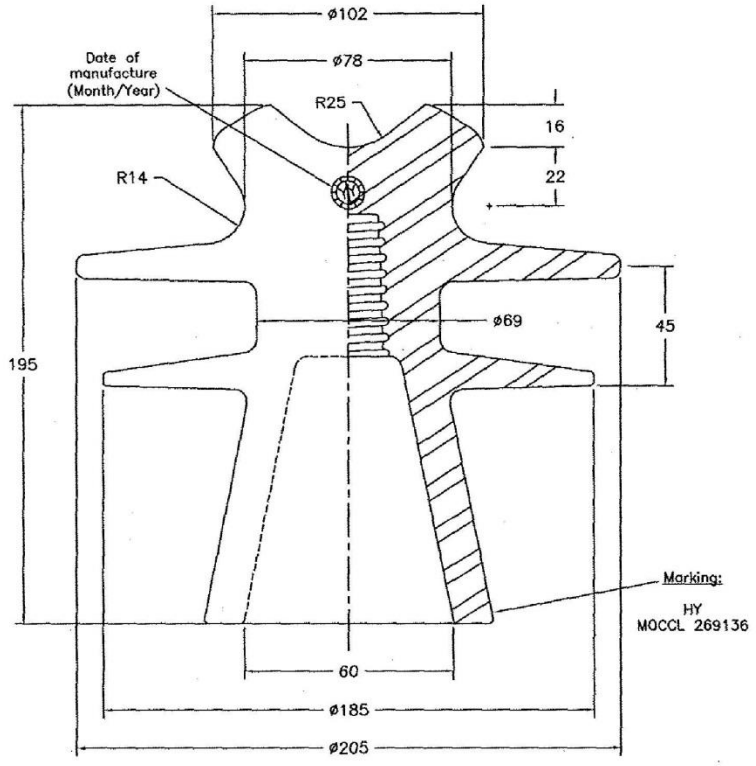
NORTHERN POWERGRID — Manufacturer Details

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

COMPOSITE INSULATOR CLAMP
AND PEDESTAL BASE FASTENING

Sheet No. 6	Scale N.T.S.	Type OVERHEAD LINES	
Prepared By Barbara.Gordon			
Revised 15/11/16	Grid Reference	Ref No. C1064702	Historic Drg.No. 1091010487
Date Issued 03/11/16	Checked By S SALKELD	Revision D	Notes

CAT. No. 253833



Notes:
1. Material; High Density Polyethylene, Colour–Grey
2. The insulator to be marked with : Manufacturers Logo
   MOCCL 269136
   Date of Manufacture (Month/Year)
3. Insulator to conform with general requirements of IEC 60383 and EATS 43–93
4. Internally moulded thread to suit large steel head pin ref 16, BS3288 Part 2.

Minimum Failing Load	10 kN
Impulse Withstand Voltage	125 kV
Wet Power Frequency Withstand Voltage	70 kV
Power Frequency Puncture Voltage	140 kV
RIV at 18KV	<20 dB
Creepage Distance (minimum)	450 mm
Approx. Weight	1.1 kg
Recommended Pin Length	230 mm

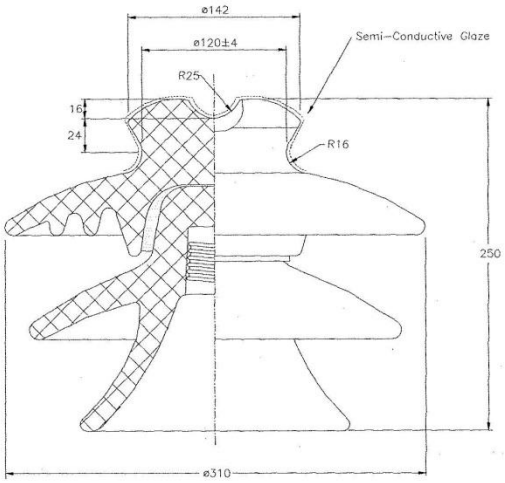
NORTHERN POWERGRID
Manufacturer Details

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

11/20KV COMPOSITE PIN INSULATOR
SUITABLE FOR ALL 11 AND 20KV EARTHED
AND UNEARTHED APPLICATIONS

Sheet No. 13	Scale N.T.S.		
Prepared By Barbara.Rimmer		Type PLANNING	SYSTEM
Revised 03/01/19	Grid Reference	Ref No. C1087353	Historic Drg.No. 1091010486
Date Issued 03/01/19	Checked By G HAMMEL	Revision B Notes	

CAT No. 253423



NOTES:

1. MATERIAL BROWN GLAZED PORCELAIN.
2. THE INSULATOR TO BE INDELIBLY MARKED: MOCCL 269059
   MONTH/YEAR MANUFACTURE
   MANUFACTURES TRADEMARK
3. INSULATOR TO CONFORM WITH REQUIREMENTS OF BSEN 60383-1 AND ENA TS 43-93
4. FITTED WITH ZINC THIMBLE SUITABLE TO FIT THE LARGE STEEL HEAD REF 16 BS3288 PART 2
5. BEFORE CEMENTING, THE SURFACE IN CONTACT WITH CEMENT SHOULD BE BRUSHED WITH BITUMINOUS PAINT.

MINIMUM FAILING LOAD	10 KN
IMPULSE WITHSTAND VOLTAGE	210kV
WET POWER FREQUENCY WITHSTAND VOLTAGE	90kV
DRY POWER FREQUENCY WITHSTAND VOLTAGE	140kV
POWER FREQUENCY PUNCTURE VOLTAGE	210kV
MINIMUM CREEPAGE DISTANCE	740mm
PROTECTED CREEPAGE DISTANCE	370mm
WEIGHT	11.5kg

MACHINE TOLERANCES	SURFACE FINISH
UNLESS OTHERWISE STATED GENERAL TOLERANCE ± 0.4mm ONE d.p. ± 0.2mm TWO d.p. ± 0.1mm ANGULAR TOLERANCE ±30°	UNLESS OTHERWISE STATED SURFACE TO BE ✓ ROUGH NO SYMBOLS USED TO BS 1134 CLA METHOD.

NORTHERN POWERGRID
Manufacturer Details

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

33KV PIN INSULATOR

Sheet No. 4	Scale N.T.S.		
Prepared By Barbara.Rimmer		Type OVERHEAD LINES	
Revised 03/01/19	Grid Reference	Ref No. C1087357	Historic Drg.No. 1091010486
Date Issued 03/01/19	Checked By G HAMMEL	Revision H Notes	

FIG 1: CLAMP

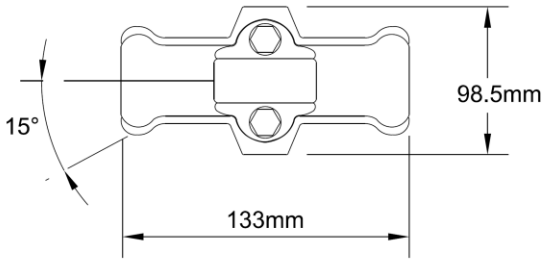


FIG 2 : CLAMP

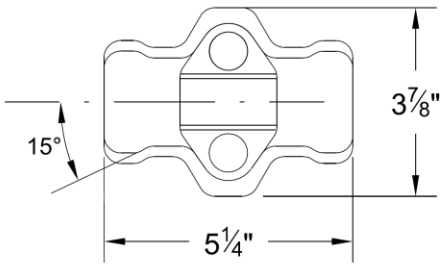
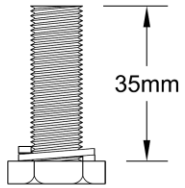
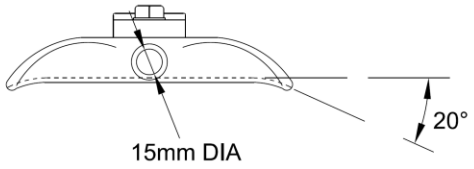
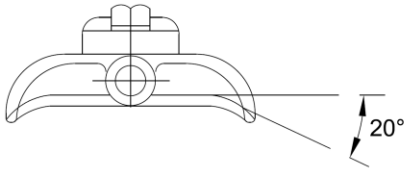


FIG 3 :
PEDESTAL BASE INSULATOR
FIXING BOLT



5/8" UNC Bolt Grade 8.8
C/W Spring Washer





Clamptop clamps can be mounted directly on Hi*Lite XL 300 posts
if the posts are ordered with the horizontal or vertical clamptop option.

MANUFACTURERS NUMBER	FIG.	BODY AND KEEPER MATERIAL	CLAMPING RANGE INCHES (mm)	ULTIMATE BODY STRENGTH Lbs (kN)	NORTHERN ELECTRIC CAT No
270660-3002	1	356-T6 Al	0.25 - 0.57 (6.3 - 14.4)	2800 (1.273)	346469
270661-3002	1	356-T6 Al	0.50 - 1.06 (12.7 - 26.9)	2800 (1.273)	346632
270662-3002	1	356-T6 Al	1.00 - 1.50 (25.4 - 38.1)	2800 (1.273)	346702
	2	TSC - 86	0.35 - 0.86 (8.8 - 21.8)	2800 (1.270)	346471
PEDESTAL BOLT	3				239892

NORTHERN POWERGRID
Manufacturer Details

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

COMPOSITE INSULATOR CLAMP
AND PEDESTAL BASE FASTENING

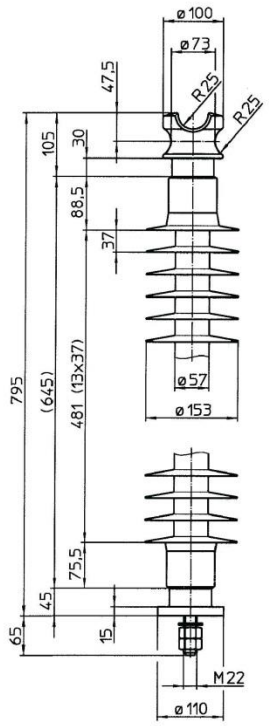
Sheet No. 6	Scale N.T.S.
Prepared By Barbara.Gordon	
Revised 15/11/16	Grid Reference
Date Issued 03/11/16	Checked By S SALKELD

Type OVERHEAD LINES

Ref No. C1064702 Historic Drg.No. 1091010487

Revision D Notes

COMMODITY CODE 253702



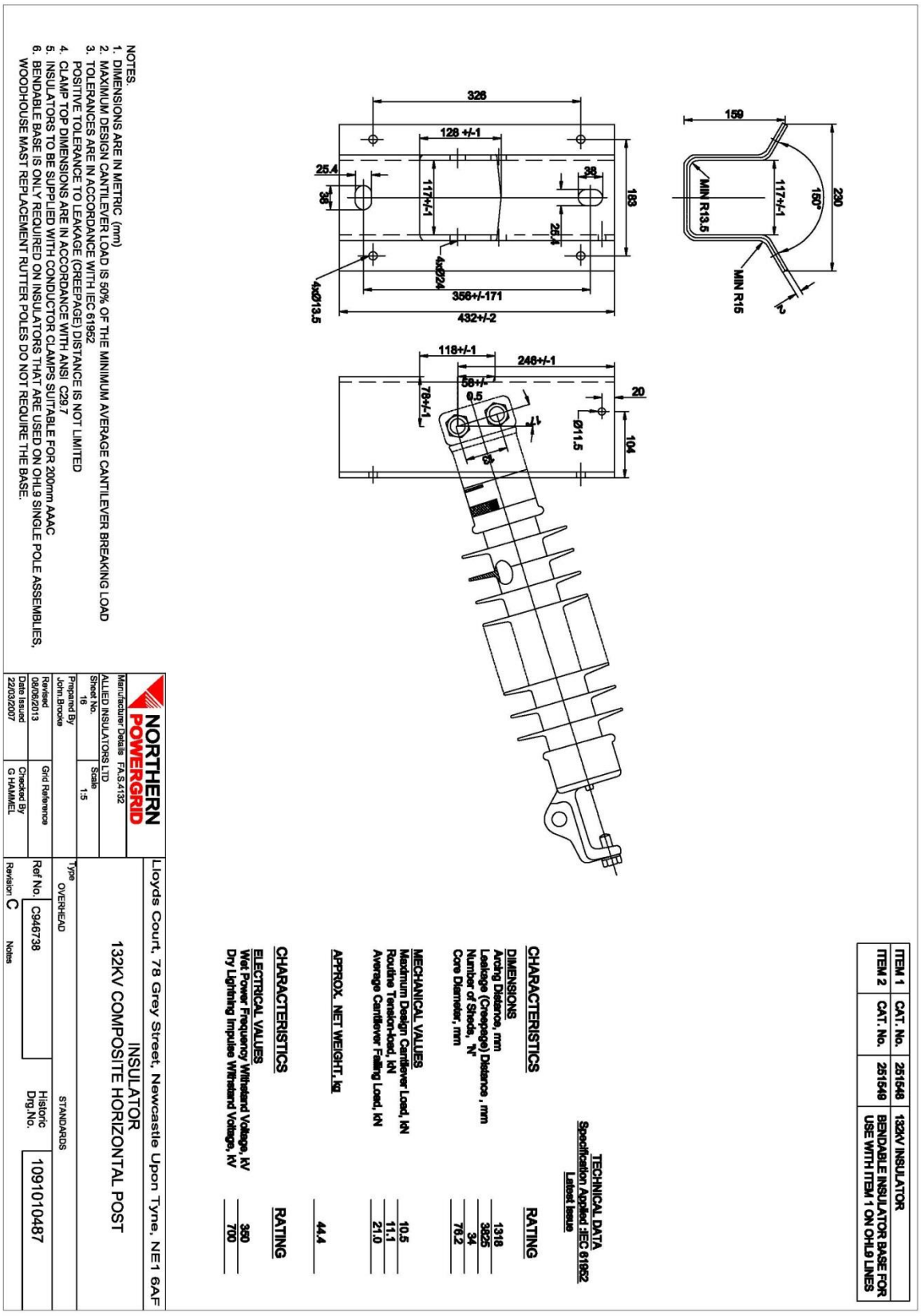
Technische Daten:

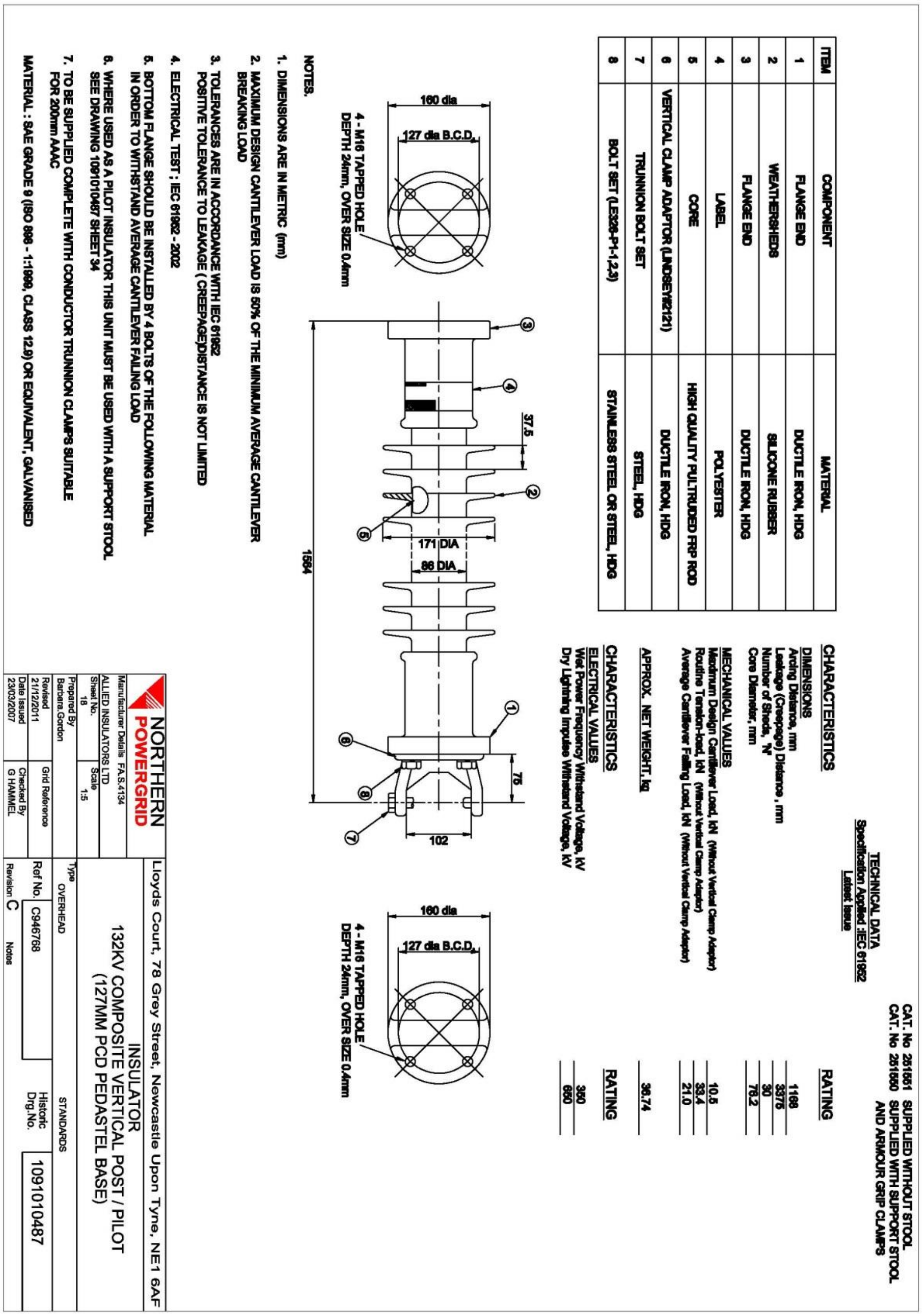
System voltage, Um	=	72,5kV
One minute power frequency withstand voltage, 50Hz, wet	=	190kV
Lightning impulse withstand voltage, 1,5/50, pos.	=	380kV
Minimum creepage distance	=	1'875mm
Arcing distance	=	660mm
Specified cantilever load (SCL)	=	12,5kN
Maximum design cantilever load (MDCL)	=	5,0kN
Number of sheds	=	14
Weight (approx.)	=	12,8kg

Material:

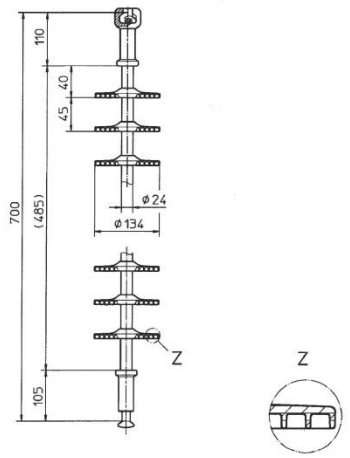
Insulator:	Epoxy glassfibre rod with HTV silicone rubber housing
End fittings:	Steel – hot dip galvanized acc. to BS 729

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Sheet No. 12	Scale 1:5	INSULATOR 66KV COMPOSITE LINE POST WITH SINGLE 50mm MOUNTING STUD	
Prepared By J OAKLEY		Type	
Revised 28/02/05	Grid Reference	Ref No. C101481	Historic Drg.No. 1091010487
Date Issued OCT 04	Checked By G. HAMMEL	Revision Notes	


NOTES.
1. DIMENSIONS ARE IN METRIC (mm)
2. MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MINIMUM AVERAGE CANTILEVER BREAKING LOAD
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61952. POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED
4. CLAMP TOP DIMENSIONS ARE IN ACCORDANCE WITH ANSI C29.7
5. INSULATORS TO BE SUPPLIED WITH CONDUCTOR CLAMPS SUITABLE FOR 200mm AAAC
6. BENDABLE BASE IS ONLY REQUIRED ON INSULATORS THAT ARE USED ON OHL9 SINGLE POLE ASSEMBLIES, WOODHOUSE MAST REPLACEMENT RUTTER POLES DO NOT REQUIRE THE BASE.
ITEM 1 CAT. No. 251548 132kV INSULATOR
ITEM 2 CAT. No. 251549 BENDABLE INSULATOR BASE FOR USE WITH ITEM 1 ON OHL9 LINES
TECHNICAL DATA
Specification Applied :IEC 61952 Latest Issue
CHARACTERISTICS RATING
DIMENSIONS
Arcing Distance, mm 1316
Leakage (Creepage) Distance , mm 3825
Number of Sheds, 'N' 34
Core Diameter, mm 76.2
MECHANICAL VALUES
Maximum Design Cantilever Load, kN 10.5
Routine Tension-load, kN 11.1
Average Cantilever Failing Load, kN 21.0
APPROX. NET WEIGHT, kg 44.4
CHARACTERISTICS RATING
ELECTRICAL VALUES
Wet Power Frequency Withstand Voltage, kV 350
Dry Lightning Impulse Withstand Voltage, kV 700
159
MIN R13.5
117+/-1
150°
230
MIN R15
326
128 +/-1
25.4
38
38
117+/-1
183
25.4
4xØ24
4xØ13.5
356+/-171
432+/-2
118+/-1
246+/-1
58+/-
78+/-1
Ø9.5
20
Ø11.5
104
NORTHERN POWERGRID
Manufacturer Details F.A.S.4132
ALLIED INSULATORS LTD
Sheet No. 16
Scale 1:5
Prepared By John.Brooke
Revised 08/06/2013
Date Issued 22/03/2007
Grid Reference
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR
132KV COMPOSITE HORIZONTAL POST
Type OVERHEAD
STANDARDS
Ref No. C946738
Historic Drg.No. 1091010487
Revision C
Notes


CAT. No 251551 SUPPLIED WITHOUT STOOL
CAT. No 251550 SUPPLIED WITH SUPPORT STOOL AND ARMOUR GRIP CLAMPS
TECHNICAL DATA
Specification Applied :IEC 61952
Latest Issue
ITEM | COMPONENT | MATERIAL
1 FLANGE END DUCTILE IRON, HDG
2 WEATHERSHEDS SILICONE RUBBER
3 FLANGE END DUCTILE IRON, HDG
4 LABEL POLYESTER
5 CORE HIGH QUALITY PULTRUDED FRP ROD
6 VERTICAL CLAMP ADAPTOR (LINDSEY#2121) DUCTILE IRON, HDG
7 TRUNNION BOLT SET STEEL, HDG
8 BOLT SET (LE326-P1-1,2,3) STAINLESS STEEL OR STEEL, HDG
CHARACTERISTICS RATING
DIMENSIONS
Arcing Distance, mm 1168
Leakage (Creepage) Distance , mm 3375
Number of Sheds, 'N' 30
Core Diameter, mm 76.2
MECHANICAL VALUES
Maximum Design Cantilever Load, kN (Without Vertical Clamp Adaptor) 10.5
Routine Tension-load, kN (Without Vertical Clamp Adaptor) 33.4
Average Cantilever Failing Load, kN (Without Vertical Clamp Adaptor) 21.0
APPROX. NET WEIGHT, kg 36.74
CHARACTERISTICS RATING
ELECTRICAL VALUES
Wet Power Frequency Withstand Voltage, kV 350
Dry Lightning Impulse Withstand Voltage, kV 650
160 dia
127 dia B.C.D.
4 - M16 TAPPED HOLE DEPTH 24mm, OVER SIZE 0.4mm
37.5
171 DIA
86 DIA
75
102
1564
NOTES.
1. DIMENSIONS ARE IN METRIC (mm)
2. MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MINIMUM AVERAGE CANTILEVER BREAKING LOAD
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61952 POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE)DISTANCE IS NOT LIMITED
4. ELECTRICAL TEST ; IEC 61952 - 2002
5. BOTTOM FLANGE SHOULD BE INSTALLED BY 4 BOLTS OF THE FOLLOWING MATERIAL IN ORDER TO WITHSTAND AVERAGE CANTILEVER FAILING LOAD
6. WHERE USED AS A PILOT INSULATOR THIS UNIT MUST BE USED WITH A SUPPORT STOOL SEE DRAWING 1091010487 SHEET 34
7. TO BE SUPPLIED COMPLETE WITH CONDUCTOR TRUNNION CLAMPS SUITABLE FOR 200mm AAAC
MATERIAL : SAE GRADE 9 (ISO 898 - 1:1999, CLASS 12.9) OR EQUIVALENT, GALVANISED
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details FA.S.4134
ALLIED INSULATORS LTD
INSULATOR
132KV COMPOSITE VERTICAL POST / PILOT
(127MM PCD PEDASTEL BASE)
Sheet No. 18
Scale 1:5
Prepared By Barbara.Gordon
Type OVERHEAD
STANDARDS
Revised 21/12/2011
Grid Reference
Ref No. C946768
Historic Drg.No. 1091010487
Date Issued 23/03/2007
Checked By G HAMMEL
Revision C
Notes

COMMODITY CODE 21623 251542



Technical data:

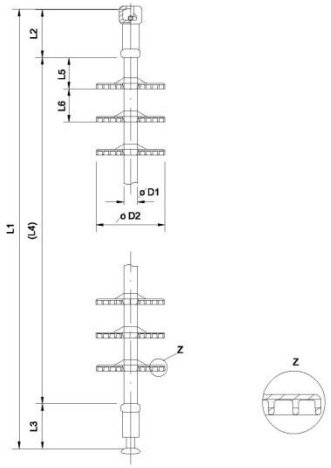
System voltage, Um	=	66kV
One minute power frequency withstand voltage 50Hz, wet	=	140kV
Lightning impulse withstand voltage, 1,2/50, pos.	=	325kV
Minimum creepage distance	=	2'030mm
Arcing distance	=	525mm
Specified mechanical load, tension	=	70kN
Number of sheds	=	10
Weight (approx.)	=	3,1kg

Ball / Socket coupling size acc. to IEC 120/16

Material:

Insulator: Glassfibre rod with silicone weathersheds
End fittings: Drop forged steel - hot dip galvanized acc. to BS 729
Cotter pin: Stainless steel

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Sheet No. 20	Scale 1:50	INSULATOR 66KV COMPOSITE SUSPENSION MFL 70KN 5 PORCELAIN DISC EQUIVALENT BALL/ SOCKET FITTING	
Prepared By Barbara.Gordon		Type OVERHEAD LINES	
Revised 19/05/16	Grid Reference	Ref No. C1059175	Historic Drg.No. 1091010487
Date Issued 03/05/16	Checked By G HAMMEL	Revision B Notes	



System voltage, Um	66kV
One munute power frequency withstand voltage, 50Hz, wet	155kV
Lightning impulse withstand voltage, 1,2 /50, pos.	364kV
Minimum creepage	1540 mm
Arcing distance	650 mm
Specified mechanical load, tension	125 kN
Routine test load, tension	60 kN
Number of sheds	6
Weight (approx.)	3.1 kg

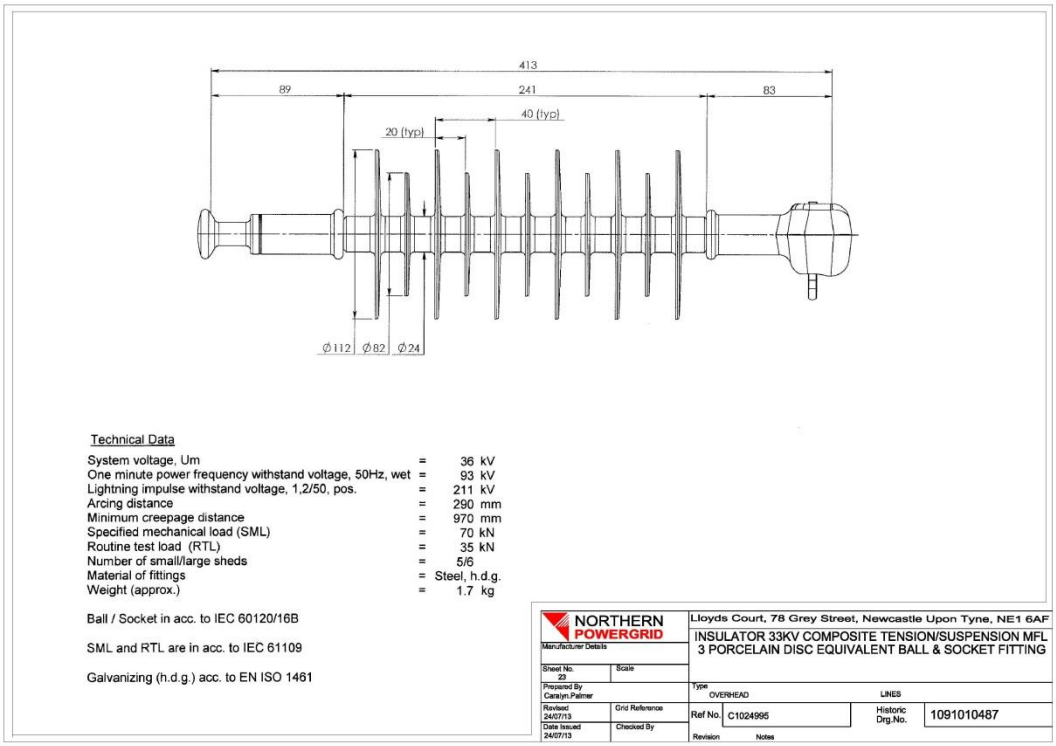
Socket coupling size according to IEC 60120 /20
Ball coupling size according to IEC 60120 /20

Insulator : E-CR-Glass fibre rod with HTV-Silicone rubber housing
Ends fittings: Drop forged steel - hot dip galvanised acc. to EN ISO 1461
Pin: Stainless steel

L1	660 mm
L2	120 mm
L3	110 mm
L4	630 mm
L5	45 mm
L6	108.0 mm
øD1	26 mm
øD2	134 mm

Tolerances in accordance to IEC 61109

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Sheet No. 21	Scale N.T.S.	SILCOSIL - LANGSTABISOLATOR SILCOSIL - LONG ROD INSULATOR	
Prepared By Barbara.Gordon		Type OVERHEAD LINES	
Revised 19/05/16	Grid Reference	Ref No. C1059414	Historic Drg.No. 1091010487
Date Issued 11/05/16	Checked By G HAMMEL	Revision B Notes	



Technical Data

System voltage, Um	=	36 kV
One minute power frequency withstand voltage, 50Hz, wet	=	93 kV
Lightning impulse withstand voltage, 1,2/50, pos.	=	211 kV
Arcing distance	=	290 mm
Minimum creepage distance	=	970 mm
Specified mechanical load (SML)	=	70 kN
Routine test load (RTL)	=	35 kN
Number of small/large sheds	=	5/6
Material of fittings	=	Steel, h.d.g.
Weight (approx.)	=	1.7 kg

Ball / Socket in acc. to IEC 60120/16B

SML and RTL are in acc. to IEC 61109

Galvanizing (h.d.g.) acc. to EN ISO 1461

NORTHERN POWERGRID

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

INSULATOR 33KV COMPOSITE TENSION/SUSPENSION MFL 3 PORCELAIN DISC EQUIVALENT BALL & SOCKET FITTING

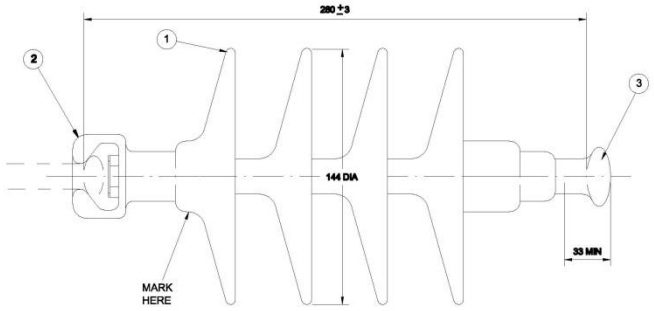
Manufacturer Details | Sheet No. 23 | Scale | Prepared By Carolyn.Palmer | Revised 24/07/13 | Grid Reference | Date Issued 24/07/13 | Checked By

Type OVERHEAD LINES | Ref No. C1024995 | Historic Drg.No. 1091010487 | Revision | Notes

CATALOGUE No 253706

SCHEDULE OF PARTS

ITEM No	PART No	No OFF	DESCRIPTION
1		1	GREY SILICONE RUBBER WEATHERSHEDS, OVER RESIN/GLASS FIBRE CORE
2		1	16mm B SOCKET FITTING, FORGED STEEL GALVANISED
3		1	16mm BALL ENDED FITTING, FORGED STEEL GALVANISED



NOTES : -

1. TOTAL CREEPAGE DISTANCE 465mm
2. MINIMUM FAILING LOAD 70kN
3. POWER FREQUENCY WITHSTAND VOLTAGE WET 70kV
4. LIGHTNING IMPULSE WITHSTAND VOLTAGE 125kV
5. 16mm B SOCKET, BALL AND SHANK TO IEC Pub 120
6. TO BE MARKED INDELIBLY WHERE SHOWN

YEAR
FA/S.4008.A
SML 70kN

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

SPECIFICATION APPLIED IEC 61109

TAKEN FROM ALLIED INSULATORS LTD DRG No FA / S.4008.A

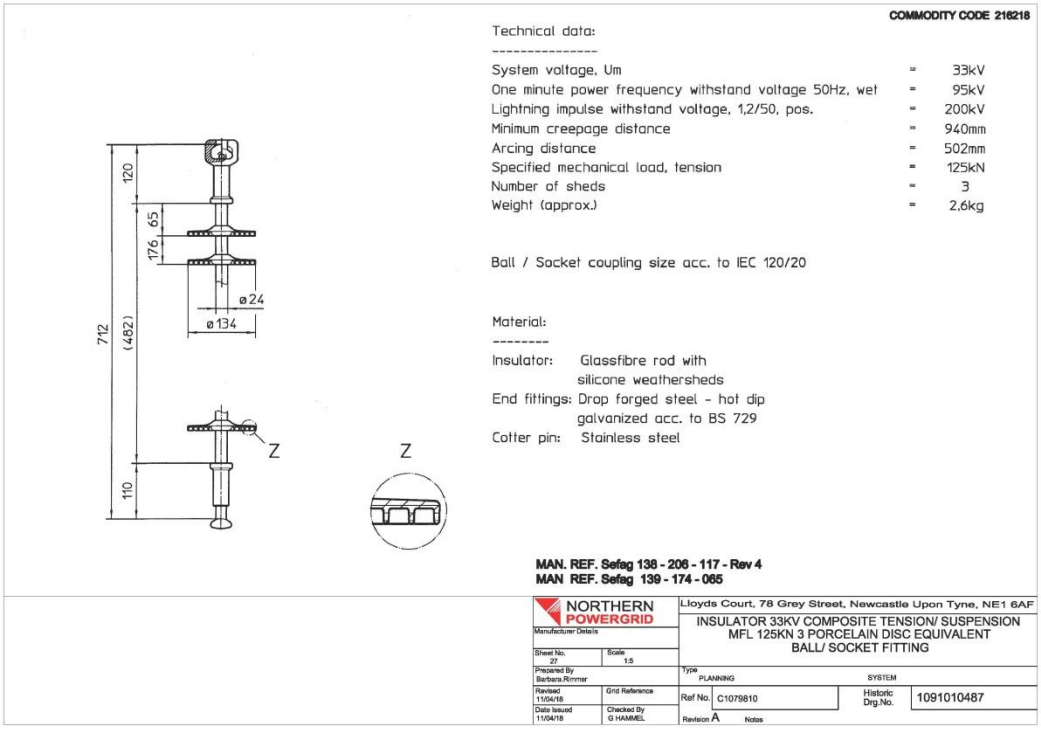
NORTHERN POWERGRID

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

11/20KV COMPOSITE TENSION INSULATOR- 70KN 2 DISC EQUIVELANT

Manufacturer Details | Sheet No. 24 | Scale | Prepared By Barbara.Rimmer | Revised 03/01/19 | Grid Reference | Date Issued 24/07/13 | Checked By

Type OVERHEAD LINES | Ref No. C1025003 | Historic Drg.No. 1091010487 | Revision A | Notes



COMMODITY CODE 216218

Technical data:

System voltage, Um	=	33kV
One minute power frequency withstand voltage 50Hz, wet	=	95kV
Lightning impulse withstand voltage, 1,2/50, pos.	=	200kV
Minimum creepage distance	=	940mm
Arcing distance	=	502mm
Specified mechanical load, tension	=	125kN
Number of sheds	=	3
Weight (approx.)	=	2,6kg

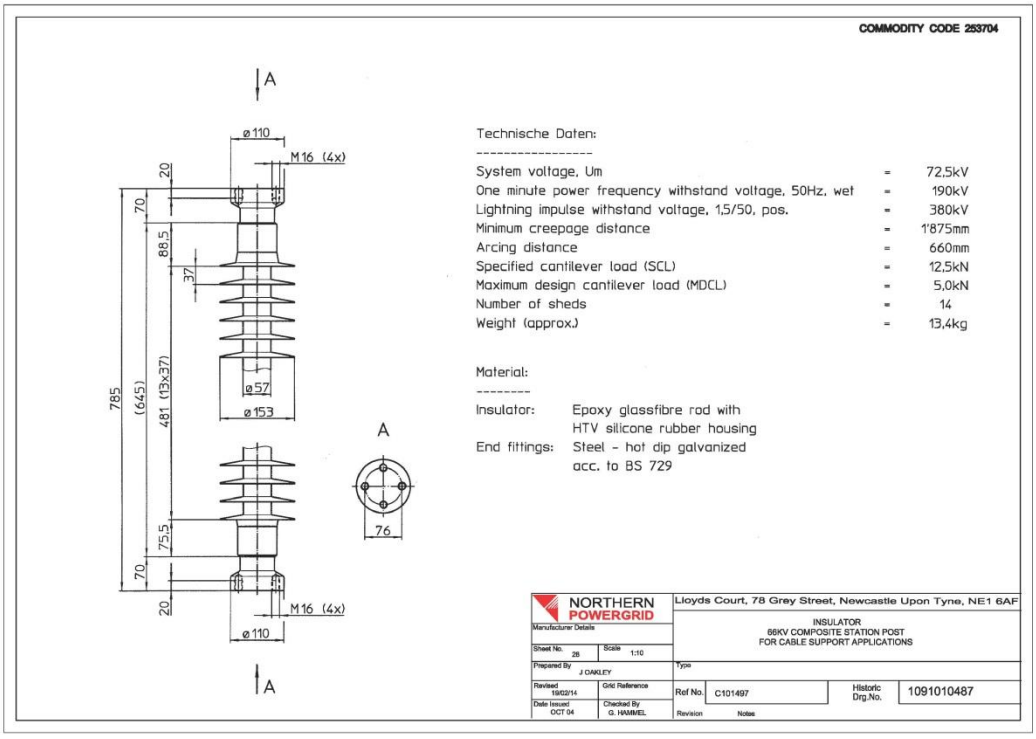
Ball / Socket coupling size acc. to IEC 120/20

Material:

Insulator: Glassfibre rod with silicone weathersheds
End fittings: Drop forged steel - hot dip galvanized acc. to BS 729
Cotter pin: Stainless steel

MAN. REF. Sefag 138 - 206 - 117 - Rev 4
MAN REF. Sefag 139 - 174 - 065

NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR 33KV COMPOSITE TENSION/ SUSPENSION
MFL 125KN 3 PORCELAIN DISC EQUIVALENT
BALL/ SOCKET FITTING
Sheet No. 27 | Scale 1:5
Prepared By Barbara.Rimmer
Revised 11/04/18 | Grid Reference
Date Issued 11/04/18 | Checked By G HAMMEL
Type PLANNING SYSTEM
Ref No. C1079810 | Historic Drg.No. 1091010487
Revision A Notes



COMMODITY CODE 253704

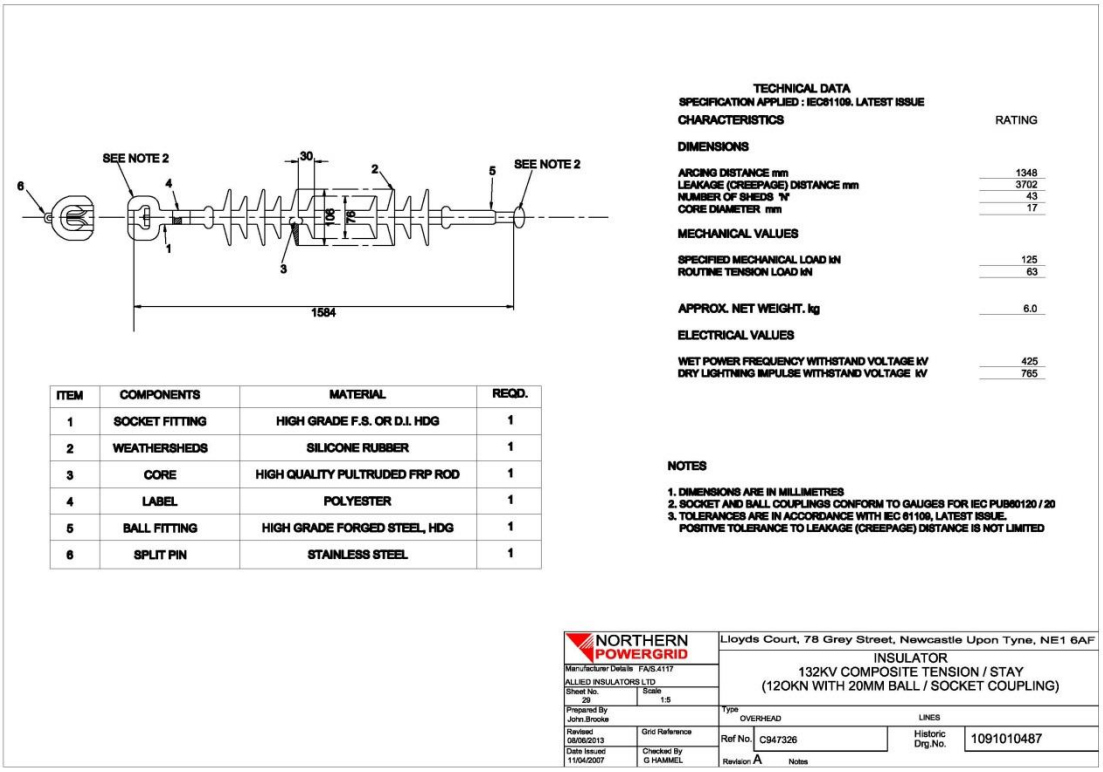
Technische Daten:

System voltage, Um	=	72,5kV
One minute power frequency withstand voltage, 50Hz, wet	=	190kV
Lightning impulse withstand voltage, 1,5/50, pos.	=	380kV
Minimum creepage distance	=	1'875mm
Arcing distance	=	660mm
Specified cantilever load (SCL)	=	12,5kN
Maximum design cantilever load (MDCL)	=	5,0kN
Number of sheds	=	14
Weight (approx.)	=	13,4kg

Material:

Insulator: Epoxy glassfibre rod with HTV silicone rubber housing
End fittings: Steel - hot dip galvanized acc. to BS 729

NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR
66KV COMPOSITE STATION POST
FOR CABLE SUPPORT APPLICATIONS
Sheet No. 28 | Scale 1:10
Prepared By J OAKLEY
Revised 19/02/14 | Grid Reference
Date Issued OCT 04 | Checked By G. HAMMEL
Type
Ref No. C101497 | Historic Drg.No. 1091010487
Revision Notes



ITEM	COMPONENTS	MATERIAL	REQD.
1	SOCKET FITTING	HIGH GRADE F.S. OR D.I. HDG	1
2	WEATHERSHEDS	SILICONE RUBBER	1
3	CORE	HIGH QUALITY PULTRUDED FRP ROD	1
4	LABEL	POLYESTER	1
5	BALL FITTING	HIGH GRADE FORGED STEEL, HDG	1
6	SPLIT PIN	STAINLESS STEEL	1

TECHNICAL DATA

SPECIFICATION APPLIED : IEC61109. LATEST ISSUE

CHARACTERISTICS	RATING
DIMENSIONS	
ARCING DISTANCE mm	1348
LEAKAGE (CREEPAGE) DISTANCE mm	3702
NUMBER OF SHEDS 'N'	43
CORE DIAMETER mm	17
MECHANICAL VALUES	
SPECIFIED MECHANICAL LOAD kN	125
ROUTINE TENSION LOAD kN	63
APPROX. NET WEIGHT. kg	6.0
ELECTRICAL VALUES	
WET POWER FREQUENCY WITHSTAND VOLTAGE kV	425
DRY LIGHTNING IMPULSE WITHSTAND VOLTAGE kV	765

NOTES

1. DIMENSIONS ARE IN MILLIMETRES
2. SOCKET AND BALL COUPLINGS CONFORM TO GAUGES FOR IEC PUB60120 / 20
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61109, LATEST ISSUE.
   POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED

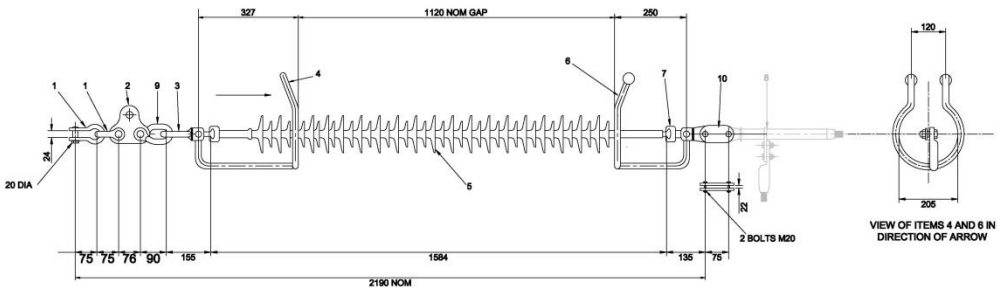
NORTHERN POWERGRID
Manufacturer Details FAIS.4117
ALLIED INSULATORS LTD
Sheet No. 29 | Scale 1:5
Prepared By John.Brooke
Revised 08/06/2013 | Grid Reference
Date Issued 11/04/2007 | Checked By G HAMMEL

Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

INSULATOR
132KV COMPOSITE TENSION / STAY
(120KN WITH 20MM BALL / SOCKET COUPLING)

Type OVERHEAD LINES
Ref No. C947326 | Historic Drg.No. 1091010487
Revision A Notes

CATALOGUE NUMBER 251552



SCHEDULE OF PARTS

ITEM No	PART No	No OFF	DESCRIPTION	MATERIAL
1	27.10.10	2	SHACKLE GALVANISED	D.F.S.
2	28 / 21	1	LANDING PLATE GALVANISED	STEEL
3	21.22.03.03X	1	BALL EYE 20° GALVANISED	D.F.S.
4	43.41.28.28 TYPE	1	ARCING RING GALVANISED	D.F.S.
5	FA.19. 4117	1	POLYMER INSULATOR ASSEMBLY GREY	POLYMER
6	43.43.20.20	1	ARCING RING GALVANISED	D.F.S.
7	24.02.43.20	1	SOCKET TONGUE GALVANISED	D.F.S.
8	400291	1	COMPRESSION DEAD END CLAMP FOR POPLAR(NOT SUPPLIED BY A.I)	AL ALLOY
9	27.32.10X	1	SHACKLE 90° GALVANISED	D.F.S.
10	28.28.09	1	EXTENSION LINK ASSEMBLY GALVANISED	STEEL

NOTES

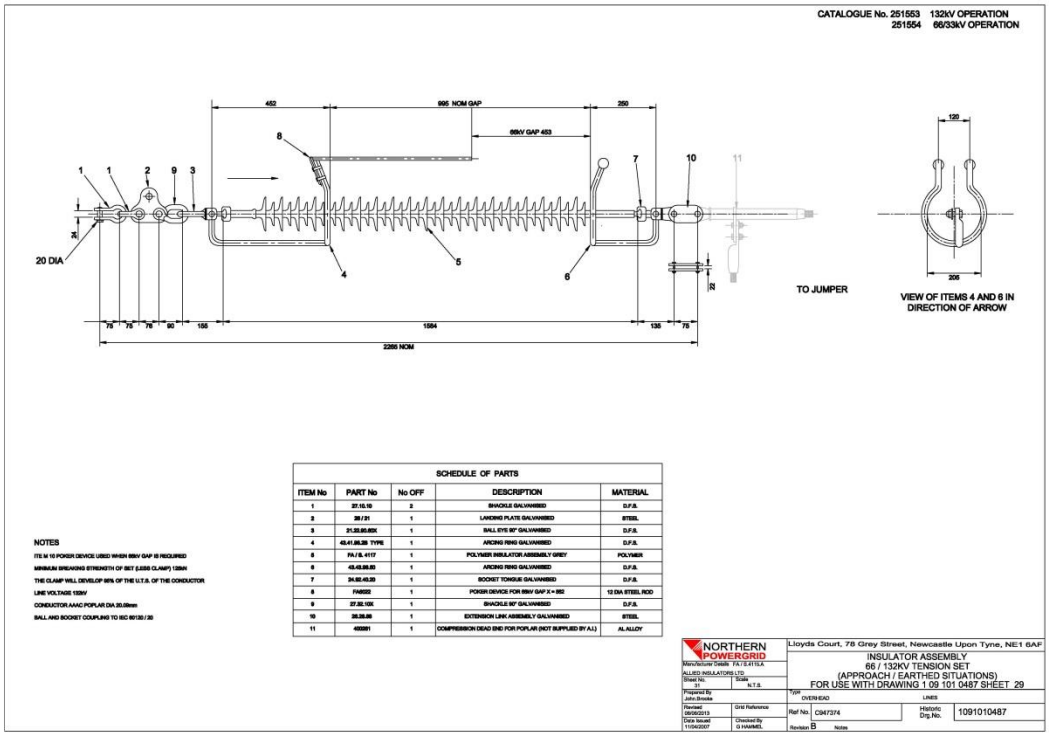
MINIMUM BREAKING STRENGTH OF SET (LESS CLAMP) 120kN
THE CLAMP WILL DEVELOP 90% OF THE U.T.S. OF THE CONDUCTOR
LINE VOLTAGE 132kV
CONDUCTOR AAAC POPLAR DIA 20.00mm
BALL AND SOCKET COUPLING TO IEC 60120 / 20

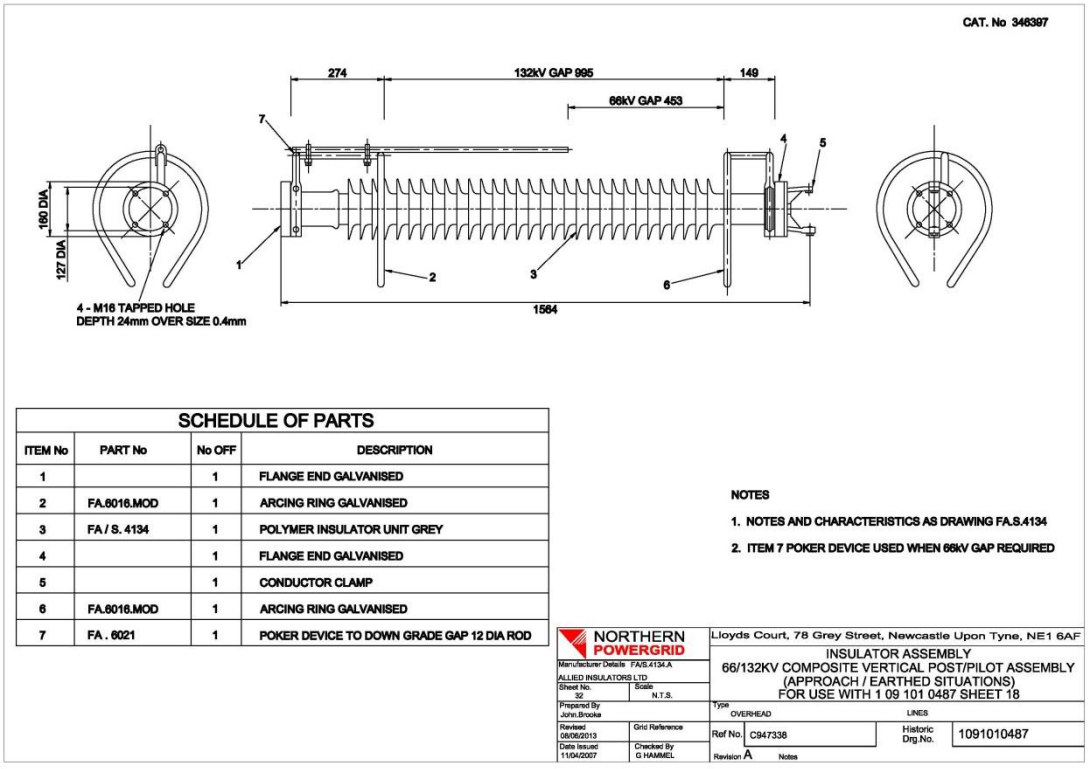
NORTHERN POWERGRID
Manufacturer Details FA.T.E.4115
ALLIED INSULATORS LTD
Sheet No. 30 | Scale N.T.S.
Prepared By John.Brooke
Revised 08/06/2013 | Grid Reference
Date Issued 13/04/2007 | Checked By G HAMMEL

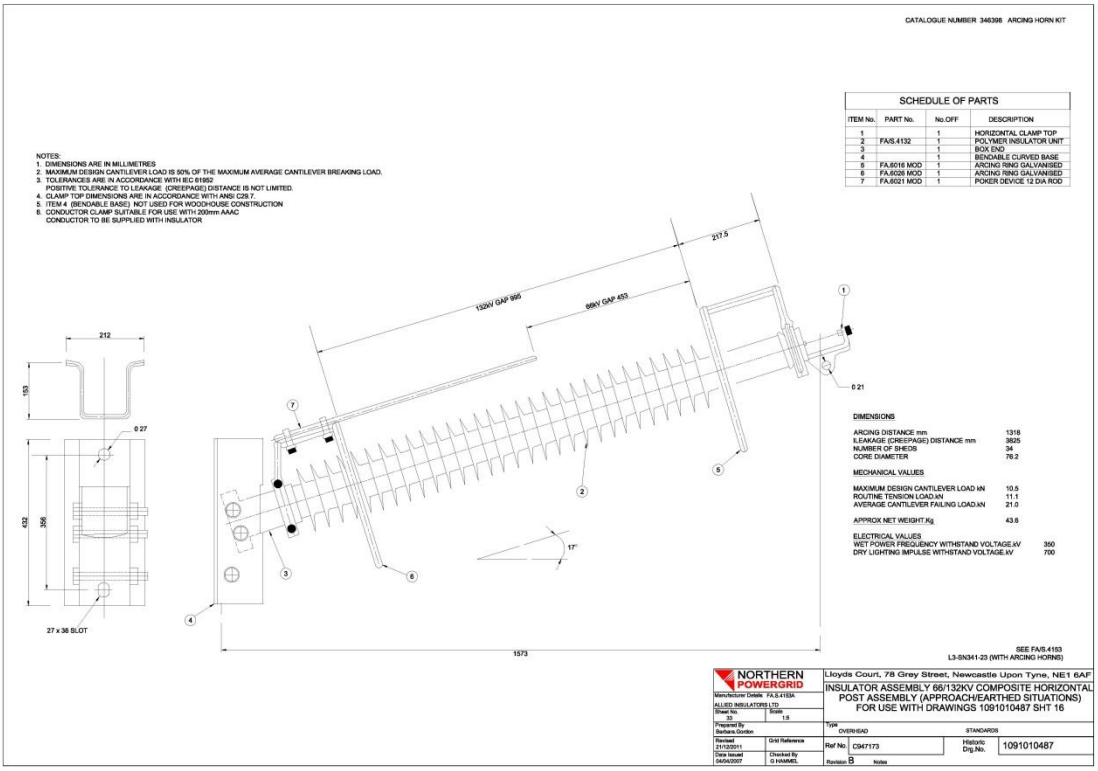
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

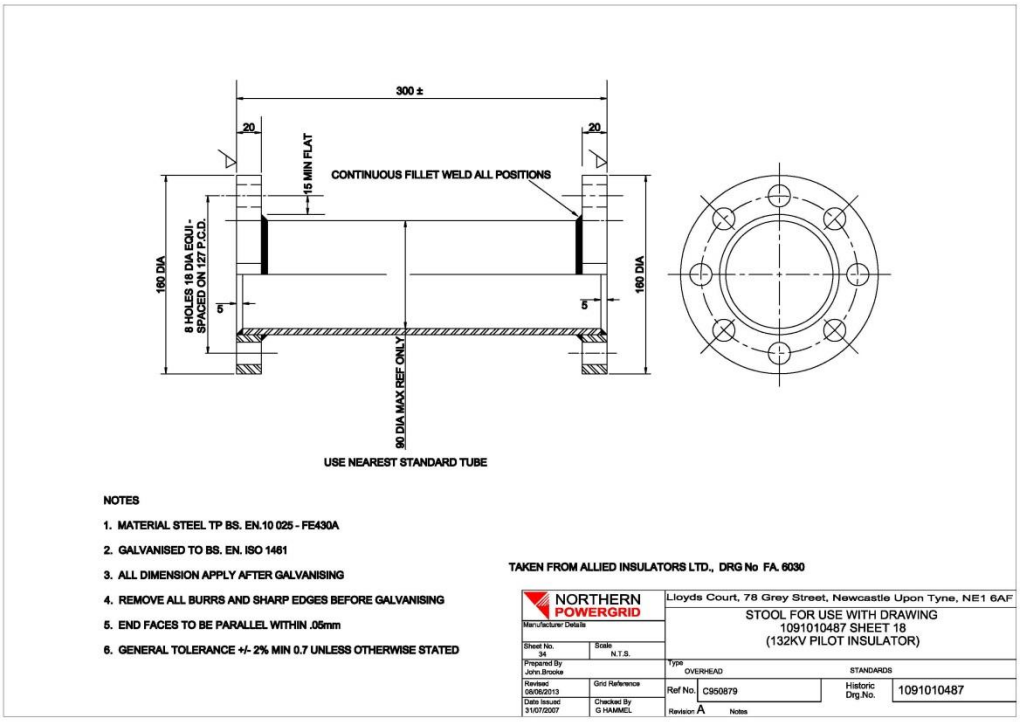
INSULATOR ASSEMBLY
66 / 132KV TENSION SET
(NORMAL UNEARTHED SITUATIONS)
FOR USE WITH DRAWING 1091010487 SHEET 29

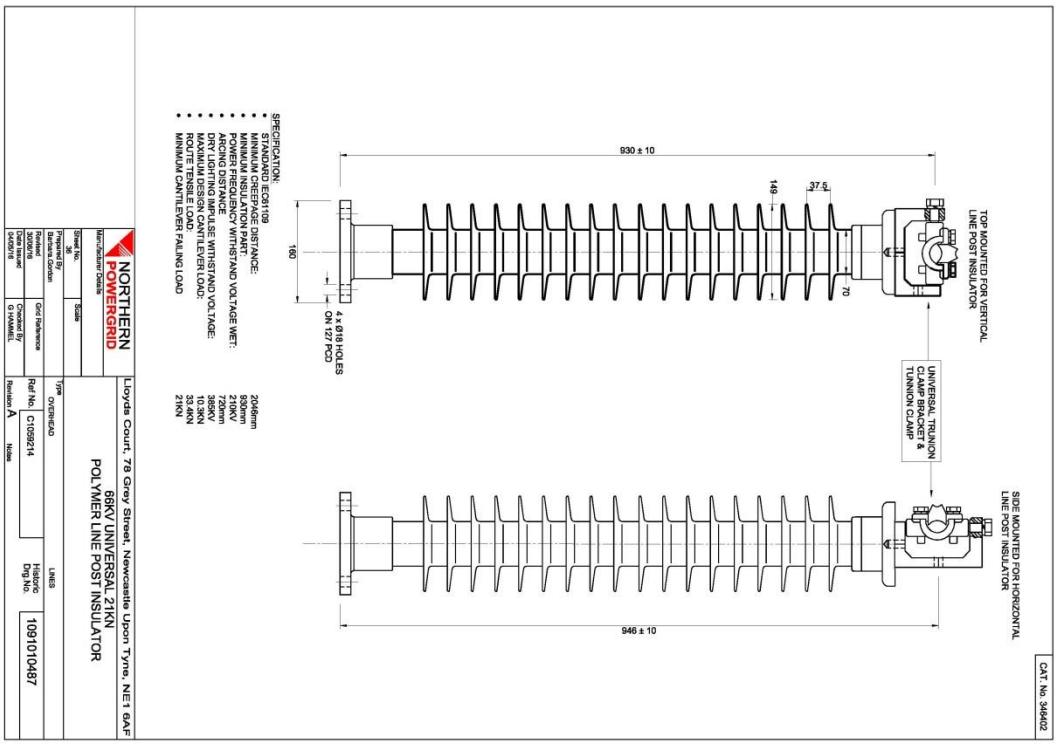
Type OVERHEAD LINES
Ref No. C947434 | Historic Drg.No. 1091010487
Revision B Notes

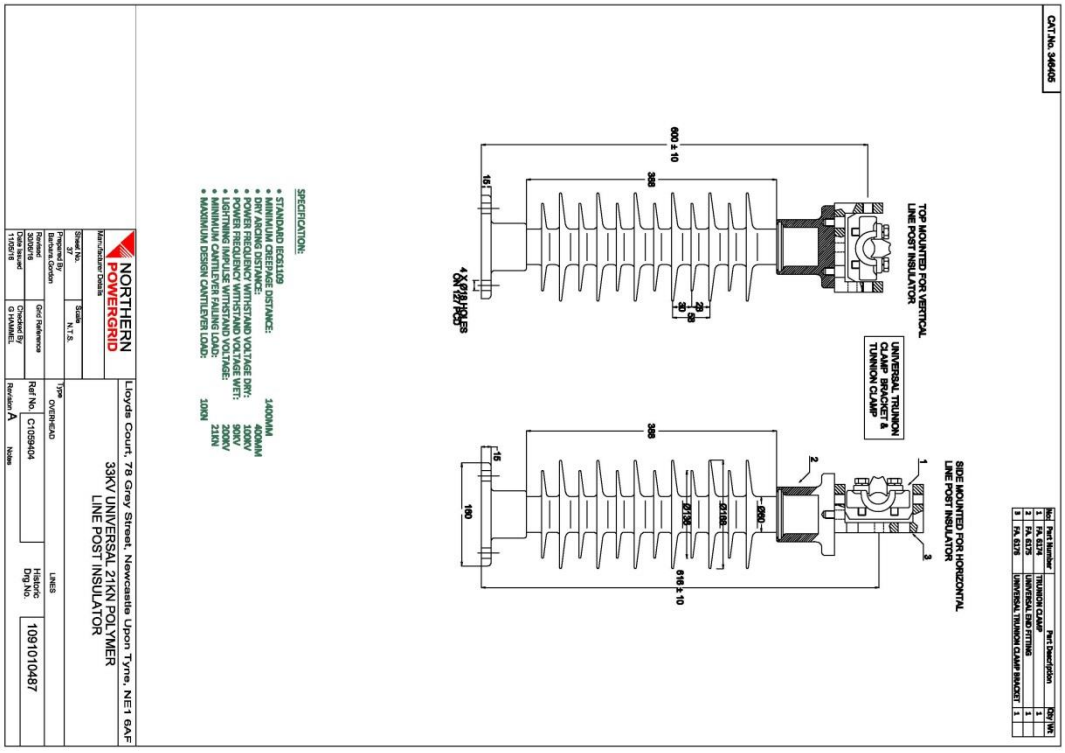

CATALOGUE No. 251553 132kV OPERATION
251554 66/33kV OPERATION
995 NOM GAP
66kV GAP 453
20 DIA
TO JUMPER
VIEW OF ITEMS 4 AND 8 IN DIRECTION OF ARROW
2265 NOM
NOTES
SCHEDULE OF PARTS
ITEM No | PART No | No OFF | DESCRIPTION | MATERIAL
1 | 27.10.10 | 2 | SHACKLE GALVANISED | D.F.S.
2 | 39 / 21 | 1 | LANDING PLATE GALVANISED | STEEL
3 | 21.20.60.BOX | 1 | BALL EYE 90° GALVANISED | D.F.S.
4 | 43.41.86.28 TYPE | 1 | ARCING RING GALVANISED | D.F.S.
5 | FA / S. 4117 | 1 | POLYMER INSULATOR ASSEMBLY GREY | POLYMER
6 | 43.43.86.83 | 1 | ARCING RING GALVANISED | D.F.S.
7 | 24.82.43.20 | 1 | SOCKET TONGUE GALVANISED | D.F.S.
8 | FA6022 | 1 | POKER DEVICE FOR 66kV GAP X = 952 | 12 DIA STEEL ROD
9 | 27.32.10X | 1 | SHACKLE 90° GALVANISED | D.F.S.
10 | 26.26.88 | 1 | EXTENSION LINK ASSEMBLY GALVANISED | STEEL
11 | 402881 | 1 | COMPRESSION DEAD END FOR POPLAR (NOT SUPPLIED BY A.L) | AL ALLOY
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR ASSEMBLY
66 / 132KV TENSION SET
(APPROACH / EARTHED SITUATIONS)
FOR USE WITH DRAWING 1 09 101 0487 SHEET 29
Ref No. C947374
Historic Drg.No. 1091010487
Revision B

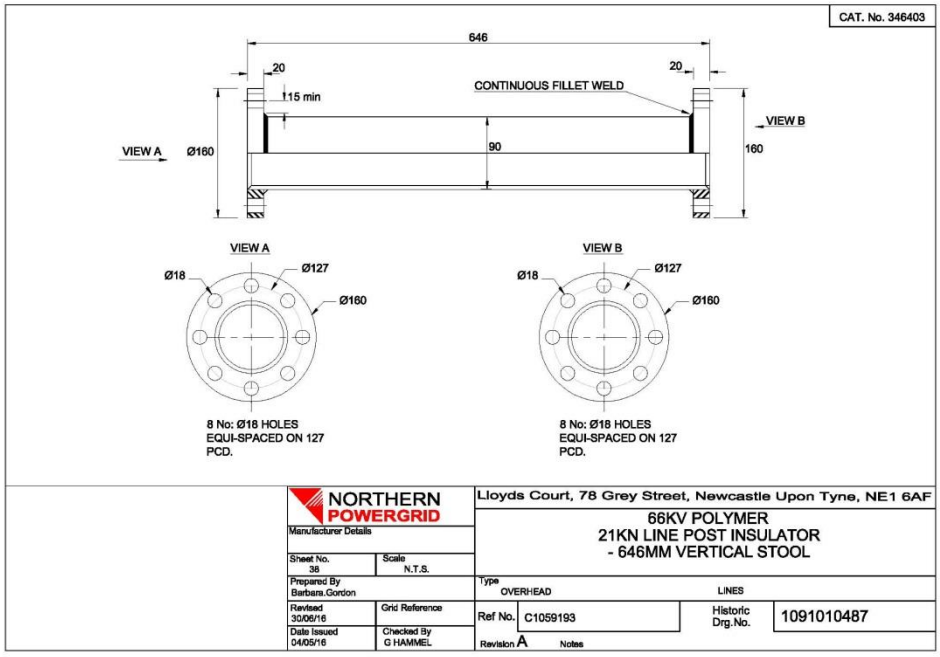

CAT. No 346397
274
132kV GAP 995
149
66kV GAP 453
160 DIA
127 DIA
4 - M16 TAPPED HOLE
DEPTH 24mm OVER SIZE 0.4mm
1564
SCHEDULE OF PARTS
ITEM No | PART No | No OFF | DESCRIPTION
1 | | 1 | FLANGE END GALVANISED
2 | FA.6016.MOD | 1 | ARCING RING GALVANISED
3 | FA / S. 4134 | 1 | POLYMER INSULATOR UNIT GREY
4 | | 1 | FLANGE END GALVANISED
5 | | 1 | CONDUCTOR CLAMP
6 | FA.6016.MOD | 1 | ARCING RING GALVANISED
7 | FA . 6021 | 1 | POKER DEVICE TO DOWN GRADE GAP 12 DIA ROD
NOTES
1. NOTES AND CHARACTERISTICS AS DRAWING FA.S.4134
2. ITEM 7 POKER DEVICE USED WHEN 66kV GAP REQUIRED
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR ASSEMBLY
66/132KV COMPOSITE VERTICAL POST/PILOT ASSEMBLY
(APPROACH / EARTHED SITUATIONS)
FOR USE WITH 1 09 101 0487 SHEET 18
Ref No. C947338
Historic Drg.No. 1091010487
Revision A

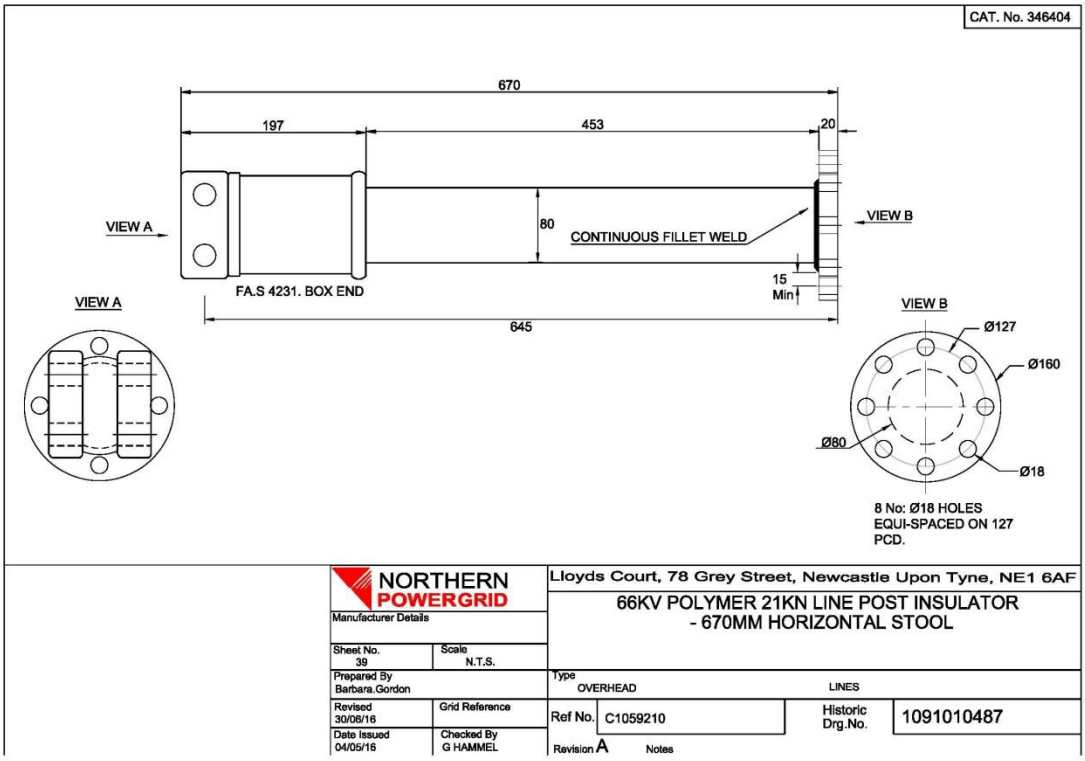

CATALOGUE NUMBER 346398 ARCING HORN KIT
SCHEDULE OF PARTS
ITEM No. | PART No. | No.OFF | DESCRIPTION
1 | | 1 | HORIZONTAL CLAMP TOP
2 | FA/S.4132 | 1 | POLYMER INSULATOR UNIT
3 | | 1 | BOX END
4 | | 1 | BENDABLE CURVED BASE
5 | FA.6016 MOD | 1 | ARCING RING GALVANISED
6 | FA.6026 MOD | 1 | ARCING RING GALVANISED
7 | FA.6021 MOD | 1 | POWER DEVICE 12 DIA ROD
NOTES:
1. DIMENSIONS ARE IN MILLIMETRES
2. MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MAXIMUM AVERAGE CANTILEVER BREAKING LOAD.
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61952
POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED.
4. CLAMP TOP DIMENSIONS ARE IN ACCORDANCE WITH ANSI C29.7.
5. ITEM 4 (BENDABLE BASE) NOT USED FOR WOODHOUSE CONSTRUCTION
6. CONDUCTOR CLAMP SUITABLE FOR USE WITH 200mm AAAC
CONDUCTOR TO BE SUPPLIED WITH INSULATOR
DIMENSIONS
ARCING DISTANCE mm 1318
LEAKAGE (CREEPAGE) DISTANCE mm 3825
NUMBER OF SHEDS 34
CORE DIAMETER 76.2
MECHANICAL VALUES
MAXIMUM DESIGN CANTILEVER LOAD kN 10.5
ROUTINE TENSION LOAD kN 11.1
AVERAGE CANTILEVER FAILING LOAD kN 21.0
APPROX NET WEIGHT Kg 43.6
ELECTRICAL VALUES
WET POWER FREQUENCY WITHSTAND VOLTAGE kV 350
DRY LIGHTING IMPULSE WITHSTAND VOLTAGE kV 700
SEE FA/S.4153
L3-SN341-23 (WITH ARCING HORNS)
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR ASSEMBLY 66/132KV COMPOSITE HORIZONTAL POST ASSEMBLY (APPROACH/EARTHED SITUATIONS) FOR USE WITH DRAWINGS 1091010487 SHT 16
Manufacturer Details FA.S.4153A ALLIED INSULATORS LTD
Sheet No. 1
Scale 1:5
Prepared By Barbara Gordon
Revised 21/12/2011
Grid Reference
Date Issued 04/04/2007
Checked By G HAMMEL
Type OVERHEAD
STANDARDS
Ref No. C947173
Historic Drg.No. 1091010487
Revision B
Notes

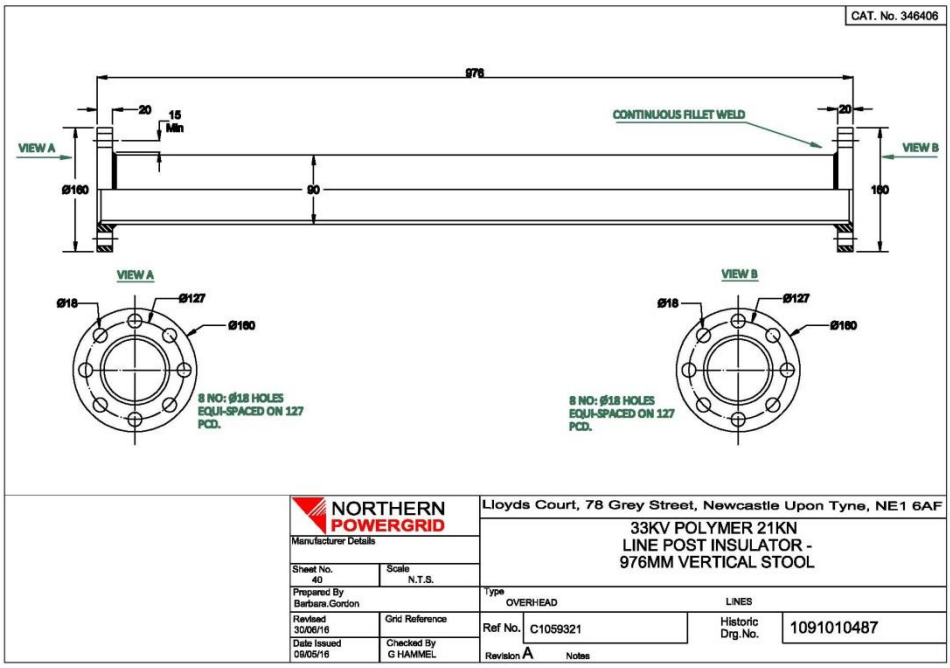

300 ±
20
20
15 MIN FLAT
CONTINUOUS FILLET WELD ALL POSITIONS
160 DIA
8 HOLES 18 DIA EQUI-SPACED ON 127 P.C.D.
160 DIA
90 DIA MAX REF ONLY
USE NEAREST STANDARD TUBE
NOTES
1. MATERIAL STEEL TP BS. EN.10 025 - FE430A
2. GALVANISED TO BS. EN. ISO 1461
3. ALL DIMENSION APPLY AFTER GALVANISING
4. REMOVE ALL BURRS AND SHARP EDGES BEFORE GALVANISING
5. END FACES TO BE PARALLEL WITHIN .05mm
6. GENERAL TOLERANCE +/- 2% MIN 0.7 UNLESS OTHERWISE STATED
TAKEN FROM ALLIED INSULATORS LTD., DRG No FA. 6030
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
STOOL FOR USE WITH DRAWING 1091010487 SHEET 18 (132KV PILOT INSULATOR)
Manufacturer Details
Sheet No. 34
Scale N.T.S.
Prepared By John.Brooke
Revised 08/06/2013
Grid Reference
Date Issued 31/07/2007
Checked By G HAMMEL
Type OVERHEAD
STANDARDS
Ref No. C950879
Historic Drg.No. 1091010487
Revision A
Notes

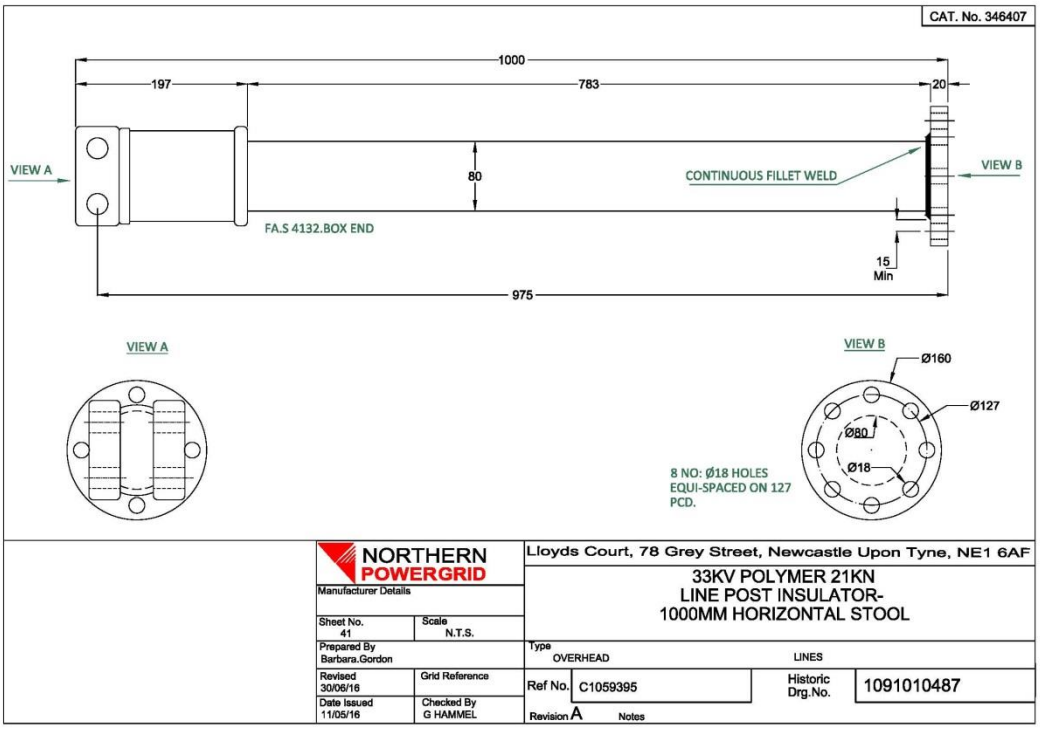

NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66KV UNIVERSAL 21KN
POLYMER LINE POST INSULATOR
Drg No. 1091010487
CAT. No. 346402
TOP MOUNTED FOR VERTICAL LINE POST INSULATOR
SIDE MOUNTED FOR HORIZONTAL LINE POST INSULATOR
UNIVERSAL TRUNION CLAMP BRACKET & TUNNION CLAMP
930 ± 10
946 ± 10
4 x Ø19 HOLES ON 127 PCD
SPECIFICATION:
STANDARD IEC60109
MINIMUM CREEPAGE DISTANCE: 2046mm
MINIMUM ARCING DISTANCE: 630mm
POWER FREQUENCY WITHSTAND VOLTAGE WET: 210KV
ARCING DISTANCE 720mm
DRY LIGHTING IMPULSE WITHSTAND VOLTAGE: 385KV
MAXIMUM DESIGN CANTILEVER LOAD: 10.3KN
MINIMUM CANTILEVER FAILING LOAD 21KN

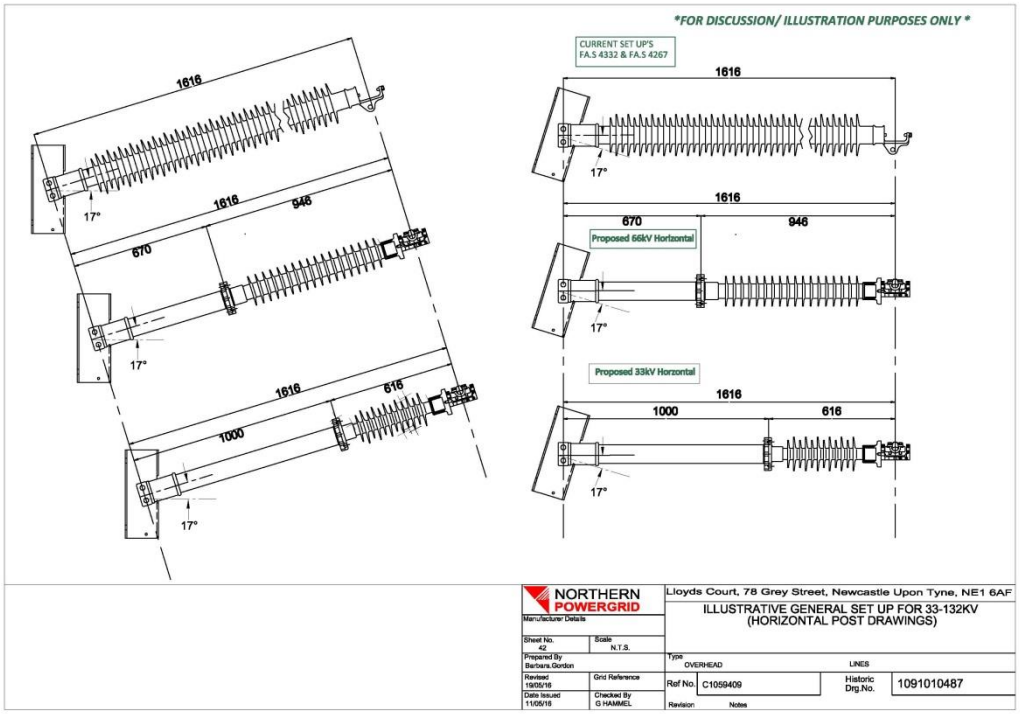

NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33KV UNIVERSAL 21KN POLYMER
LINE POST INSULATOR
CAT.No. 346405
TOP MOUNTED FOR VERTICAL LINE POST INSULATOR
SIDE MOUNTED FOR HORIZONTAL LINE POST INSULATOR
UNIVERSAL TRUNION CLAMP BRACKET & TUNNION CLAMP
600 ± 10
610 ± 10
SPECIFICATION:
STANDARD IEC60109
MINIMUM CREEPAGE DISTANCE: 1400MM
MINIMUM ARCING DISTANCE: 400MM
DRY ARCING DISTANCE: 100KV
POWER FREQUENCY WITHSTAND VOLTAGE DRY: 90KV
POWER FREQUENCY WITHSTAND VOLTAGE WET: 70KV
DRY LIGHTING IMPULSE WITHSTAND VOLTAGE: 170KV
MINIMUM CANTILEVER FAILING LOAD: 21KN
MAXIMUM DESIGN CANTILEVER LOAD: 10KN

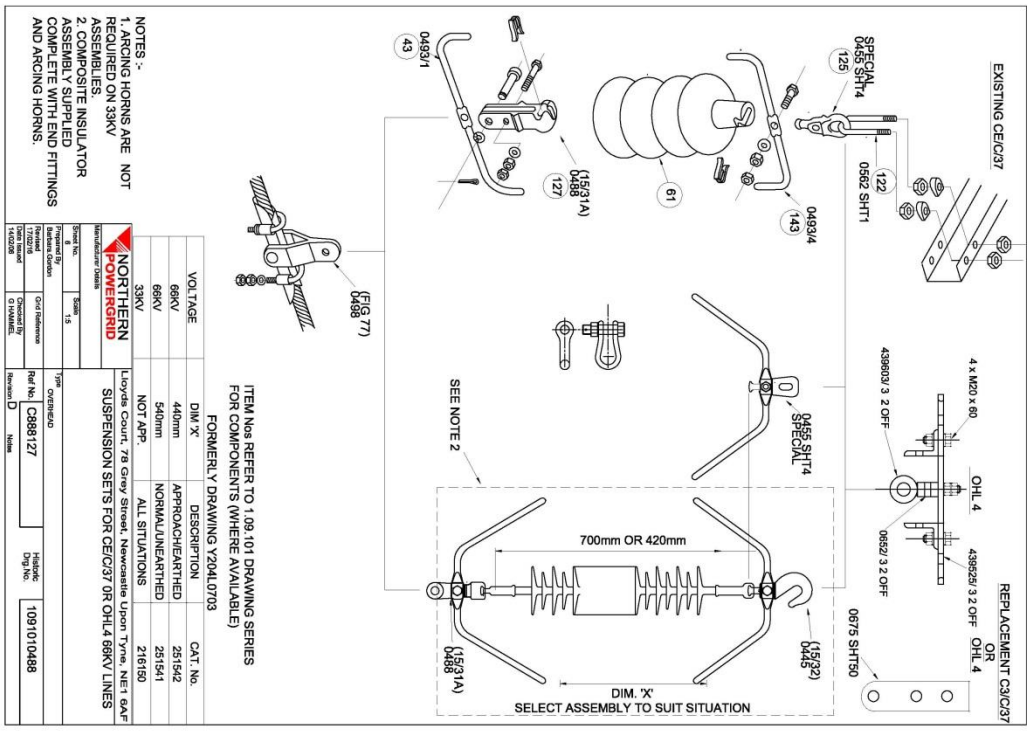

CAT. No. 346403
646
20
20
15 min
CONTINUOUS FILLET WELD
VIEW A
Ø160
90
160
VIEW B
VIEW A
Ø18
Ø127
Ø160
8 No: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
VIEW B
Ø18
Ø127
Ø160
8 No: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 38
Scale N.T.S.
Prepared By Barbara.Gordon
Revised 30/06/16
Grid Reference
Date Issued 04/05/16
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66KV POLYMER
21KN LINE POST INSULATOR
- 646MM VERTICAL STOOL
Type OVERHEAD LINES
Ref No. C1059193
Historic Drg.No. 1091010487
Revision A
Notes

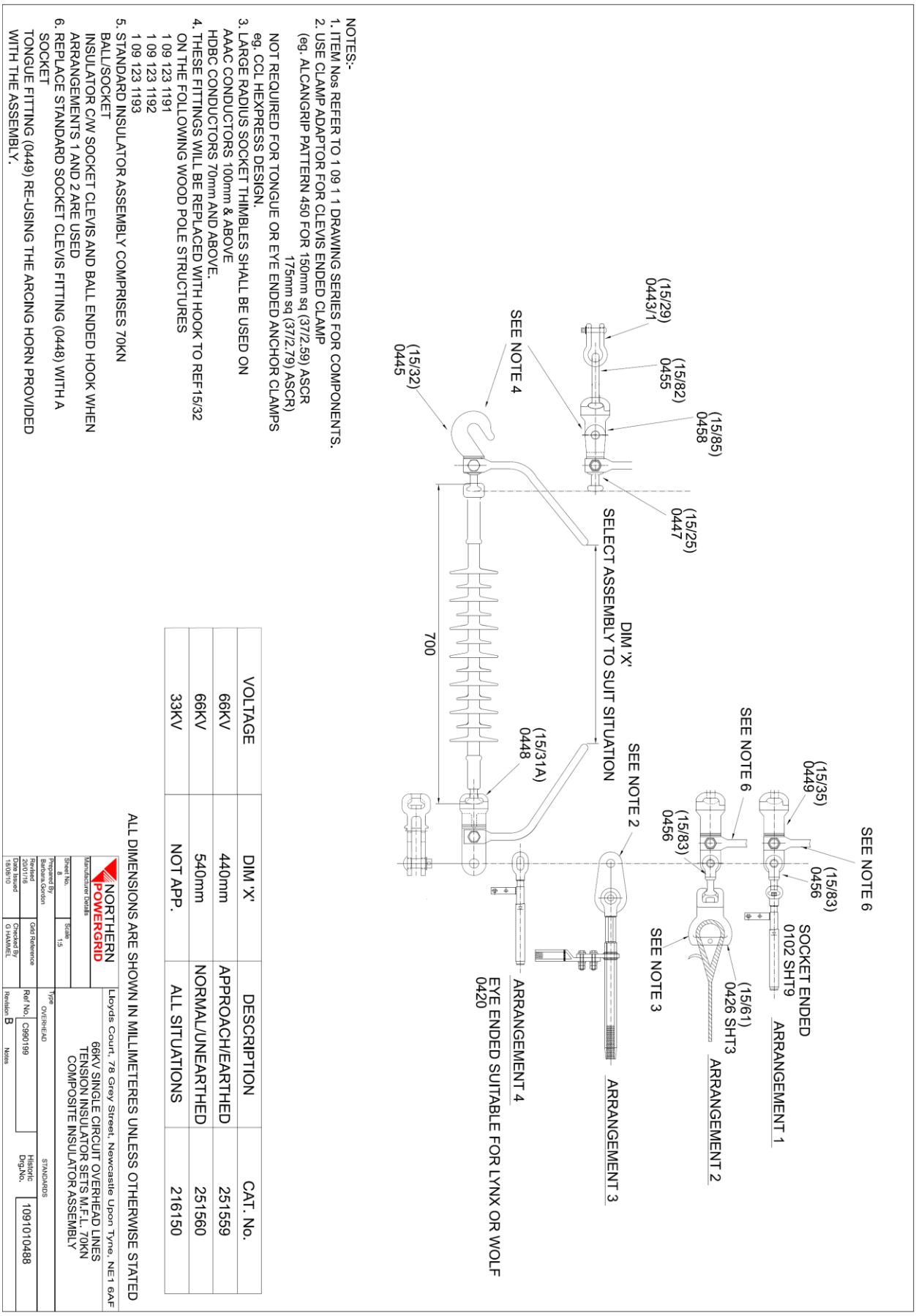

CAT. No. 346404
670
197
453
20
VIEW A
80
CONTINUOUS FILLET WELD
VIEW B
FA.S 4231. BOX END
15
Min
645
VIEW A
VIEW B
Ø127
Ø160
Ø80
Ø18
8 No: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 39
Scale N.T.S.
Prepared By Barbara.Gordon
Revised 30/06/16
Grid Reference
Date Issued 04/05/16
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66KV POLYMER 21KN LINE POST INSULATOR
- 670MM HORIZONTAL STOOL
Type OVERHEAD LINES
Ref No. C1059210
Historic Drg.No. 1091010487
Revision A
Notes


CAT. No. 346406
976
20
15
Min
CONTINUOUS FILLET WELD
20
VIEW A
VIEW B
Ø160
90
160
VIEW A
Ø18
Ø127
Ø160
8 NO: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
VIEW B
Ø18
Ø127
Ø160
8 NO: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33KV POLYMER 21KN
LINE POST INSULATOR -
976MM VERTICAL STOOL
Sheet No. 40
Scale N.T.S.
Prepared By Barbara.Gordon
Type OVERHEAD LINES
Revised 30/06/16
Grid Reference
Date Issued 08/05/16
Checked By G HAMMEL
Ref No. C1059321
Historic Drg.No. 1091010487
Revision A
Notes


CAT. No. 346407
1000
197
783
20
VIEW A
80
CONTINUOUS FILLET WELD
VIEW B
FA.S 4132.BOX END
15
Min
975
VIEW A
VIEW B
Ø160
Ø127
Ø80
Ø18
8 NO: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33KV POLYMER 21KN
LINE POST INSULATOR-
1000MM HORIZONTAL STOOL
Sheet No. 41
Scale N.T.S.
Prepared By Barbara.Gordon
Type OVERHEAD LINES
Revised 30/06/16
Grid Reference
Date Issued 11/05/16
Checked By G HAMMEL
Ref No. C1059395
Historic Drg.No. 1091010487
Revision A
Notes


*FOR DISCUSSION/ ILLUSTRATION PURPOSES ONLY *
CURRENT SET UP'S
FA.5 4332 & FA.5 4267
1616
946
670
616
1000
17°
Proposed 66kV Horizontal
Proposed 33kV Horizontal
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ILLUSTRATIVE GENERAL SET UP FOR 33-132KV
(HORIZONTAL POST DRAWINGS)
Scale N.T.S.
Type OVERHEAD LINES
Ref No. C1059409
Historic Drg.No. 1091010487


NOTES :-
1. ARCING HORNS ARE NOT REQUIRED ON 33KV ASSEMBLIES.
2. COMPOSITE INSULATOR ASSEMBLY SUPPLIED COMPLETE WITH END FITTINGS AND ARCING HORNS.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
SUSPENSION SETS FOR CE/C/37 OR OHL4 66KV LINES
Ref No. C888127
Historic Drg No. 1091010488
VOLTAGE
33KV NOT APP.
66KV 540mm NORMALJUNEARTHED 251541
66KV 440mm APPROACHEARTHED 251542
DIM 'X' DESCRIPTION CAT. No.
ALL SITUATIONS 216150
ITEM Nos REFER TO 1.09.101 DRAWING SERIES FOR COMPONENTS (WHERE AVAILABLE)
FORMERLY DRAWING Y20AL0703
SEE NOTE 2
700mm OR 420mm
DIM. 'X'
SELECT ASSEMBLY TO SUIT SITUATION
EXISTING CE/C/37
REPLACEMENT C3/C/37 OR OHL 4
OHL 4
4 x M20 x 60
0455 SHT4 SPECIAL
0562 SHT1
0675 SHT50
0493/1 43
0493/4 143
(15/31A) 0488 127
61
122
125
(15/32) 0455
(FIG 77) 0488



NOTES:-
1. ITEM Nos REFER TO 1 09 1 1 DRAWING SERIES FOR COMPONENTS.
2. USE CLAMP ADAPTOR FOR CLEVIS ENDED CLAMP (eg. ALCANGRIP PATTERN 450 FOR 150mm sq (37/2.59) ASCR 175mm sq (37/2.79) ASCR)
   NOT REQUIRED FOR TONGUE OR EYE ENDED ANCHOR CLAMPS eg. CCL HEXPRESS DESIGN.
3. LARGE RADIUS SOCKET THIMBLES SHALL BE USED ON AAAC CONDUCTORS 100mm & ABOVE HDBC CONDUCTORS 70mm AND ABOVE.
4. THESE FITTINGS WILL BE REPLACED WITH HOOK TO REF15/32 ON THE FOLLOWING WOOD POLE STRUCTURES
   1 09 123 1191
   1 09 123 1192
   1 09 123 1193
5. STANDARD INSULATOR ASSEMBLY COMPRISES 70KN BALL/SOCKET INSULATOR C/W SOCKET CLEVIS AND BALL ENDED HOOK WHEN ARRANGEMENTS 1 AND 2 ARE USED
6. REPLACE STANDARD SOCKET CLEVIS FITTING (0448) WITH A SOCKET TONGUE FITTING (0449) RE-USING THE ARCING HORN PROVIDED WITH THE ASSEMBLY.

VOLTAGE	DIM 'X'	DESCRIPTION	CAT. No.
66KV	440mm	APPROACH/EARTHED	251559
66KV	540mm	NORMAL/UNEARTHED	251560
33KV	NOT APP.	ALL SITUATIONS	216150

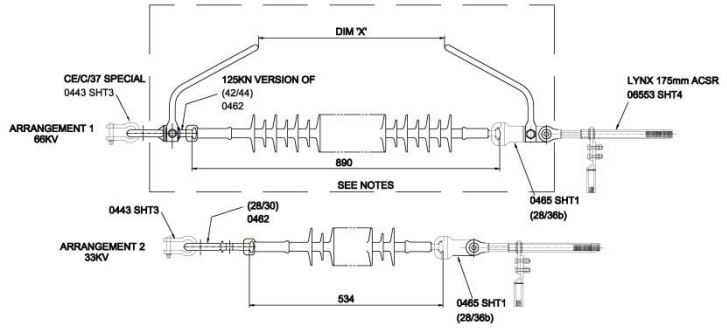
ALL DIMENSIONS ARE SHOWN IN MILLIMETERES UNLESS OTHERWISE STATED

NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

66KV SINGLE CIRCUIT OVERHEAD LINES
TENSION INSULATOR SETS M.F.L. 70KN
COMPOSITE INSULATOR ASSEMBLY

Sheet No. 8	Scale 1:5	Type OVERHEAD	STANDARDS
Prepared By Barbara Garlton			
Issue Date 20/01/16	Grid Reference	Ref No. C990199	Historic Drg.No. 1091010488
Date Issued 18/08/10	Checked By G HAMMEL	Revision B	Notes

VOLTAGE	DIM 'X'	DESCRIPTION	CAT. No.
66KV	440mm	APPROACH/EARTHED	251539
66KV	540mm	NORMAL/UNEARTHED	251536
33KV	NOT APP.	ALL SITUATIONS	251546

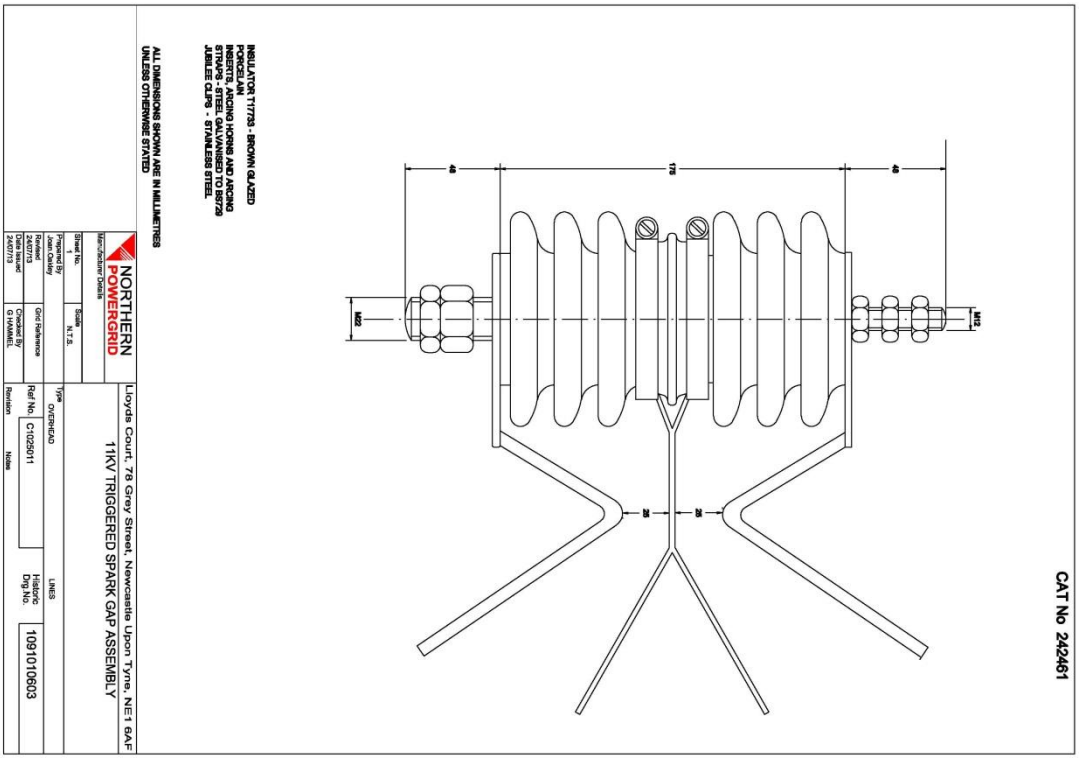


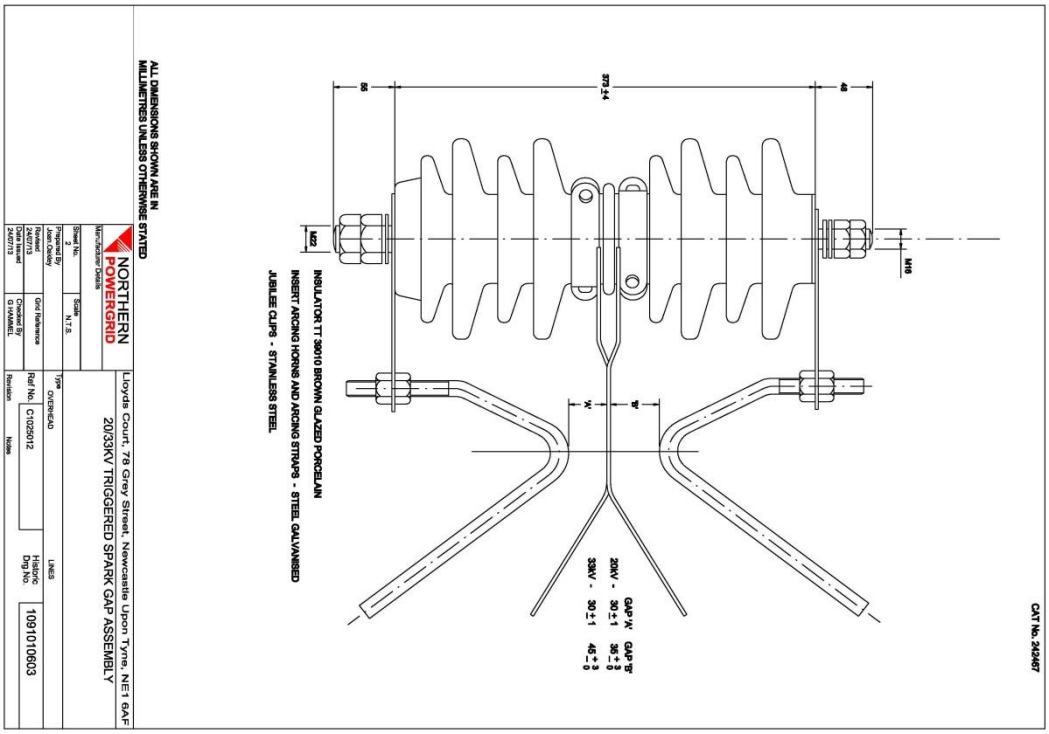
NOTES

1.COMPOSITE INSULATOR ASSEMBLY SUPPLIED COMPLETE WITH END FITTING AND ARCING HORNS.
2. WHERE IT IS REQUIRED TO REPLACE EXISTING HISTORICAL INSULATOR ASSEMBLIES THAT UTILISE SMALLER CONDUCTORS THAN 175mm ACSR, THIS MAY BE ACHIEVED BY REPLACING THIS ASSEMBLY WITH 70KN ASSEMBLIES AS SHOWN ON 1 09 101 0488 SHT8
3. ARRANGEMENT 2 TO BE USED AT 33KV, ARCING HORNS NOT REQUIRED.

ALL DIMENSIONS ARE SHOWN IN MILLIMETERES UNLESS OTHERWISE STATED

NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33/66KV SINGLE CIRCUIT OVERHEAD LINES
TENSION INSULATOR SETS M.F.L. 125KN
COMPOSITE INSULATOR ASSEMBLY
Ref No. C990229
1091010488
Revision B


INSULATOR TT/7793 - BROWN GLAZED PORCELAIN
INSERTS, ARCING HORNS AND ARCING STRAPS - STEEL GALVANISED
JUBILEE CLIPS - STAINLESS STEEL
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
11KV TRIGGERED SPARK GAP ASSEMBLY
Ref No. C1025011
Hist/Orc Drg No. 1091010603
CAT No 242461
242471


INSULATOR TT 39010 BROWN GLAZED PORCELAIN
INSERT ARCING HORNS AND ARCING STRAPS - STEEL GALVANISED
JUBILEE CLIPS - STAINLESS STEEL
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
20/33KV TRIGGERED SPARK GAP ASSEMBLY
Ref No. C1025012
Hist/Orc Drg No. 1091010603
CAT No. 242467
242537

Appendix 5 - Self Certification Conformance Declaration

Line insulators manufactured in accordance with ENA TS 43-93 shall comply with the latest issues of the relevant international and British Standards.

This check sheet identifies the clauses in ENA TS 43-93 and the clauses of the aforementioned Standards relevant to line insulators for use on the Northern Powergrid distribution system.
The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes. Additionally, manufacturers shall provide test evidence for all completed tests.

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 then details of how

compliance is achieved shall be provided in the Remarks column. This shall include details of type tests, where appropriate/applicable.

Supplier/Manufacturer:		
Product Reference:		
Name:	Signature:	Date:

B1- General Clauses

ENA TS 43-93				
Clause	**Requirement**	Conformance Code	Evidence (test reports)	Remarks
4.2	Porcelain or glass components			
	4.2.1 General			
	4.2.2 HV Insulators			
	4.2.3 LV Insulators			
4.3	Metal Components			
4.4	Composite Insulator materials			
	Composite Insulator End Fittings			
	Composite Insulator – Housing sheds			
	Composite Insulator - Tolerances			
4.5	Thermoplastic Insulators			
5	HV Line Insulators			
	5.1 General			
	5.2 11kV Insulators			
	5.2.1 11/20kV Pin Insulators			
	5.2.2 11/20kV Tension Insulators			
	5.3 33kV Insulators			
	5.3.1 33kV Pin Insulators			
	5.3.2 33kV Tension Insulators			
	5.3.3 33kV Line Post insulators			
	5.4 33-132kV Post Insulators			
	5.4.1 33-132kV Line Post Insulators			
	5.4.2 132kv Pilot Post Insulators			
	5.5 Insulator Clamp Tops			
	5.6 String Insulator Units			
	5.7 Composite String Insulator Units			
	5.7 Insulator Overvoltage protective Devices			
6.6	Radio interference voltage (RIV) requirements and corona extinction voltage			
	6.6.1 General			

ENA TS 43-93				
Clause	**Requirement**	Conformance Code	Evidence (test reports)	Remarks
	6.6.2 Corona Extinction test			
	6.6.3 Single unit RIV test 132kV			
	6.6.4 Insulator Sets RIV test			
	6.6.5 Insulator sets RIV and corona test arrangement			
	6.6.6 Pin & Post insulators RIV Tests			
7	Pollution performance			
8	Mechanical Performance			
Annex A	Summary of Type and sample tests			

B2- Clauses Specific to Porcelain and Glass Insulators

IEC 60383- 1			ENA TS 43– 93				
Clause / Section	Requirement	Conformance Code	Clause	Requirement	Conformance Code	Evidence (test reports)	Remarks
Clause 5	Identification of insulators		4.1				
Clause 9 to 16 Clause 17 to 31	Test procedures for electrical tests Test procedures for mechanical and other tests (Note 1)		6	Test Requirements 6.1 General 6.2 Design and Type Tests (Note 2) 6.3 sample Tests 6.4 Routine Tests 6.7 Test Reports			
18 19	Electromechanical failing load test, Mechanical failing load test		8.	Mechanical Performance			
Note 1: See also TS 43-93 clause 8 Note 2: See also TS 43-93 Annex A							

IEC 60383- 2			ENA TS 43– 93				
Clause / Section	Requirement	Conformance Code	Clause	Requirement	Conformance Code	Evidence (test reports)	Remarks
9 10	Lightning Impulse Voltage Tests Wet Power frequency Voltage Tests		6	Test Requirements 6.1 General 6.2 Design and Type Tests 6.7 Test Reports			

B3- Clauses Specific to composite Insulators

IEC 61466- 1			ENA TS 43– 93				
Clause / Section	Requirement	Conformance Code	Clause	Requirement	Conformance Code	Evidence (test reports)	Remarks
Clause 6	Marking		4.1	Marking			

EN 601952			ENA TS 43– 93				
Clause / Section	Requirement	Conformance Code	Clause	Requirement	Conformance Code	Evidence (test reports)	Remarks
11.1	Electrical Tests		6	Test Requirements 6.1 General			
10	Design Tests			6.2 Design & Type tests			
11	Type tests (Note 1 & 2)						
12	Sample tests			6.3 sample tests			
13	Routine Tests			6.4 Routine tests			
11.2	Mechanical tests		8	Mechanical tests			
NOTE 1: For Clause 11.1 of IEC 61952, see also Clause 6.2 of ENA TS 43-93. NOTE 2: For Clause 11.2 of IEC 61952, see also Clause 8 of ENA TS 43-93							

EN 61109			**ENA TS 43– 93**				
Clause / Section	Requirement	Conformance Code	Clause	Requirement	Conformance Code	Evidence (test reports)	Remarks
11.1	Electrical Tests		6	Test Requirements 6.1 General			
10	Design Tests			6.2 Design & Type tests			
11	Type tests (Note 1 & 2)						
12	Sample tests			6.3 sample tests			
13	Routine Tests			6.4 Routine tests			
11.2	Damage Limit proof test		8	Mechanical tests			
Annex A	Principles of the damage Limit						
NOTE 1: For Clause 11.1 of IEC 61109, see also Clause 6.2 of ENA TS 43-93. NOTE 2: For Clause 11.2 of IEC 61109, see also Clause 8 of ENA TS 43-93							

ENA TS 43-93				
Clause	**Requirement**	Conformance Code	Evidence (test reports)	Remarks
6.5	Tracking and Erosion tests			
6.7	Test reports			

B4- Clauses specific to LV Insulators

ENA TS 43-93				
Clause	**Requirement**	Conformance Code	Evidence (test reports)	Remarks
9	LV Line & Service insulators			
	9.1 Standard applications			
	9.1.1 Reel Insulators			
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