NSP/004/042 – Specification for HV Wood Pole Lines up to and including 33kV

1. Purpose

The purpose of this document is to provide a specification detailing the design and construction requirements for new and renovated High Voltage overhead lines. This specification ensures compliance with the requirements of ESQCR 2002.

Additionally, this specification confirms the reference OHL 5/10 as the reference to be quoted on all planning applications for new lines or on correspondence to the Department of Energy and Climate Change.

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

Document Reference	Document Title	Version	Published Date
NSP/004/042	Specification for HV Wood Pole Lines up to and including 33kV	4.0	Oct 2022

2. Scope

This specification covers the design and construction requirements for new and renovated 3-phase and single-phase overhead lines on wood poles up to and including 33kV. It has been designed to be in accordance with ENATS 43-40: Issue 2 (2004) utilising 50, 100, 175 & 200 mm2 bare aluminium alloy (AAAC) conductors. This specification has been designed to comply with the "Empirical" design approach as detailed in the scope of ENATS 43-40.

Where lines are required to be constructed or refurbished in high tree density areas, recreational areas or ESQCR sites where inadvertent contact of the overhead line could occur, they have been excluded from this document. Lines of this type shall instead be constructed with covered conductors in accordance with NSP/004/044 - Specification for HV Wood Pole Lines of Compact Covered Construction up to and including 33kV.

2.1. Table of Contents

3. Technical Specification

3.1. Design Criteria

3.1.1. Weather Loadings

The following weather loadings which are dependent upon conductor cross sectional area will be utilized within the Company's geographic area.

*a) "Normal' A*ltitudes

- For conductors with a CSA > 35mm^2 copper equivalents, Wind pressure 380 N/m^2 with a radial ice thickness of 9.5 mm.
- For conductors up to and including 35mm^2 copper equivalent area (60mm^2 aluminium based conductors), wind pressure 380 N/m^2 with a radial ice thickness of 5.0 mm.

*b) "High" A*ltitudes

- For conductors with a CSA > 35mm^2 copper equivalents, wind pressure 570 N/m^2 with radial ice thickness 12.5 mm.
- For conductors up to and including 35mm^2 copper equivalent area (60mm^2 aluminium based conductors), wind pressure 380 N/m^2 with a radial ice thickness of 5.0 mm.

"Normal' altitude is defined as all locations with site altitudes not exceeding 300 m above sea level.

"High" altitude is defined as all locations with site altitudes above 300m but **not** exceeding 500 m.

For further reference, drawing 1071010066 sht1 provides details on those areas within Northern Powergrid located above 300m

Note: -

Ice / snow densities shall be considered as being equivalent to "*glaze ice*" at 913 kg/m^3.

3.1.2. Conductors

Conductors of cross-sectional area up to and including 35mm^2 copper equivalent area (60mm^2 aluminium based conductors), shall utilise a minimum factor of safety of 2.5 on their nominal breaking load. The minimum factors of safety on all conductors with a larger cross-sectional area shall be 2.0 on their nominal breaking loads. This limitation in conductor tension is known as Maximum Working Tension (MWT) and occurs at minimum conductor temperature, taken as -5.6°C.

Conductors have self-damping characteristics that reduce the amplitude of damaging Aeolian vibrations. The self-damping effect increases with conductor size but decreases as strands become locked more tightly together with increasing tension or compaction. Experience has shown that the self-damping of normally bare aluminium-based conductors require a maximum Everyday Tension (EDT) of 20 % of Rated Breaking Strength (RBS) at 5°C to reduce Aeolian vibration to an acceptable level in open terrain. For copper-based conductors, the EDT limit is normally 33 % of RBS, also at 5°C.

In line with standard UK practice a further MWT limit of 23.3kN has been applied to this specification to provide a minimum factor of safety of 3.0 on the 70kN tension insulator fittings.

The historic practice of artificially limiting the MWT of larger conductor sizes to 17.79kN (1814kgf) will no longer be applied to the construction of new lines. In practice this limit only applied to lines with conductor larger than 70mm HDBC or 100mm AAAC. However, users need to recognise the presence of existing lines designed to these criteria when checking clearances on old lines or creating a transition between new and existing lines.

3.1.3. Conductor Spacing to Avoid Clash

Maximum span lengths to avoid clash for any conductor and associated tension regime have been calculated within this design. The method employed assumes smoothed gust and lull wind pressures of 1.832 times the mean- and 0.546 times the mean- wind pressures respectively for a gust factor of 1.5. The likely mean wind and ice accretion levels for a specific locality and elevation are indicated as "weather zones" on the maps included in section 8 of ENATS 43-40. The numeral indicates the wind pressure in 190 N/m² increments and the letter as 10 mm diametric ice thickness increments for the indices A through to E respectively. The worst combination of wind and ice loading is used for the calculation, with the actual wind and ice loads employed enhanced by a withstand factor of 1.1.

For lines at *"Normal"* altitudes the conductor spacing has been related to a "2B" weather zone.

For *"High"* altitudes the conductor spacing has been related to a "3C" weather zone.

3.1.4. Crossarm Assemblies

Crossarm assemblies have been designed in accordance with ENATS 43-40 clause 4.3 utilising a 2.5 factor of safety for all steelwork and bolts (excluding insulator pins see details below). All crossarm arrangements are constructed using standard crossarms detailed in ENATS 43-95.

Insulator Pins

ENATS 43-40 issue 2 recommends that 10kN MFL insulator pins should be utilised with a maximum design stress equivalent to the ultimate stress of mild steel 430 N/mm^2 divided by a factor of safety of 2.5 which equals 172N/mm^2. (This effectively rates 10kN insulator pins at 4kN). This rating is at variance with the previous version of ENATS 43-40, which designed steel components to operate within their elastic limit.

Based on the good service history provided by ENATS 43-40 issue 1, this specification has been designed to limit the maximum design stress to the yield strength of steel (430/275 = a factor of 1.56).

This factor has been enhanced with a survival factor of 1.1 providing the traditional 10kN insulator pin with a maximum available rating of (10 / 1.56x1.1) = 5.83kN.

The resultant maximum allowable angle of deviation due to this reduced value has been detailed in each design table.

Note: -

For simplicity reasons all references to 10kN pins in the attached design tables, describe the pins with their full MFL rating even though the reduced rating has been used in the calculations.

3.1.5. Supports

Within this specification the stresses created in intermediate supports are considered as bending stresses only due to wind load on conductors and insulators, the loading point being approximately 160mm above pole tops for 11 kV lines. (Note: -: this dimension is the standard for 11/20 kV construction and equates to 260 mm above the top flange of the crossarm).

See clause 3.2.4 -for details on available "Wind Loading Spans" and the associated factors of safety applied within this design.

The stresses created in stayed supports are crippling stresses due to stay tension, conductor weight / downpull and crossarm hamper loads acting at the pole top. The distribution of stresses in the limbs of "H" supports on which stays are equally deployed on the two poles and are adjusted to equal tension is considered to be 50 % of stress in each limb. Unequal staying (two stays on one limb and one on the other) the strut load is assumed to be 60 % or 40 % respectively.

The following data details the factors of safety that have been used within this specification to determine the strut capability of poles.

Three Phase Construction

a) *"Normal"* altitudes - : Angle/Term. Pole, Min Pole Factor of safety shall be 2.5

b) *"High"* altitudes - : Angle/Term. Pole Min Factor of safety shall be 2.5

Single Phase Construction

c) *"Normal"* altitudes - : Angle/Term. Pole, Min Pole Factor of safety shall be 3.0

d) *"High"* altitudes - : Angle/Term. Pole Min Factor of safety shall be 3.5

Note: -

Factors of safety have been applied to poles based on minimum pole top diameters.

The strength of supports is derived from formulae contained in BS 1990 part 1 and in respect of *Pinus Sylvestris* wooden products; the pole producers in the UK have confirmed the following parameters:

Mean ultimate extreme fibre stress	53.3 N/mm²
Average modulus of elasticity	10 054 N/mm²

These parameters are based on a wood pole population whose southern border occurs at 60° latitude. Where some other species and / or pole population is considered, other strength parameters may be applicable and, in this respect, amended support capabilities may need to be calculated.

A Schedule of approved structure arrangement drawings used within this specification is provided in Appendix 1.

3.1.6. Fasteners

All fasteners are dimensionally in accordance with ENATS 43-96 and have been designed utilising the criteria detailed in ENATS 43-40 clause 4.5.

3.2. Technical Requirements

To ensure a line fully complies with this technical specification the following clauses provide more detailed explanations of key design options. Throughout the clauses reference will be made to a series of design tables that have been prepared to summarise the design options available for each combination of conductor and weather environment.

See appendix 2 - 11 - For design tables related to new construction.

See appendix 15 - 24 - For design tables related to the renovation of historical heavy construction lines.

See appendix 26 - 41 - For design tables related to the renovation of historical light construction lines.

3.2.1. Span Lengths

The basic span (recommended span) is used in the sag tension calculations to provide a theoretical mathematical design model for an overhead line. In conjunction with the selected weather severity level, it produces a series of horizontal and vertical loads which are then applied to each structure in the proposed design to determine the structures capabilities. Within the design charts one or more basic spans have been assigned against each conductor to provide the best economical balance between structure capabilities and the risk of failure.

Where two basic span lengths have been assigned it normally indicates that the larger of the two values is likely to be susceptible to a higher risk of conductor failure due to conductor clashing. Hence the users need to balance the need for larger spanning with the additional requirements of failure containment.

Typically, a Basic Span will be in the range of 80m to 120 m. Use of different basic spans within one overhead line is only approved where effective back staying, or other means, are provided to stabilise the out of balance tensions between the different sections at the transition structure.

The maximum span shown in the design tables is typically within +20 % of the basic span length. In this design specification the maximum span is determined by the clashing capabilities available from the phase to phase spacing on a standard support. The max clashing span contains an additional set of figures in brackets which is provided for information only. This figure has been included to identify how the maximum allowable clashing span compares with the calculated maximum span before clashing is likely to occur and hence require the use of failure containment.

Conductor clashing is recognised within this design as a major potential source of disruption to both supply reliability and to the overall integrity of the overhead line. Where the line design tables offer users a choice of available basic span options, users shall attempt to utilise the options that have the FCD required box set to "No". Where this cannot be economically justified, and the FCD "Yes" option is selected, users shall ensure that additional FCD measures are included within the line in accordance with clause 3.2.3.

The use of occasional long spans to supplement the normal maximum span is permitted within this specification. The occasional long span data box shown in the design tables confirms the increased spanning capability available beyond the normal maximum span provided a wider phase to phase structure is inserted into the line. Two structures are available for use in the creation of occasional long spans.

The options available are: -

a) 1000434007 sht1 - 2.5m centre's H structure with conductor section pole steelwork.

b) 1000434007 sht2 - 2.5m centre's H structure with intermediate insulator pin supporting steelwork.

In certain cases, the design tables may identify a requirement to enhance the pole in order to meet the full capabilities of the design basic span. This limit known as the "windspan limit", means the conductor horizontal loading has increased beyond the limit of the selected pole.

Where the combination of conductor / weather environment / basic span indicates span lengths that are considered too short or uneconomical, it is recommended that a stronger conductor be employed.

3.2.2. Construction of Single-Phase Lines

This specification is essentially a specification for the construction of 3 phase lines. Consequently, where new single-phase lines are required, they shall be constructed to cater for ultimate uprating to 3 phase operation. There are occasions however where the probability of uprating to 3 phase is very small, for example a diversion section in the centre of a long single-phase spur. In cases such as this the alternative range of single-phase drawing arrangements shown in appendix 1 shall be used.

The 2m phase to phase spacing offered by these alternative arrangements maximises the available clashing span allowing a more cost-effective line to be constructed. Single Phase lines shall be limited in conductor size to 50mm^2 AAAC conductors. The associated design tables for this conductor can be found in appendix 10 & 11.

3.2.3. Failure Containment

For the purpose of this specification, failure containment measures shall be deemed to include discrete failure containment devices (FCD) that operate to relieve excess conductor forces on one of a range of designated structures that incorporate additional strength to assist in the reduction of cascade pole failure.

Regardless of the requirement to check for the inclusion of failure containment measures within the design tables associated with a particular conductor and to improve line security, no section of line shall

exceed 1000m or 10 spans without a section or angle structure being inserted into the line, which meets the requirements of failure containment as detailed below.

The failure containment arrangements shown below are considered appropriate when any of the following situations occur: -

a) Where a line is to be built in a particularly exposed location.

b) Where an enhanced security of supply is required for a line.

c) Where the applicable conductor design table has identified the spanning as being susceptible to conductor clashing and hence has recommended the use of failure containment measures.

Where failure containment measures are required, the structures that incorporate them shall normally be separated by no more than 5 spans:

1) Intermediate supports to 1000434003 fitted with failure containment devices. (Drawing 1000434003 sht1 provides details on the installation of this device).

2) Intermediate supports to 1000434004 on a minimum of stout grade poles.

3) Pin angle arrangements to 1000434004 (on minimum of stout grade poles) at least equipped with twin splayed stays spread at 45° to the pole. *Not recommended for higher security feeders.*

4) Section supports to 1000434005 of a pole grade at least able to support 125 % of the windspan that applies in practice unless the pole grade is Stout, in which case this grade shall be adequate to satisfy this clause. Where the line is constructed in a High environment and a high security is required, additional stays shall be employed on both sides of the structure in the plane of the line.

5) Any of the "H" section, section angle or terminal structures installed in accordance with this specification. Where the line is constructed in a High environment and a high security is required, additional stays shall be employed on both sides of the structure in the plane of the line for section structures.

3.2.4. Wind Loading Spans

The maximum wind loading capability for structures has been incorporated into the design tables. Where the maximum allowable clashing span exceeds the maximum windspan capability of the standard pole type, a stronger pole grade will be required.

The maximum wind loading figures have been derived through the use of two weather related loading situations. These shall be used on level conditions up to 1:10 declination.

<u>Three Phase Construction</u>

a) *"Normal' A*ltitudes

- CSA > 35mm^2 copper equivalent - Min intermediate pole Factor of Safety = 2.5.
- CSA < or = 35mm^2 copper equivalent - Min intermediate pole Factor of Safety = 2.5

b) *"High" A*ltitudes

- CSA > 35mm^2 copper equivalent - Min intermediate pole factor of safety = 2.0. (See Note: - 1).
- CSA < or = to 35mm^2 copper equivalent - Min intermediate pole factor of safety = 2.0

<u>Single Phase Construction</u>

c) *"Normal"* Altitudes

- All conductors - Min intermediate pole factor of safety = 3.0

d) *"High"* Altitudes

- All conductors - Min intermediate pole factor of safety = 3.5

Note: -

All factors of safety have been applied to poles based on minimum pole top diameters.

The factor of safety on intermediate poles subjected to transverse loads shall be increased with increasing declination (The minimum factors of safety detailed above shall be increased by +0.5 for

1:7.5 declination and by +1.0 for a 1:5 declination

3.2.5. Maximum Angles of Line Deviation

Maximum angles of line deviation are determined by five aspects:

I. The mechanical capability of the Insulator Pin – See Clause 3.1.4 for available pin strengths

II. The mechanical capability of the complete crossarm assembly

III. The available stay wires mechanical strength

IV. The wood pole strut load capability. See clause 3.1.5

V. The available phase to phase clearance

The maximum angles of deviation permissible on each support type to achieve the most economically advantageous arrangement whilst balancing the risks to the structures have been tabulated against each conductor type / weather severity. See the appropriate design table for details.

The recommended maximum angle of line deviation on any standard 1.2m or 1.4m phase to phase spacing crossarm has been limited to a 60°.

Strut Load

The calculated strut loads used to determine the pole selection in the design tables have been generated on the basis that angle supports are located on level ground. Angle structures located on sloping ground with gradients of less or equal to 1:10 will generate additional strut loads approx. equal to an additional 5° of line deviation. Reference shall be made to the appropriate design table to ensure that the chosen pole grade/stay spread is still suitable for the on-site angle of deviation. Where the check identifies that this can no longer be achieved, an alternative arrangement designed for larger angles of deviation shall be chosen from the design table.

Both "*Normal*" and "*High*" altitude stay arrangements have been prepared using a Factor of Safety of 2.5 for all stay wire and stay fittings.

Note: -

For loading purposes, 60° angles of deviations shall be assumed as being equivalent to terminal loads.

Where the line design requires the use of 90° angles of deviation, the additional factor of the reduced phase to phase clearance and possible consequential clashing restrictions need to be considered. Under normal circumstances this will be achieved through the use of structures to drawing no. 1000434007 (2.5m centred H pole). However, where land usage precludes the use of this structure a standard 1.8m centred H pole dressed to drawing 1000434006 can be utilised but only with reduced spans adjacent to the structure.

ENATS 43-40 is based around the available clashing capability offered by a standard 1200mm phase to phase crossarm spacing on an intermediate structure. To enable large angles of deviation to be accommodated on structures with tension insulators, it is sometimes necessary to adjust the available phase to phase spacing to maintain the same clashing performance.

For example

If we assume a max angle of deviation of 60°, then based on a 1200mm clashing requirement the spacing would need to increase to 1200/Cos (60/2) = 1385mm. This is normally achieved by the use of structures dressed to drawings 1000434005 or 1000434006. Both of these are based on a 1400mm phase to phase spacing.

Using the same philosophy to achieve a 90° deviation would require an available phase to phase spacing of 1697mm. This can be achieved through the use of structures to drawing 1000434007 angle structure since it is based around a 2000mm phase to phase clearances.

Alternatively, an angle structure to drawing 1000434006 may also be used to provide the 90° deviation.

The following table details the reduced clashing spans that must be utilised if the alternative approach is used:

Conductor/Weather Zone Combination			
Normal Environment	Elm = 120	Oak = 110	Hazel = 90
High Environment	Elm = 110	Oak = 100	Hazel = 80

3.2.6. Stay Arrangements

Stay spreads will normally be such that an angle of 45° is provided between stay and pole. (i.e. stay and the vertical). As a general rule, therefore, the stay spread on horizontal ground will be equal to the length of the pole less its sinking depth. In circumstances when tighter stay spreads are unavoidable because of the location of physical obstructions, reduced values in line with the data provided in the appropriate design tables may be used. See appendix 2 - 11 for details. In all cases the minimum allowed stay angle shall be 30º.

NSP/004/104 provides details on converting minimum stay angles into actual stay spreads.

However, it must be accepted that use of these minima will reduce the normal capacity of the structure to withstand extreme conditions and it is expected that the vast majority of angle situations will be planned to avoid recourse to the use of minimum values.

In extreme weather conditions, stayed supports may be required to afford appreciable failure containment capability. In practice the design loading when applied to the case of large angles of line deviation and terminals, is generally more onerous than abnormal cases associated with broken conductors when applied to the same structures with correctly installed and maintained stays. A correctly stayed 'H' structure is deemed to provide an acceptable level of failure containment when used up to the ultimate loading case.

In the case of small angles of line deviation, single stays set at the minimum angle required to resist the normal design loading case do not offer significant failure containment capability.

At single pole angle supports, if a single stay is used then it shall be set so as to bisect the complement of the angle of deviation to counteract the side pull. When two or more stays are fitted, they shall be arranged in a splayed formation.

Triple stays shall comprise two splayed stays as above set at the approved angle to the pole, the third stay being placed to bisect the two and entering the ground at least one metre behind them viewed from the pole

Multiple stay baulks shall be installed so that the length of undisturbed ground between stay pits is not less than 3.0m.

At section positions where change of conductor type or sag chart gives rise to the need for out of balance stays, single or double splayed stays per leg will normally be fitted to provide an angle of 45° between pole and stay. Normally, out of balance stays will be set under the line in each direction sufficient in number to be capable of terminating the line in each direction, unless by examination of the appropriate

sag charts it can be shown that out of balance tensions do not reverse with change of temperatures, in which case stays may only be fitted against the higher tension conductors.

All stays supporting HV lines shall be effectively bonded at the top of the line crossarm. The method of bonding stays is to take one wire from the stay strand, or centre 'king' wire from a pre-formed pole top make off and connect it to the designated bolt on the HV crossarm. Stays shall be considered to be effectively bonded where they are either terminated direct onto a stay plate which itself is bolted direct to pole top steelwork, or where one wire is taken from the pole top make off and connected to a designated bolt on the HV crossarm as stipulated in ENATS 43-91.

3.2.6.1. Strut Poles - Stayed Pole Alternative

Under exceptional circumstances where no other traditional stayed support can be utilised due to wayleave or access problems, a strut pole arrangement as shown on drawing 1000434001sht2 may be utilised. Strut poles are limited to a maximum conductor size of 50mm^2 AAAC and a maximum angle of deviation of 20°. Supports shall be matched in grade to the pole grade for the traditional stayed support shown in the design tables for the appropriate conductor.

3.2.7. Conductor Design/Erection Sags & Tension

Conductor design and erection charts are provided in NSP/004/042/001

Lines constructed to this specification shall be designed such that the specified clearances in clause 3.2.10 of this specification are not infringed with the following conductor design temperatures:

For conductor sizes of 50mm^2 AAAC and below ..... 50°C

For conductor sizes greater than 50mm^2 AAAC ..... 75°C

3.2.8. Strut Loading of Supports

Supports shall be in accordance with the general arrangement drawings that form part of this Specification. It is recommended that all stays on angle and terminal poles be set at the maximum stay angle possible to afford the structure the greatest level of failure containment capability.

See applicable factors of safety applied to strut loaded supports in Clause 3.1.5

3.2.9. Pole Foundations

The maximum available windspan capability of poles is dependent upon the effectiveness of the associated pole foundations. ENATS 43-40 details three soil grades with the lateral rupture capacity of soil, 628 kN/m², 471 kN/m² and 314 kN/m² per metre depth for good, good / average and average / poor soils respectively.

Unless specific soil strength information is available, all calculations shall be based on 628 kN/m² or "good" as described in ENATS 43-40. This design premise is based on the use of soil additives.

All pole foundations used in this specification have been designed with a minimum factor of safety of 2.5

Augured pole foundations shall be utilised as the default pole foundation arrangement for single pole structures. Care shall be taken during the installation of these poles to ensure that the auger sizes match as close as possible to the pole base diameter.

The table shown below details the pole foundation sinking depths that shall be used with this specification to obtain the acceptable windspan capabilities from the poles:

Standard Pole Sinking Depths

Pole Length	Augured Pole Foundations Medium Grade Poles	Augured Pole Foundations Stout and E/Stout Grade Poles	Pole Sinking Depth Standard Block Founds Medium / Stout Poles
9.0 - 11.5m	2100mm	2400mm	1900 mm
12.0 – 14.0	2400mm	2600mm	2100 mm
15.0 – 18.0	2400mm	2800mm	2400 mm
19.0 – 22.0	Not Allowed	Not Allowed	3000 mm

Standard Pole Foundations

Where augured pole foundations cannot be used due to poor ground types or the inability to access site with appropriate installation equipment, then as an alternative poles shall be fitted with two wood foundation blocks (1300 x 250 x 125mm) as detailed in ENATS 43-91 fig 3, Type 2 or company drawing 1000439103 sht1. The blocks shall be placed as follows:

Ground line to Top Block Pole Bolt = 500mm

Ground line to Bottom Block Pole bolt = 880mm.

H Pole structures shall continue to be installed as fully augmented foundations with stay blocks and brace steelwork.

All pole foundation types shall incorporate the use of the backfill "Perma-Soil backfill additive as detailed below.

25kg of Perma-Soil should be added to the excavated spoil in layers throughout the excavation of the pole hole, half of this amount shall be added to augured holes. Reinstatement/Compaction should be completed in lifts as per the existing re-instatement practice.

Research work has shown that where average to poor foundations is identified, the Perma-Soil stabiliser will normally provide sufficient improvements in the foundation capability to improve the soil quality to that of a 'Good' backfill.

Foundation Strut Loadings

The maximum allowable strut loading utilised within this specification has been designed to be less than the respective value for the available soil bearing strength. An average soil bearing capacity of 429 kN/m^2 (4 tons/ft^2) has been used within this specification. This value will be utilised for all soil grades.

Note: -

The foundation type utilised by the site construction staff may not always be evident to the line surveyor/designer at the time of when the line is profiled using Polecad.

The line surveyor/designer shall default to the augured sinking depths provided above when creating a line design in Polecad. The surveyor/designer shall endorse the line schedule with a Note: - confirming that the profile has been designed on the basis of augured founds. Site construction staff may then utilise their preferred construction technique, but they must utilise the augured depths. The actual technique utilised shall be reflected on the as built line schedule returned to the surveyor/designer on completion of the work so that this info can be captured into the records system.

3.2.10. Clearances

The minimum height of all line conductors and clearances to other objects shall be compliant with NSP/004/011 which supplements the basic clearance requirements as recommended by ENATS 43-8 "Overhead Line Clearances" with any additional Company requirements to compensate for long term conductor creep etc.

3.2.11. Earthing

Earthing shall be fully compliant with IMP/010/011 Code of practice for earthing LV networks and HV Distribution Substations.

The following key values or requirements have been inserted for ease of reference.

3.2.11.1. Earthing of HV Metal work at Pole Mounted S/S

All non-current carrying metalwork associated with HV equipment at pole mounted substations, such as transformer tanks, aerial switches, top sections of stays and any HV cable terminations must be bonded together with 32mm^2 insulated (green) copper lead to an earth electrode which will be referred to as the HV metalwork earth electrode.

The approved type of earth electrodes should consist of two or more 1220 x 16mm^2 driven earth rods. See drawing no 1091010146 for details.

The resistance to earth of the HV metalwork earth must be low enough to ensure operation of the HV protection in the event of a breakdown of the insulation between the HV line or HV transformer winding and the non-current carrying metalwork.

At substations protected by overhead line fuses or connected to lines provided with sensitive earth fault protection, the resistance to earth must not exceed 20 ohms.

3.2.11.2. Earthing of LV Neutral at Pole Mounted Substations

The Neutral conductor of the LV network and any non-current carrying metalwork associated with LV cable terminations shall be bonded together and connected by means of a 32mm2 insulated (black) copper lead to an earth electrode, which will be referred to as the LV Neutral earth electrode. See drawing no 1091010209 and 1091193339 for details.

The resistance to earth of the LV Neutral earth electrode must not exceed 20 ohms.

3.2.11.3. Common HV & LV Earthing Systems

Where it is anticipated that the combined resistance to earth of the HV & LV earthing systems will be less than 1 ohm, the LV Neutral earth electrode shall be installed at the substation. Where tests prove that the combined resistance to earth is in fact 1 ohm or less, the two systems shall be bonded together to form a common earthing system.

3.2.11.4. Separate HV & LV Earthing Systems

Where it is anticipated that the combined resistance to earth of two electrode systems will exceed 1 ohm, they must be electrically separated by suitable spacing. At pole mounted substations connected to an LV overhead network by an overhead line or a short length of cable, the combined resistance of the two electrode systems will normally exceed 1 ohm. In these cases, the required electrical separation shall normally be achieved by installing the LV Neutral earth electrode at the first pole of the LV network.

Wherever possible, the LV Neutral earth electrode shall be positioned at least 9m from the HV metalwork electrode.

3.2.11.5. Earthing of Surge Diverters

Pole mounted surge diverters for cable protection should be installed close to the cable termination and the HV and earth connections should be as short and straight as possible. The diverter earth terminals must be bonded directly to the HV cable earth terminal which must also be connected to an earth electrode as shown on drawing 1091010146. The combined resistance to earth of the electrode and cable sheath for surge diverter installations shall not exceed 10 ohms.

3.3. Materials

All components shall comply with the requirements of the appropriate Network Product Specifications (NPS) referenced below. The following clauses include information specific to the application of the materials.

3.3.1. Anti-Climbing Devices

Anti-climbing devices and Safety Signs shall be designed in accordance with material specification NPS/001/005. They shall be installed in accordance with NSP/004/109.

3.3.2. Safety Signs, Labels and Notices

Safety Signs, labels & notices shall be designed in accordance with material specification NPS/001/010. They shall be installed in accordance with NSP/004/109.

3.3.3. Conductor

This specification has been designed around the use of 50, 100, 175 and 200mm^2 bare aluminium alloy (AAAC) conductors designed in accordance with material specification NPS/001/007. All conductors shall be installed in accordance with NSP/004/105.

3.3.4. Conductor Terminations and Joints

Conductor terminations, joints and other binders shall be in accordance with NPS/001/016.

Conductors shall be terminated at terminal/section structures using one of the following methods, preferably method (a).

a) Use of helical distribution grip dead ends with appropriate socket thimbles to ensure correct bending radius. See drawing 1091010425 for details.

b) Compression dead ends complete with jumper jugs where required. See drawing number 1091010102 sht9 for details

All terminations and joints shall be installed as detailed in NSP/004/106 & NSP/004/107.

Full tension joints shall not be utilised in the construction of new lines. Where they are required as a repair medium, they shall be constructed using compression connectors appropriate to the conductor size and material. See drawing 1091010102 for details. Under no circumstances shall they ever be used over road or rail crossings.

Non tension joints shall be constructed using compression connectors appropriate to the conductor size and material. See drawing 1000439202 or 9204 for details of approved components.

Bi-metal connections shall be made using non-tension joints designed in accordance with NPS/001/016. Care shall be taken to ensure that conductors are thoroughly cleaned before the conductors are inserted, and the joint shall be arranged with the aluminium in the uppermost position so that it is not possible for water to drain copper salts down onto the aluminium.

3.3.5. Conductor Binders

Conductors shall be secured to pin insulators using helical fittings in accordance with NPS/001/002 and installed in accordance with NSP/004/106.

Straight line and pilot pins shall be secured using fittings as detailed in drawing 1091010660

Pin Angle and jumper pins shall be secured using fittings as detailed in drawing 1091010662

3.3.6. Fasteners and Washers

Fasteners and Washers shall be in accordance with NPS/001/001.

3.3.7. Insulators and associated Fittings

Insulators and fittings shall be in accordance with NPS/001/006 and NPS/001/005. See NSP/004/127 for information on the applicable types and design of insulator and insulator assemblies.

3.3.8. Stays and Wood Baulks

All stays shall utilise 7/4.00mm grade 1150 galvanised steel stay strand supplied in accordance with NPS/001/013.

- See NSP/004/104 for details of approved stay assemblies and installation arrangements.
- Default stay assemblies shall employ the use of augured stay anchors, however where particular ground conditions or access issues preclude their use, then stay blocks to ENATS 43-91 drawing no. 1000439103 type 2 and installed at a depth of 1.8m below ground level shall be used as an alternative.
- Every stay shall be
    a) Fitted with an approved type of stay insulator(s) positioned as specified on drawing number 1000439108 sht1.
    b) Bonded at the top to the line crossarm.

In situations where a broken jumper or a broken stay may result in the stay becoming 'live', the insulator shall be placed below any likely point of contact with live metal, but not below a position which would maintain a minimum of 3.0 m above the ground with the stay swung vertically.

3.3.9. Steelwork

All steelwork shall be in accordance with ENATS 43-95, and designed to BS 5950: Part 1. All steelwork shall be in accordance with NPS/001/005.

3.3.10. Wood Poles

Wood poles shall be fabricated in accordance with the requirements of ENATS 43-88 Parts 1 and 2. All wood poles shall be treated with creosote and be in accordance with NPS/001/001.

For "H" poles, the minimum pole top diameters for Medium-grade poles shall be 175 mm and for Stout-grade poles they shall be 210 mm, as indicated on drawing 434002.

The pole assembly drawing 1000434010 utilised on single pole terminal arrangements requires a fixed pole top dimension of 210mm to facilitate the installation of the crossarm bracing straps. Additionally, the presence of a fixed pole top dimension ensures a minimum strut load capability in this pole.

3.3.11. Provision of Safety Signs

Each support shall be provided with at least one safety sign to ENATS 43-90. The sign shall be mounted approximately 3 m above the ground level, above any anti-climbing guard and clearly visible to an observer on the ground. See additional guidance Notes: - on the application of signs & notices. All safety signs shall be in accordance with NPS/001/010

3.3.12. Precautions against Access

The types of support requiring precautions against access and the methods to be employed are detailed in ENATS 43-90 and NSP/004/109.

3.3.13. Erection of Auxiliary Equipment - Substation/Plant Poles

Allowances have been made in the basic support design for the additional mechanical loading that would be imposed by auxiliary equipment and additional conductors / cables. (i.e. the additional weight due to pole mounted transformers etc.)

A selection of standard arrangement drawings is available for all Substation/Plant poles (including their associated pole fabrication drawings).

New pole arrangements shall wherever practicably make use of pre-fabricated poles as opposed to standard poles being drilled and fabricated on site.

Reference shall be made to the Company's Overhead Line Standards Manager for proposed arrangements not available within the existing standard arrangements.

See NSP/004/120 for details of Standard arrangement drawings and jumper connections to auxiliary plant.

3.3.14. Relationships with Other Bodies – Network Rail or Telecommunication Providers

Where lines to this standard are erected over or alongside the plant of Telecommunications Operators or Network Rail operators, then the provisions of the relevant joint agreements shall apply.

Note - Arrangements for Access to Network Rail Infrastructure is detailed in ENA Engineering Recommendation G56, the contents of which have been embodied into *"NSP/005/001 - Access Arrangements to Network Rail infrastructure"*

For details on the required clearances and any special provisions over network rail infrastructure see *"NSP/004/011 – Guidance on Overhead Line Clearances"*

Additional information with respect to Telecommunication requirements can be found in PO5 "Protection of Telecommunication lines from Power Lines"

The requirements of Waterways Authorities may also be found in NSP/004/011.

3.3.15. High Speed Road Crossings

Where new lines are required to cross over high-speed roads, e.g. motorways and dual carriage ways, the structures either side of the crossing shall be section poles with additional backstays installed to prevent a broken conductor in the spans either side of the crossing span affecting the actual crossing span. This policy is not retrospective but shall be applied on new builds where the alternative option of undergrounding has not been selected.

3.4. Conductor Erection Guidance - Long Term Creep Compensation

3.4.1. Conductor Creep

Suspended conductors are subject to longitudinal stresses that cause permanent long-term elongation termed conductor creep. This results in an increase in sag in the conductors. In order to ensure satisfactory ground clearance exists throughout the life of the line, a combination of compensation techniques have been employed within this specification.

Pre-Tensioning

Prior to final sagging, all newly erected conductors shall be pre-tensioned to reduce the amount of elongation that will occur in service. Pre-tensioning conductors has the additional advantage of proof testing other line components e.g. loading up stay assemblies to ensure all movement has been taken up.

For safety reasons, the pre-tension values have been selected to ensure that the following limit conditions are never exceeded (MWT or 50 % of the conductor rated breaking strength).

The pre-tensioning regime consists of the conductor being tensioned to this value for one hour. At 15 minute intervals during this period, the tension shall be adjusted to maintain the pre-tension value. At the end of the period, the conductors shall be tensioned in accordance with the appropriate erection tension table and then terminated. Further details of this process can be found in NSP/004/105.

Over-Tensioning

The reduction of sag due to the increased tension compensates for the increase in sag due to conductor creep during the life of the line. The amount of over tension applied is expressed as a percentage increase over the design tension. Over-tension values of 0 % or 10 % at 15°C depending on the conductor type and construction have been applied to the conductor erection tables.

Conductor Type	% Over-tension reduction	
Copper conductors & copper alloy	0	Nil
Aluminium alloy conductors 50 mm²	0	Nil
Aluminium alloy conductors 100 -200 mm²	10	Over-tension
ACSR conductors 100 - 175 mm²	10	Over-tension reduction

Ordinate Shift

The Company utilises the "Optimal, PoleCad Software" to design overhead lines and ensure all statutory clearance requirements have been complied with. The calculations used in the production of ground clearance curves apply a technique of modifying the clearance ordinates by reducing the conductor tension with a percentage reduction. This process builds in a very small hidden safety factor into the clearances. All percentage reduction values are based on an application temperature of 15°C. The following table details the % reduction applicable to each conductor type.

Conductor Type	% Reduction	
Copper conductors	5	% Reduction
Aluminium alloy conductors 50 mm²	5	% Reduction
Aluminium alloy conductors 100 -175 mm²	10	% Reduction
ACSR conductors 175 mm² (37 + 1)	5	% Reduction

3.5. Weather Co-ordinate Maps

See ENATS 43-40 Clause 8.0 for details.

3.6. Survey and Profiling

Survey and profiling shall be carried out in accordance with NSP/004/031. All proposed routes shall be surveyed to ensure conformance with company's design and clearance criteria.

Note: -

Since the line construction technique (i.e. augured foundations or traditional block foundations) may not always be apparent to the line surveyor it is recommended that lines are profiled for augured foundations. This will default to a safe condition where lines utilising block foundations will typically result in 0.5m additional line clearance. (This technique can only be used where complete line sections are being constructed as occasional pole replacements, could result in uplift to adjacent poles).

Using these methods, the typical standard pole height will be a 12m pole.

Northern Powergrid uses the Optimal Software PoleCad package and will provide any necessary Cell or Conductor Libraries for use with the system.

In addition, way-leaves shall be obtained and forwarded together with plans to a 1: 10,000 scale to enable consents to be applied for.

Upon completion of a satisfactory design and receipt of way-leaves and consents, line schedules shall be produced for construction and line record purposes. All CAD designs shall be given a unique file reference, related to the line feeder route number and archived.

When the line is ready for connection to the Companies distribution system, all network diagrams and asset databases shall be updated.

3.7. Conductor Design Checks

a) Proposed lines shall be checked for possible conductor uplift conditions through the use of an unloaded, -6.0°C conductor catenary curve. The check shall ensure that 0.5m exists between the top of the insulator and the cold curve position.

b) Where uplift conditions are designed out of the line, this process shall not result in excessive pole heights (i.e. under normal circumstances due to ground clearance requirements only it is envisaged that poles will not exceed 14m, poles in excess of this value shall be sectioned).

c) Lines shall be checked for conformance with the clearance requirements of clause 3.2.10 of this specification.

3.8. Inspection

All lines shall be inspected before commissioning.

3.9. Renovation of Existing Overhead Lines

During the period 2009/10 all HV lines in Northern Powergrid were subjected to a detailed condition assessment. The results from this survey have been used in conjunction with a health index tool to prioritise and quantify the amount of work required on all or part of each line.

Appendix 46 details a table of the condition points used for the line assessment together with guidance on those “CR” ratings that must be resolved.

Appendix 47 provides a template to summarise the condition points recorded in the original line assessment so that they can be confirmed by a secondary condition survey and used as the basis for the line authorisation.

The necessary refurbishment work required on each feeder can be categorised as follows: -

a) Extensive Maintenance

b) Line Strengthening

c) Rebuild/Upgrade

Note: -

It is envisaged that the majority of overhead lines will fall into the extensive maintenance category especially those lines in Northern Powergrid (Northeast Ltd) that have already been the subject of line strengthening in the past.

The refurbishment tables included in Appendix 25-44 indicate the required type of replacement structures or allowable spanning to make the line compliant with current design standards.

Despite the fact that the network has been previously inspected as part of the overall Northern Powergrid asset condition survey all networks shall be subjected to a re-inspection survey prior to actual work commencement as the condition of the asset may have changed from its original inspection by the time work is due to commence. The inspection shall include but not be limited to the following:

a) Conductor type, CSA and condition.

b) Adequate clearances to the ground and other obstacles

c) Assessment of applicable weather environment for the line.

d) Pole types, pole condition and an assessment of the typical spanning and angles of deviation.

e) Crossarm steelwork type and condition.

f) Type of conductor joints and terminations

g) Type and number of stays

h) Type and condition of anti-climbing devices

i) Type and condition of all signs and notices

j) Type and condition of all auxiliary plant

The level of detail involved in the re-inspection survey will be very much dependent upon the confidence we gain in the original survey data and the period of time between the original line survey and work starting as in some cases this could be many years

3.9.1. Extensive Maintenance

It is envisaged that this category will be applicable where less than 20% of the total number of poles on a feeder require attention.

The aim of carrying work out in this category is to preserve the line to its original design performance by means of replacement of components on a like for like basis (or their modern equivalent). It will normally involve carrying out the minimum amount of work to return the structures back to a fit for purpose condition for a minimum life of 10-15 years as all lines will be subjected to a full re-inspection on a 10-year cycle.

Apart from the replacement of a rotten pole this will typically include the replacement of individual line components e.g. stays broken insulators and ties. Where it is found necessary to replace a single broken insulator or insulator string assembly all three phases shall be replaced.

As a general rule all components classified via the inspection process as a “CR4” will be replaced. In addition any pole classified as a “CR3” will also be replaced.

Poles that cannot be confirmed as having a minimum of 1.5m sinking depth shall be classified as a “CR4” and as such shall be replaced. The local piling of ground around the pole does not constitute an increase of sinking depth.

Note: -

On average every 100mm reduction in pole sinking depth less than 1.5m results in a reduction in allowable windspan capability of 20%.

Where a line falls into this category, but a review of the existing conductor strength / clashing performance identifies that the feeder does not achieve acceptable minimum performance levels, then the feeder shall be subjected to further IIS review to determine if the feeder warrants additional investment to instead re-categorise the feeder into a candidate for line strengthening.

The likely performance levels of the existing line can be determined by reviewing the drawing arrangements and typical span lengths recorded for each structure in the associated line schedules. This information will indicate the typical crossarm arrangement on the intermediate structures and thus the likely existing phase to phase separation.

3.9.2. Line Strengthening

Where a line requires work on > 20% but < 50% of the structures or the IIS review has identified the feeder as being a suitable candidate for line strengthening,

Line strengthening typically involves the same work as detailed in the extensive maintenance category shown above plus the replacement of the existing crossarms with modern wider phase to phase spacing crossarms to improve a lines conductor clashing performance. It is envisaged that this category will normally only be applicable to historical light lines and that its use will be limited to those feeders that achieve a justifiable step change in improvement for the additional investment. The improvement potential for a line can be verified by reference to Appendix 14 of this specification.

3.9.3. Line Rebuild/Upgrade

Lines will normally fall into this category where more than 50% of the poles in a feeder are identified as requiring replacement or where the conductor is unsuitable for continued use.

Unsuitable conductor can be described as follows: -

a) Poor or unsatisfactory conductor condition which would be typically indicated by the presence of a "CR4" comment in the inspection data and or >2 joints per phase conductor per span

b) No longer suitable for future load or voltage regulation requirements.

c) No longer supported from a maintenance/ logistics viewpoint and thus in the event of a fault the necessary repair components are not readily available.

d) Where the existing conductor strength factor has been confirmed as being no longer suitable for continued use and the results of an IIS review have confirmed that the conductor should be replaced.

Note:-

Where a feeder is recommended for rebuilding purely on the grounds of voltage problems, it is permissible to partially rebuild the line with a larger than necessary conductor CSA to reduce the overall line impedance to an acceptable level and thus negate the requirement to rebuild the complete feeder in its entirety. See the additional Note:-s in clause 3.10.4

3.10. Historical Design Data

Over the years a number of design specifications have been utilised within Northern Powergrid, but all based on two generic types.

I. Heavy Construction

II. Light Construction

3.10.1. Design Criteria for Historical "H*eavy Construction Lines*"

Heavy construction lines are typically described as being lines with CSA >or = to .1" / 70mm HDBC or its copper equivalent. They were constructed to the following criteria:

- Weather loading - 380n/m^2 wind and 19mm diametric Ice.
- MWT's were based on a 2.0 conductor factor of safety @ -5.6°C loaded.
- Vibration limits were based on 20% or 33.3% of the conductor RBS @ 5°C for aluminium or copper respectively.
- Permissible Windspan and Strut loads for poles were based on a 2.5 factor of safety or 3.5 in High altitudes.
- Permissible stay loads were based on a 2.5 factor of safety.
- 8.5m - 14m supports were sunk 1.8m & 15m - 20m supports were sunk 2.1m all with a single
- ENATS 43-91 type 2 wood block.

3.10.2. Design Criteria for Historical *"Light Construction Lines "*

Light construction lines are typically described as being lines with CSA <or = to .05" / 32mm HDBC or its copper equivalent. They were constructed to the following criteria:

- Weather loading - 760n/m^2 wind and 0mm diametric Ice.
- MWT's were based on a 2.5 conductor factor of safety @ -5.6°C loaded.

- Vibration limits were based on 20% or 33.3% of the conductor RBS @ 5°C for aluminium or copper respectively.
- Permissible Windspan and Strut loads for poles were based on a 2.5 factor of safety or 3.5 in High altitudes.
- Permissible stay loads were based on a 2.5 factor of safety.
- 8.5m - 10.5m supports were sunk 1.5m, 11.0m -14.0m supports were sunk 1.8m & 15m - 20m supports were sunk 2.1m all with a single ENATS 43-91 type 1 wood foundation block.

The following table provides a summary of the historical design specification utilised within Northern Powergrid:

Design	Construction Period
Heavy Construction	
CE/C/18 (Tipped Triangle Design)	-------
NEDL / YEDL 43-40	1989 - present
CE/C/31 - (YEDL)	1930 - 1989
CE/C/36 - (YEDL	1930 - 1989
CE/C/26 & CE/C/28 - (YEDL)	Pre 1930
CE/C/37 – (YEDL) Long Span 33kV Lines Only	------ - present
EATS 43-20 (1969) - (NEDL)	1968 - 1989
Heavy Duty Wishbone (NEDL)	1030 - 1968
Std Wishbone - (NEDL)	1930 - 1968
Light Construction	
NEDL / YEDL 43-40	1989 -------
EATS 43-10 (1968) - (NEDL)	1968 -1989
BS 1320 - (NEDL)	1953 -1968
Nesco Oak - (NEDL)	1939 -1953
Std Wishbone (Light) - (NEDL)	1930 -1939
BS 1320 - (YEDL)	1953 -1989

Renovation guidelines have been included for each line type, indicating where appropriate the risk of premature line failure due to conductor strength or clashing.

3.10.3. Overall Renovation Criteria and Objectives

Where ever practicable: -

- Renovated lines designed in accordance with this part of the specification will provide performance levels equivalent to that of newly constructed lines.
- This will be achieved through the use of existing supports and conductors.
- All suspect or under strength poles will be replaced.
- Conductor sags and line tensions will continue in line with their original design criteria.
- All lines will incorporate a level of failure containment equal to or better than that prescribed for new overhead lines.
- All conductors that can no longer be economically supported and maintained with associated fittings will be replaced with modern equivalents.
- All lines will be designed to provide maximum operating temperatures and clearances in accordance with those employed on new construction. (However, poles shall not be replaced solely to provide an increase in existing operating temperature providing the existing minimum ground clearances at the original max design temperatures still comply with ENATS 43-08).

- All lines will provide a minimum resistance to conductor failure caused by severe wind and ice loading.

3.11. Design Criteria for Renovated Lines

3.11.1. Weather Loading

The weather loads detailed in clause 3.1.1 have been applied to each historical conductor type to determine the required support, crossarm hamper and stay arrangements necessary to facilitate the new weather loads.

3.11.2. Conductors

Unlike in new construction where all conductors have been assigned a factor of safety of 2.0 or 2.5 this cannot always be guaranteed on refurbished lines.

The capacity for a given conductor to carry wind and ice loading is determined by the MWT and loading conditions that were assigned to the conductor when it was originally erected. To view the design criteria attributed to historical line designs see clause 3.9.1 and 3.9.2.

To provide existing lines with the facility to carry increased weather loading beyond their original design criteria is not practicable, as this would require reduced line tensions with a resultant increases in conductor sag.

Each renovation design table includes an assessment of the "Resultant Conductor Strength Factor" (RCSF) to identify those lines types which are most at risk from premature conductor failure during weather events equal to the proposed weather loading conditions.

Where the design table identifies an overhead line with an RCSF of < or = 85%, guidance shall be sought from the network investment section policy paper. This will determine if the line can be maintained at its current risk level or if it should be replaced with a larger conductor to improve its reliability.

The following list of conductor types have already been pre-assessed and determined to be unsuitable for continued use on the company's distribution system. These have been assessed on grounds of conductor strength and the ability to support the old conductors through spares or replacement materials.

- .025" (3/.104") / 16mm2 HDBC
- .04" (7/.116") ACSR
- .025" (7/.093") ACSR
- No3 SWG (.05") Solid Copper
- No5 SWG (0.35") Solid Copper
- No6 SWG (0.29") Solid Copper
- No7 SWG (.025") Solid Copper
- Any ACSR conductors erected prior to 1956 (Period before grease was applied to protect conductors).

Note: -

As can be seen in the design tables the conductor clashing performance and the RCSF factor of .017" (13mm^2) CadCu conductor is very low. In principle this conductor is no longer suitable for continued use on the company's distribution system. However, the volume of this conductor type installed on the NEDL distribution system (approx. 5500km or 50% of the total route length) warrants a risk management approach to its continued use or replacement.

Note: -

To assist in the management of fault repairs on 13mm CadCu conductor despite its unavailability as a conductor, the following guidance Notes:- have been documented

Requirements for Short Lengths

Install short repair lengths of 32mm^2 HDBC available on cat no. 225264 - Restricted to a maximum length of 10m in any single span, then utilise the range taking full tension compression joints available on cat 268397.

The repaired conductor shall then be re-sagged as though it was still completely constructed from 13mm^2 CadCu. i.e. the heavier weight of the larger conductor is ignored. Any increase in sag due to this repair will be negligible and hence under normal circumstances will not affect existing ground clearances

Requirements for Long Length

In the event that one or more complete span lengths of conductor are required, this must be achieved by the creation of a discrete section of line. Out of balance stays shall then be installed against the 32mm^2 HDBC conductor to allow it to be erected to its normal design tension. Failure to do so will result in the 32mm^2 HDBC conductor infringing statutory ground clearances.

Note: -

16mm HDBC conductor shall **not** be used as an alternative repair medium. It is weaker than the 13mm^2 CadCu conductor and will therefore exceed its (MWT) Maximum Working Tension if erected to the same tension as the CadCu conductor. The current range of associated products such as helical fittings will still remain available

Advice will be provided from the company's network investment section to identify those sections of line that may be retained and hence refurbished in accordance with the appropriate design table.

The companies risk assessment policy will attempt to balance the potential number of CI's & CML's against the following factors:

I. The performance factors shown in the design tables

II. The relative route length of a feeder that contains this type of conductor.

III. The type of protection available on the feeder

IV. The ability of an alternative switched source of supply

3.11.3. Conductor Spacing to avoid Clash

The capacity to affect the existing clashing performance of an existing line is limited by the availability of alternative support locations. The renovation design tables have been prepared on the assumption that existing crossarm arrangements will be replaced with modern ENATS 43-40 crossarms with 1.2m minimum phase to phase spacing.

The occasional long span figure provides guidance on the maximum spanning achievable using a 2.0m phase to phase spacing.

In some cases, the recommendations for a particular line type may indicate retaining the existing crossarm. This will normally only be applicable where the crossarm is in good condition and it can be demonstrated that the existing clashing performance is similar to that achievable with a replacement crossarm.

Appendix 14 has been provided to identify those historical line types that provide adequate clashing performance with their existing crossarm arrangements. It can be seen from the table in Appendix 14 that the clashing performance of existing lines splits into two groups: -

a) <= .05 HDBC or equivalent conductor lines

Which in general need crossarms to be replaced to improve clashing and or the conductor replaced to provide higher conductor strength.

b) *>= .1" HDBC or equivalent conductor lines*

Which in general do not require crossarm replacement solely on the grounds of clashing performance.

When a line is being renovated, designers shall consider the options available to them to reduce excessive span or the incorporation of alternative structure types to bring the span lengths back within the design specification. Where a satisfactory or cost-effective solution cannot be achieved, designers shall utilise the system design investment policy paper to determine if the risk level can be tolerated or if the conductors should be replaced with larger conductors or covered conductors.

Where a conductor type is assessed as having an acceptable RCSF but perhaps a slightly lower than acceptable maximum clashing span, consideration should be given to the use of Limited Contact Spacers LCS as a means of improving the clashing performance. It shall be assumed that these will provide a potential 10% improvement in clashing performance.

3.11.4. Conductor Sagging Comparisons

The following table has been prepared to demonstrate the relative sagging characteristics for a range of new and historic conductor types. All conductors were erected on a standard 100m span to their applicable design tensions. Where a given conductor is located higher up the list than a second conductor this indicates that in principle the higher placed conductor can be erected on the existing pole without effecting ground clearances. This assumes that the required poles grades and allowable windspans are equivalent for both conductors. In most cases this will require angle structures and stay spreads to be replaced.

New (increased tension 23.79kN) 175mm AAAC conductor operating at 50 Deg C
New (Increased tension 23.79kN) 200mm AAAC conductor operating at 50 Deg C
13mm / .017” CA CU conductor operating at 50 Deg C
50mm / .05” AAAC conductor operating at 50 Deg C
100mm AAAC conductor operating at 50 Deg C
70mm / .1” HDBC conductor operating at 50 Deg C
New (Increased tension 23.79kN) 175mm AAAC conductor operating at 75 Deg C
New (Increased tension 23.79kN) 200mm AAAC conductor operating at 75 Deg C
32mm / .05” HDBC conductor operating at 50 Deg C
100mm AAAC conductor operating at 75 Deg C

Note: -

Clause 3.2.7 of this specification specifies the standard design temperature ratings expected for each conductor size. However, where a section of line requires the CSA of the conductor to be increased solely for voltage purposes and the normal application of a 75ºC design rating would require excessive amounts of pole to be changes due to ground clearance infringements, consideration shall be given to designing the line to only operate at 50ºC. Where this option is chosen but the line still requires replacement poles due to rot, the opportunity shall be taken to select poles that will assist in any future uprating options rather than replacement on a like for like basis.

3.11.5. Crossarm Assemblies

All supports will be renovated either by retaining the existing crossarms or by their replacement with standard crossarms available within the new construction inventory. Detailed guidance has been provided within each historical line type to determine the actions required with the renovation of each line type. The design tables have been prepared on the assumption that the crossarms have been replaced.

3.11.6. Supports

Renovated supports have been designed on the basis of achieving the following factors of safety for the windspan capacity on intermediate supports.

Three Phase Lines

a) Normal environment - All conductor CSA's = 2.5

b) High environment - conductor CSA of >35mm^2 copper equivalent = 2.0

c) High environment - conductor CSA of <35mm^2 copper equivalent = 2.0

Single Phase Lines

d) Normal environment - All conductor CSA's = 3.0

e) High environment - All conductor CSA's = 3.5

f) Strut loading has been designed to provide a minimum factor of safety of 2.5 in line with those recommended for new construction.

See clause 3.1.5 for stayed support subject to strut loads and clause 3.2.4 for windspan figures.

The renovation design tables have been prepared on the basis of the minimum acceptable pole grade to support a given conductor in the selected weather environment.

The windspan figure in each table confirms a poles ability to provide spanning at least equal to the largest recommended span in that design option. In some cases, it will be seen that a stronger pole has been recommended to achieve the larger spans.

3.11.7. Fasteners

The renovation design tables assume that all replacement fastenings are dimensionally in accordance with ENATS 43-96.

3.12. Technical Requirements including a Summary of Work

Appendix 15 - 23 has been prepared to identify the recommended work that is specific to particular historical overhead design specifications. More detailed instructions or additional activities that are common to all constructions are included in the following specific clauses.

The layout of the following clauses may be used as a logical assessment process in determining the correct actions required to refurbish an existing overhead line.

3.12.1. Conductors

See clauses 3.10.2 & 3.10.3 to confirm that the conductor strength and clashing performance requirements have been satisfied.

Where conductors are retained they shall be visually examined for signs of previous conductor clashing or wear at clamp and binders positions. Where minor damage is observed, this shall be repaired through the use of a small length of replacement conductor and two full tension joints.

Where multiple repair joints are required in a single span of conductor or it results in potential repair joints over road or rail crossings, the complete span of conductor shall be replaced.

Existing conductors shall be re-sagged using the design charts appropriate to the particular conductor.

All green PVC insulated conductors located across road, rail and BT crossings shall be replaced with sections of XLPE covered line.

3.12.2. High Speed Crossings

Particular attention shall be paid to all overhead lines in the vicinity of high-speed road crossings. It is not necessary to retrospectively install section structure and back stays either side of these crossings provided the following features of the spans adjacent to the crossings can be confirmed:

a) The spans between the crossing span and the nearest section structure have adequate phase to phase clearance and comply with the maximum clashing span limits for the type of conductor being used.

b) All insulators and fittings used to terminate the conductors on the adjacent section structures have been replaced with modern compression or helical deadend terminations.

c) No midspan joints or signs of previous conductor damage are evident.

d) The distance between the nearest adjacent section structure and the road crossing span does not exceed 5 supports.

3.12.3. Existing and Replacement Supports

The existing pole grade shall be compared with the minimum requirements of the renovation design tables detailed in Appendix 25 to 43, where they are found to be inadequate, they shall be replaced.

When a number of inadequate supports are found to be located adjacent to one another, consideration shall be given to the acceptability of the existing line routing as changes in land usage may now present an opportunity to re-align the circuit.

Where it is confirmed that existing supports comply with the minimum pole grade requirements in the appropriate design table, they shall be examined in accordance with NSP/004/112 to access their suitability for continued use. All retained poles shall be capable of providing a minimum of 10-15 years' service.

Supports that have been identified with minor deterioration shall only be retained when they are in straight line positions and do not carry additional pole mounted plant.

All supports that are retained and are in excess of 10 years old shall be treated with BORON ROD preservative.

Replacement supports shall utilise pole fabrication drawings as detailed in the appropriate design table.

All new and refurbished poles shall incorporate the use of anti-split bolts installed above and below the crossarm fixing position. This may be achieved through the use of existing bolt holes in the correct plane of the pole or through the fabrication of new holes.

Note: -

Where the need has been identified to replace a single leg of an existing 'H' or 'A' pole support, the support shall be replaced as a composite structure. (multi-pole supports are designed and manufactured as matched pairs).

3.12.4. Existing Pole Steelwork

Where the existing conductor clashing performance of a design is shown to be acceptable and the existing steelwork is in good condition, the existing steelwork shall be retained. Where it is found necessary to replace any component part of the steelwork this will normally require the complete replacement of the crossarm assembly as individual components for historical design arrangements are unlikely to be available.

In certain situations, the degree of re-fabrication of the pole top may result in an otherwise healthy pole being recommended for replacement to accommodate the modern steelwork.

3.12.5. Insulators

Existing insulators shall normally be retained unless they have been identified within the condition report as being defective. Where it is necessary to replace a defective insulator or insulator assembly during planned refurbishment works, then all phases shall be replaced at that time.

NSP/004/127 provides specific details on the type and number of replacement insulators to be utilised.

When line refurbishment activities result in the need to replace insulators at an earthed support, that currently contains a single disc tension insulator, the existing insulator shall be fitted with a minimum of two-disc insulators (or a composite insulator equivalent) irrespective of system operating voltage. In some cases, especially where the existing string assembly is terminated with scissor straps this requirement may also result in the need to replace the associated conductor termination fittings as they are no longer available.

3.12.6. Conductor Terminations and Joints (including binders)

All conductor terminations shall be assessed for compliance with the approved arrangements detailed in NSP/004/106 "Conductors Joints, Terminations & Binders" and NSP/004/107 "Conductor Jumpers and non-tension connectors on wood pole lines". Any non-compliant connections shall be replaced, in addition the following reliability driven changes shall be applied:

- Live line taps shall not be utilised as an electrical connection medium on main lines i.e. jumpers to pole mounted reclosers, ABSD's and across shorted out live line section points. Non-conforming connections shall be replaced with slotted bolted lug connections.
- All unnecessary live line sections installed in the main line shall be removed (except where these have been deliberately installed to divide up the line into manageable shorter sections).
- All transformers shall be connected via live line taps unless they can be isolated via local drop-out expulsion fuses or sectionalisers.
- Bolted tension clamps shall be replaced with helical dead-end terminations.
- ACSR conductors shall be terminated utilising compression dead-ends.
- Where split bolt connectors are used as non-tension joints in bows or droppers, they shall be replaced with non-tension compression connectors.
- All aluminium or solid copper jumpers shall be replaced with stranded copper jumpers.
- Live line taps located on conductor tails shall be replaced by installing an appropriate compression bail on the main line conductor and a live line tap located on the bail.
- All conductor binders shall be replaced with helical ties appropriate to the conductor CSA and support type. See NSP/004/106 for details.

3.12.7. Stays and Stay Assemblies

All stays assemblies shall consist of 7/4.00mm stay strand with ENATS 43-91 type 1 stay insulator assemblies inserted a minimum of 3 metres above ground level when the insulator is swung through to vertical. The insulators shall also be positioned so as to prevent live equipment coming into contact with the bottom section of the stay strand.

OHI 4 provides details on the correct installation of stays and stays assemblies.

The design tables included in the appendix of this document have been prepared on the assumption that all stays are high tensile 7/4.00mm grade 1150 stay strand. Existing 7/4.00mm grade 700 stays may be retained provided they are in good condition and of sufficient quantity and stay spread. All other stay strand and the related assemblies must be replaced.

Where the support construction is of an earthed design, the existing stay rods shall be inspected and or replaced as in most cases the rod will have suffered corrosion or thinning below ground level due to previous leakage currents.

Where stays rods are replaced, every attempt shall be made to increase the stay spreads to spreads in excess of the 30° minimum.

Where possible stays arranged in tandem shall be replaced with splayed stay arrangements to improve the structure's FCD capabilities.

Under exceptional circumstances where no other traditional stayed support can be utilised due to wayleave or access problems, a strut pole arrangement as shown on drawing 1000434003 sht 3 may be utilised. All existing wood strut poles must be replaced with new replacement supports with the replacement supports being matched in grade to the pole grade for the traditional stayed support shown in the design tables for the appropriate conductor.

Strut poles are limited to use with the following conductors: -

- .017" CADCU and .05" HDBC- Maximum angle of deviation of 30° (All situations)
- .05" AAAC - Maximum angle of deviation of 20° (Normal Altitude) or 10° (High Altitude)

3.12.8. Signs and Notices (including Anti Climbing Devices)

All safety signs, labels, notices and Anti Climbing Devices shall be replaced. Guidance on the correct type and fitting location can be found in NSP/004/109 (OHI 9) - Guidance on Anti-Climbing Devices, Safety Signs and Labels Required on Overhead Line Supports.

3.12.9. Tree Clearances

All trees shall be cleared back to a minimum of 3m from the line.

3.12.10. Auxiliary Plant

All auxiliary plant and connections shall be inspected for compliance with the companies approved equipment and arrangements. NSP/004/120 - (OHI 20) Guidance on mounting OHL plant and equipment on HV poles.

4. References

4.1. External Documentation

Reference	Title
ENATS 43-121	Single circuit overhead lines of compact covered construction on wood poles for use at high voltage up to and including 33kV
ENATS 43-40	High voltage single circuit overhead lines on wood poles
ENATS 43-8	Overhead Line Clearances
ENATS 43-88	Selection and treatment of wood poles and associated timber for overhead lines.
ENATS 43-90	Anti-Climbing devices and Safety signs for HV lines up to and including 400kV.
ENATS 43-91	Stay strands and stay fittings for overhead lines
ENATS 43-93	Line insulators
ENATS 43-95	Steelwork for overhead lines
ENATS 43-96	Fasteners and washers for wood pole overhead lines
ESQCR	The Electricity Safety, Quality and continuity Regulations 2002, SI 2665
OHL 5/10	Specification description lodged with the Department of Energy and Climate Change for new lines designed in accordance with this specification.
Pr EN 50423-1	Overhead electrical lines with rated voltage exceeding AC 1kV up to and including AC 45kV Part 1: General Requirements - Common Specifications

4.2. Internal Documentation

Reference	Title
IMP/010/011	Code of Practice for Earthing EHV Networks and Substations
NPS/001/001	Technical Specification for Wood Poles and Associated Products for Overhead Lines
NPS/001/002	Technical Specification for Helical Products
NPS/001/005	Technical Specification for Overhead Line Steelwork, Conductor Fittings, Insulator Fittings and Stay Fittings
NPS/001/006	Technical Specification for Insulators for Overhead Lines up to and including 132kV
NPS/001/007	Technical Specification for Overhead Line Conductors
NPS/001/010	Technical Specification for Fasteners and Fixings for Wood Pole Overhead Lines and General Construction Works
NPS/001/011	Technical Specification for Notice Plates and Signs
NPS/001/013	Technical Specification for Galvanised Steel Stay Wire
NPS/001/015	Technical Specification for Barbed Wire
NPS/001/016	Technical Specification for Compression and Mechanical Fittings for Overhead Lines
NPS/001/020	Technical Specification for Stay Ground Anchors for Overhead Lines
NSP/004/011	Guidance on Overhead Line Clearances
NSP/004/031	Code of Practice for the Survey of Overhead Line Routes
NSP/004/042/001	Conductor Sag Charts for Wood Pole Lines up to and including 33kV
NSP/004/044	Specification for HV Wood Pole Lines of Compact Covered Construction up to and including 33kV
NSP/004/104	(OHI 4) Guidance on the Types and Installation Requirements for Stays
NSP/004/105	(OHI 5) Guidance on the selection, erection and sagging of O/H line conductors
NSP/004/106	(OHI 6) Guidance on the Selection and Application of Conductor Joints, Terminations & Binders
NSP/004/107	(OHI 7) Guidance on the selection of conductor jumpers and non-tension connections
NSP/004/109	(OHI 9) Guidance on anti-climbing devices, safety signs and labels required on overhead line supports
NSP/004/112	(OHI 12) Guidance for the Inspection and Testing of Wood & Steel Poles
NSP/004/120	(OHI 20) Guidance on mounting OHL plant and equipment on HV poles
NSP/004/127	(OHI 27) Guidance on the selection and application of insulators
NSP/005/001	Access Arrangements to Network Rail infrastructure

4.3. Amendments from Previous Version

Reference	Description
Appendix 4, 5, 8 & 9	Amended to show options for full span tee-offs on lines constructed with 175 and 200mm AAAC
Clause 2.0 Scope	Scope amended to confirm that "Where lines are required to be constructed or refurbished in high tree density areas, recreational areas or ESQCR sites where inadvertent contact of the overhead line could occur, or adjacent to known recreational areas they have been excluded from this document. Lines of this type shall instead be constructed with covered conductors in accordance with NSP/004/044 - Specification for HV Wood Pole Lines of Compact Covered Construction up to and including 33kV."

5. Definitions

Term	Definition
Aeolian Vibration	Conductor Oscillation caused by low winds (1 m/s to 7 m/s) blowing steadily across the conductor.
Auxiliary Equipment	Equipment other than that forming part of the design that may be erected on supports such as transformers, fuse-gear etc.
Average Span	The arithmetic average of a number of spans in a line or section of line
Basic Span	The span length adopted for sag/tension calculations
Clashing	The electrical contact between two dissimilar line conductors of an overhead line displaced from their normal position by environmental forces such that the conductors are likely to touch.
Compact Covered Conductor	Stranded conductor that has been compacted and served overall with a radial layer of cross linked polyethylene (XLPE)
Conductor Creep	Permanent long term elongation of the conductor
Conductor Downpull	The vertical loading imposed by conductors corresponding to a gradient measured between adjacent pole tops
Crossarm Hamper	A descriptive term used to include all pole top crossarm components and fixings
Everyday Tension (EDT)	The design stress in an unloaded conductor at 5°C. Used in sag / tension calculations to limit harmful conductor vibrations
Freezing Point Tension (FPT)	The design tension of an unloaded conductor at 0°C in still air.
Ice Co-ordinate	The intercept on the ice axis of the weather incidence load line (See ENA TR 111) whose value is given for differing height and UK locations in the associated weather maps
Intermediate Support	A support in a straight run of line on which the conductors are supported on pin insulators.
Maximum Conductor Pressure (MCP)	The maximum transverse component of applied conductor load when subjected to a wind load.
Maximum Conductor Weight (MCW	The maximum vertical component of applied conductor load, including the weight of accreted ice, if present.
Maximum Span	The maximum permitted length of any span
Maximum Working Tension (MWT)	The absolute maximum conductor tension assessed at -5.6°C with wind and ice loading.
Minimum Failing Load	The minimum applied mechanical load that will cause failure by breakage of a component.
OHI	Northern Powergrid Overhead Line Instructions
Over-tensioning	Excess tension applied above normal tension at time of erection to compensate for conductor creep.
Pin Angle Support	A support at which a line deviates and the conductors are supported on pin insulators
Pre- tensioning	The tension treatment applied to a conductor for a short duration before final erection tension is established to remove a proportion of conductor creep
Rated Breaking Strength (RBS)	The rating assigned to a component (usually conductors) that defines the maximum mechanical load that the component will withstand without damage.
RCSF	Resultant Conductor Strength Factor - An assessment of a conductors ability to carry design loads above its original design capability.
Recommended Span	The average span length in any section to which the line shall be planned. Individual spans will normally be within +/- 20% of the chosen basic span.
Sag	The vertical distance, under any system of conductor loading, between the conductor and a straight line joining adjacent supporting points, measured at mid-span
Section Angle Support	A support at which a line deviates and the conductors are made off on either side of the crossarm on tension insulator sets

Section Support	A support in a straight line on which the conductors are made off on either side of the crossarm on tension insulator sets
Span	The horizontal distance between adjacent supports. Individual spans will normally be within 20% of the chosen basic span
Weather Zone	A geographical area in which the likely mean wind pressure and absolute maximum ice accretion thickness may be described by a numeral and letter respectively. The wind co-ordinate is described in 190N/m^2 increments, whilst the ice co-ordinate is measured in 10mm diametric thickness increments.
Wind Co-ordinate	The intercept on the wind axis of the weather incidence load line (See ENA TR 111) whose value is given for differing height and UK locations in the associated weather maps
Wind Loading Span	Half the sum of the spans adjacent to the support

6. Authority for Issue

6.1. CDS Assurance

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

		Date
Liz Beat	Governance Administrator	05/07/2023

6.2. Author

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

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

Standard CDS review of 3 years?	Non Standard Review Period & Reason	
Yes	Period: n/a	Reason: n/a
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Ged Hammel	Senior Policy and Standards Engineer	05/07/2023

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
Steven Salkeld	Policy and Standards Engineer	06/07/2023
Joe Helm	Policy and Standards Manager	12/07/2023

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	System Engineering Manager	20/07/2023

Appendix 1 - Schedule of Structure Drawings

Drawing Number and brief Description	Application
1000434001 sht1 Single pole fabrication drawing	To be used for all single poles except the 1000434010 Terminal pole.
1000434002 sht1 Single pole fabrication drawing	To be used for all 'H' poles.
1000434003 sht1 Single crossarm, single pole	Three Phase - Straight Line, small deviation angle, 1:10 down pull
1000434003 sht2 Single crossarm, single pole	Single Phase (1000439556 Xarm) - Straight Line, small deviation angle, 1:10 down pull
1000434004 sht1 Double crossarm, single pole	Three Phase - Straight Line, small deviation angle, 1:10 down pull
1000434004 sht2 Double crossarm, single pole	Single Phase (1000439556 Xarm) - Straight Line, small deviation angle, 1:10 down pull
1000434005 sht1 Double crossarm, single pole	Three Phase - Straight Line and Section, medium deviation angles, 1:10 down pull
1000434005 sht2 Double crossarm, single pole	Single Phase (1000439556 Xarm) - Straight Line and Section, medium deviation angles, 1:10 down pull
1000434006 sht1 Double crossarm, 'H' pole	Three Phase - Section, Straight Line, heavy deviation angles, 1:10 down pull
1000434007 sht1 Double crossarm, 'H' pole	Three Phase - Section, occasional long span, heavy deviation angles, 1:10 down pull
1000434007 sht2 Double crossarm, 'H' pole	Three Phase - Intermediate, occasional long span, 1:10 down pull
1000434008 sht1 Tee-off double crossarm, single pole	Three Phase - Tee off
1000434008 sht2 Tee-off double crossarm, single pole	Single Phase - Tee off
1000434009 sht1 Unbraced double crossarm, single pole	Three Phase - Terminal (Small conductors only)
1000434009 sht4 Single crossarm, single pole	Single Phase - Terminal
1000434010 Double braced crossarm, single pole	Three Phase Terminal
1000434010 sht2 Single pole fabrication drawing	To be used for all 1000434010 sht1 terminal poles. Incorporates a minimum 210mm pole top dimension.
1000434011 Double crossarm, 'H' pole	Three Phase Terminal
1000434012 Single crossarm, single pole	Renovation of existing poles using existing conductors, straight line, limited deviation angles using existing pole drillings.

Notes

Structures that require the installation of additional pole mounted equipment shall be based on these assembly drawings. Specific drawings for approved arrangements are detailed in NSP/004/120.

Appendix 2 - 11 - Design Tables for New Construction

Appendix 2 - Design Tables - 50mm^2 AAAC (Hazel) - Normal Altitude)

Basic Design Span	90
Max Clashing Span ***	108 (108)
Occasional Long Span (2.0m Phase to Phase)	132
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of Safety applied to Wood poles	2.5
Strut load factor of Safety applied to Wood poles	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	112m
434003	Intermediate	Stout	10kN	221m
434007/2 *	Intermediate	Stout 'H'	10kN	221+m
434005	Section	Stout	-	221m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	30°	1 @ 45°
434003	Pin Angle	Stout	10kN	45°	1 @ 30°
434005	Sect Angle	Stout	-	60°	1 @ 45°
434005	Sect Angle	Stout <=13m	-	60°	2 @ 30°
434005	Sect Angle	E/Stout	-	60°	2 @ 30°
434007	H Sect Angle	Med H	-	90°	3 @ 45°
434007	H Sect Angle	Stout H	-	90°	3 @ 30°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off **	Stout	1 @ 45°
434008	Tee Off **	Stout <=13m	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434010	Terminal	Stout	1 @ 45°
434010	Terminal	Stout <=13m	2 @ 30°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- Angle & terminal structures based on higher basic span

Appendix 3 - Design Tables - 100mm² AAAC (Oak) - Normal Altitude

Basic Design Span	110
Max Clashing Span ***	130 (125)
Occasional Long Span (2.0m Phase to Phase)	152
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of Safety Applied to Wood Poles	2.5
Strut load factor of Safety Applied to Wood Poles	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Stout	10kN	133m
434007/2 *	Intermediate	Stout 'H'	10kN	133+m
434005	Section	Stout	-	133m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434003	Pin Angle	Stout	10kN	18°	1 @ 45°
434003	Pin Angle	Stout <=13m	10kN	18°	1 @ 30°
434005	Sect Angle	Stout	-	30°	2 @ 45°
434005	Sect Angle	Stout <=13m	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=15m	-	45°	2 @ 30°
434005	Sect Angle	E/Stout <=15m	-	60°	2 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 30°
434007	H Sect Angle	Stout H	-	90°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout (Tee-off cond Size 50mm AAAC	1 @ 45°
434008	Tee Off	E/Stout (Tee-off cond Size 100mm AAAC	2 @ 45°
434008	Tee Off	E/Stout <=15m (Tee-off cond Size 100mm AAAC	2 @ 35°
434010	Terminal	Stout <=11m	2 @ 45°
434010	Terminal	E/Stout <=15m	2 @ 35°
434011	Terminal	Stout H	4 @ 30°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- Angle & terminal structures based on higher basic span

Appendix 4 - Design Tables - 175mm^2 AAAC - (Elm) Normal Altitude

Basic Design Span	110
Max Clashing Span ***	130 (128)
Occasional Long Span (2.0m Phase to Phase)	166
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of safety applied to Wood Poles	2.5
Strut load factor of safety applied to Wood Poles	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	116m
434004	Intermediate	E/Stout	10kN	156m
434007/2 *	Intermediate	Stout 'H'	-	156+m
434005	Section	Stout	-	116m
434005	Section	E/Stout	-	156m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	12°	1 @ 45º
434004	Pin Angle	Stout <=13m	10kN	12°	1 @ 30°
434005	Sect Angle	E/Stout	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=13m	-	43°	2 @ 35°
434006	H Sect Angle	Stout H <=13m	-	60°	3 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout (Tee-off cond Size 50mm AAAC)	1 @ 45°
434008	Tee Off	**E/Stout** (Tee-off cond Size 100mm AAAC)	2 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 5 - Design Tables - 200mm^2 AAAC - (Poplar) Normal Altitude

Basic Design Span	120
Max Clashing Span ***	140 (138)
Occasional Long Span (2.0m Phase to Phase)	158
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of safety applied to Wood Poles	2.5
Strut load factor of safety applied to Wood Poles	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	112m
434004	Intermediate	E/Stout	10kN	151m
434007/2 *	Intermediate	Stout 'H'	-	151+m
434005	Section	Stout	-	151m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	9°	1 @ 45º
434004	Pin Angle	Stout <=13m	10kN	9°	1 @ 30°
434005	Sect Angle	E/Stout	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=13m	-	43°	2 @ 35°
434006	H Sect Angle	Stout H <=13m	-	60°	3 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout (Tee-off cond Size 50mm AAAC)	1 @ 45°
434008	Tee Off	**E/Stout** (Tee-off cond Size 100mm AAAC)	2 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 6 - Design Tables - 50mm² AAAC (Hazel) - High Altitude

Basic Design Span	75	80
Max Clashing Span ***	90 (90)	96 (91)
Occasional Long Span (2.0m Phase to Phase)	116	119
FCD Required	No	Yes
Clashing Weather Zone	3C	3C
Windspan factor of safety applied to Wood Poles	3.0	3.0
Strut load factor of safety applied to Wood Poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	91m
434003	Intermediate	Stout	10kN	180m
434007/2 *	Intermediate	Stout 'H'	10kN	180+m
434005	Section	Stout	-	180m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434003	Pin Angle	Medium	10kN	12°	1 @ 45°
434003	Pin Angle	Stout	10kN	30°	1 @ 30º
434005	Sect Angle	Stout	-	60°	1 @ 45°
434005	Sect Angle	Stout	-	60°	2 @ 35°
434006	H Sect Angle	Stout H	-	60°	3 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	3 @ 30°
434007	H Sect Angle	Stout H	-	90°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	2 @ 45°
434008	Tee Off	Stout <=13m	2 @ 35°
434009	Terminal (No Plant)	Stout	2 @ 45°
434010	Terminal	Stout <=13m	2 @ 35°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- Angle & terminal structures based on higher basic span

Appendix 7 - Design Tables - 100mm² AAAC (Oak) - High Altitude

Basic Design Span	80m	90m
Max Clashing Span ***	96m (101)	108m (105)
Occasional Long Span (2.0m Phase to Phase)	135m	134m
FCD Required	No	Yes
Clashing Weather Zone	3C	3C
Windspan factor of safety applied to Wood Poles	2.0	2.0
Strut load factor of safety applied to Wood Poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	92m
434004	Intermediate	E/Stout	10kN	123m
434007/2 *	Intermediate	Stout H	10kN	123+m
434005	Section	Stout	-	92m
434005	Section	E/Stout	-	123m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	13°	1 @ 45°
434004	Pin Angle	Stout<=13m	10kN	13°	1 @ 30º
434005	Sect Angle	Stout <=13m	-	30°	2 @ 45°
434005	Sect Angle	E/Stout	-	30°	2 @ 30°
434005	Sect Angle	E/Stout	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=13m	-	45°	2 @ 30°
434006	H Sect Angle	Stout H <=13m	-	60°	3 @ 35°
434007	H Sect Angle	Stout H		90°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off **	Stout	2 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 35°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- Angle & terminal structures based on higher basic span

Appendix 8 - Design Tables - 175mm^2 AAAC - (Elm) High Altitude

Basic Design Span	90	100
Max Clashing Span	108 (112)	120 (116)
Occasional Long Span (2.0m Phase to Phase)	135	138
FCD Required	No	No
Weather	3C	3C
Windspan factor of safety applied to Wood Poles	2.0	2.0
Strut load factor of safety applied to Wood Poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	81m
434004	Intermediate	E/Stout	10kN	115m
434007/2 *	Intermediate	Stout H	10kN	115+m
434005	Section	E/Stout	-	110m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	8°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	8°	1 @ 30°
434005	Sect Angle	E/Stout	-	32°	2 @ 45º
434005	Sect Angle	E/Stout <=13m	-	32°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off **	Stout	2 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- Angle & terminal structures based on higher basic span

Appendix 9 - Design Tables - 200mm^2 AAAC - (Poplar) High Altitude

Basic Design Span	90	100
Max Clashing Span	108 (113)	120 (116)
Occasional Long Span (2.0m Phase to Phase)	134	136
FCD Required	No	Yes
Clashing Weather Zone	3C	3C
Windspan factor of safety applied to Wood Poles	2.0	2.0
Strut load factor of safety applied to Wood Poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	79m
434004	Intermediate	E/Stout	10kN	110m
434007/2 *	Intermediate	Stout H	10kN	110+m
434005	Section	E/Stout	-	106m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	6°	1 @ 45°
434004	Pin Angle	Stout	10kN	6°	1 @ 30°
434005	Sect Angle	Stout <=13m	-	32°	2 @ 45º
434005	Sect Angle	E/Stout	-	32°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off **	Stout	2 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- Angle & terminal structures based on higher basic span

Appendix 10 - 50mm² AAAC (Hazel) - Single Phase (Normal Altitude)

Basic Design Span	120
Max Clashing Span ***	144 (150)
Occasional Long Span (2.0m Phase to Phase)	144
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of Safety applied to Wood poles	3.0
Strut load factor of Safety applied to Wood poles	3.0

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003/2	Intermediate	Medium	10kN	136m
434003/2	Intermediate	Stout	10kN	200+m
434005/2	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003/2	Pin Angle	Medium <=13m	10kN	45°	1 @ 45°
434003/2	Pin Angle	Stout	10kN	45°	1 @ 30°
434005/2	Sect Angle	Stout	-	60°	1 @ 45°
434005/2	Sect Angle	Stout <=13m	-	60°	1 @ 30°
434005/2	Sect Angle	Stout	-	90°	2 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	2 @ 45°
434008	Tee Off	Stout <=13m	2 @ 30°
434009/4	Terminal	Stout	2 @ 45°
434009/4	Terminal	Stout <=13m	2 @ 30°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- *** (value in brackets = actual clashing limit for given basic span)
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 11- 50mm² AAAC (Hazel) - Single Phase (High Altitude)

Basic Design Span	100
Max Clashing Span ***	120 (127)
Occasional Long Span (2.0m Phase to Phase)	127
FCD Required	Yes
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	3.5
Strut load factor of Safety applied to Wood poles	3.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003/2	Intermediate	Medium	10kN	113m
434003/2	Intermediate	Stout	10kN	200+m
434005/2	Section	Stout	-	200+m

Angle Structures

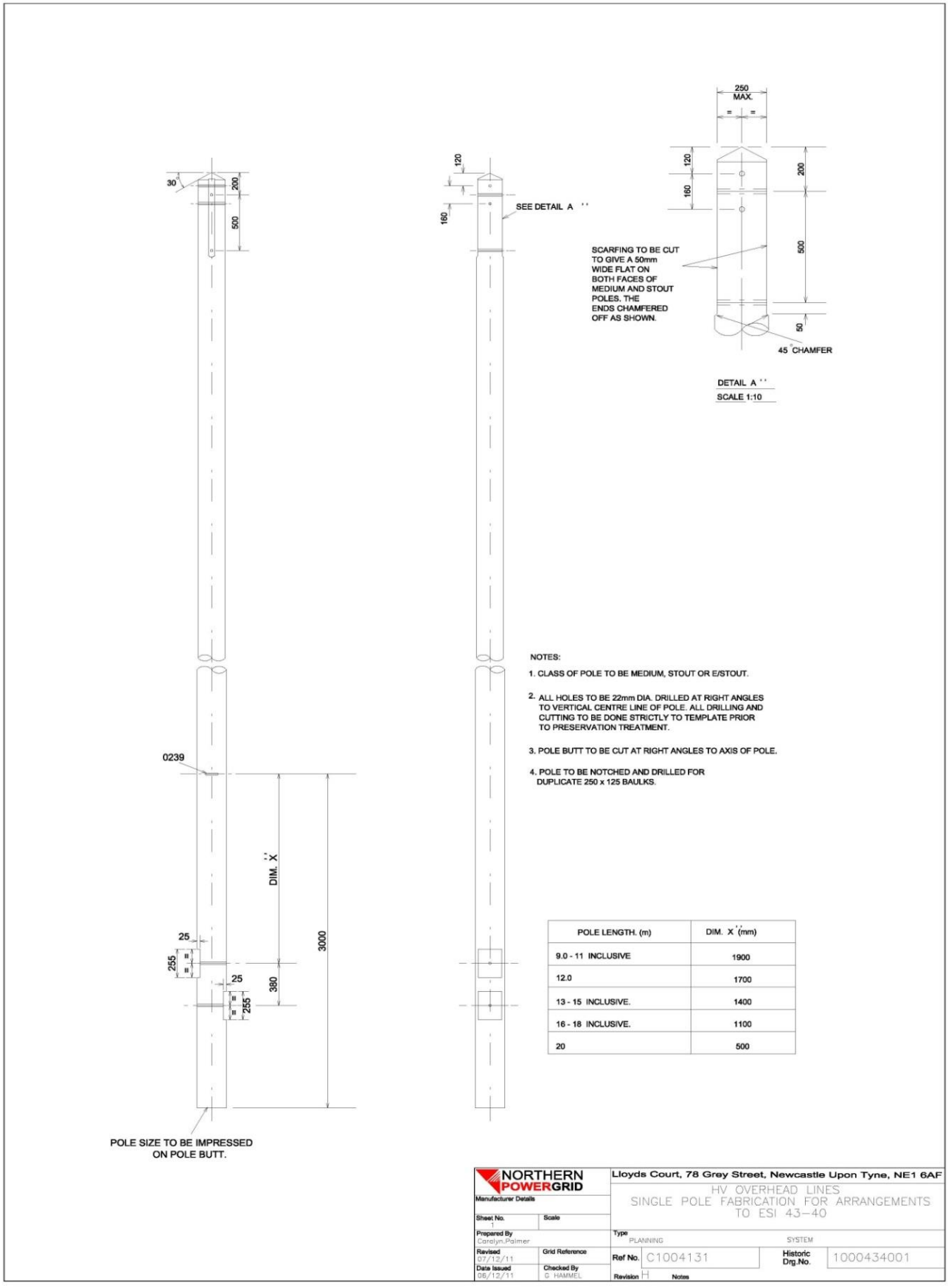
Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003/2	Pin Angle	Medium	10kN	20°	1 @ 45°
434003/2	Pin Angle	Stout	10kN	30°	1 @ 30°
434005/2	Sect Angle	Stout	-	60°	1 @ 45°
434005/2	Sect Angle	Stout <=14m	-	60°	2 @ 35°
434005/2	Sect Angle	Stout	-	90°	2 @ 45°

Terminal Structures

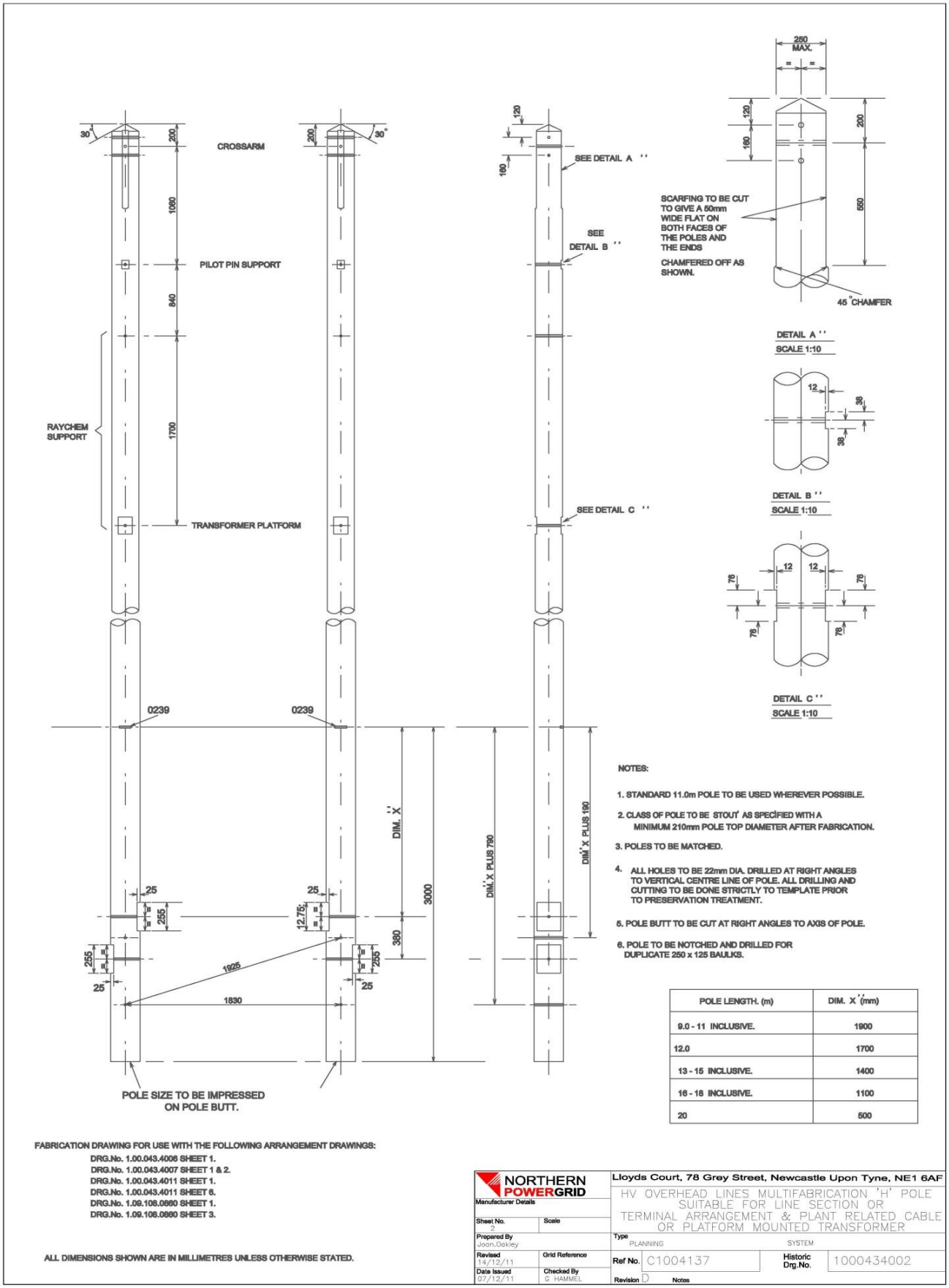
Drawing No.	Support Type	Support Class	Stays
434008	Tee Off **	Stout	1 @ 45°
434008	Tee Off	Stout <=14m	2 @ 35°
434009/4	Terminal	Stout	1 @ 45°
434009/4	Terminal	Stout <=14m	1 @ 35°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- *** (value in brackets = actual clashing limit for given basic span)
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 12 - Arrangement Drawings and Materials Lists



POLE LENGTH. (m)	DIM. X ''(mm)
9.0 - 11 INCLUSIVE	1900
12.0	1700
13 - 15 INCLUSIVE.	1400
16 - 18 INCLUSIVE.	1100
20	500



NOTES:

1. STANDARD 11.0m POLE TO BE USED WHEREVER POSSIBLE.
2. CLASS OF POLE TO BE 'STOUT' AS SPECIFIED WITH A MINIMUM 210mm POLE TOP DIAMETER AFTER FABRICATION.
3. POLES TO BE MATCHED.
4. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO PRESERVATION TREATMENT.
5. POLE BUTT TO BE CUT AT RIGHT ANGLES TO AXIS OF POLE.
6. POLE TO BE NOTCHED AND DRILLED FOR DUPLICATE 250 x 125 BAULKS.

POLE LENGTH. (m)	DIM. 'X' (mm)
9.0 - 11 INCLUSIVE.	1900
12.0	1700
13 - 15 INCLUSIVE.	1400
16 - 18 INCLUSIVE.	1100
20	500

FABRICATION DRAWING FOR USE WITH THE FOLLOWING ARRANGEMENT DRAWINGS:

DRG.No. 1.00.043.4006 SHEET 1.
DRG.No. 1.00.043.4007 SHEET 1 & 2.
DRG.No. 1.00.043.4011 SHEET 1.
DRG.No. 1.00.043.4011 SHEET 6.
DRG.No. 1.09.108.0860 SHEET 1.
DRG.No. 1.09.108.0860 SHEET 3.

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

NORTHERN POWERGRID
Manufacturer Details

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

HV OVERHEAD LINES MULTIFABRICATION 'H' POLE SUITABLE FOR LINE SECTION OR TERMINAL ARRANGEMENT & PLANT RELATED CABLE OR PLATFORM MOUNTED TRANSFORMER

Sheet No. 2	Scale	Type PLANNING	SYSTEM
Prepared By Joan Oakley			
Revised 14/12/11	Grid Reference	Ref No. C1004137	Historic Drg.No. 1000434002
Date Issued 07/12/11	Checked By G HAMMEL	Revision D	Notes

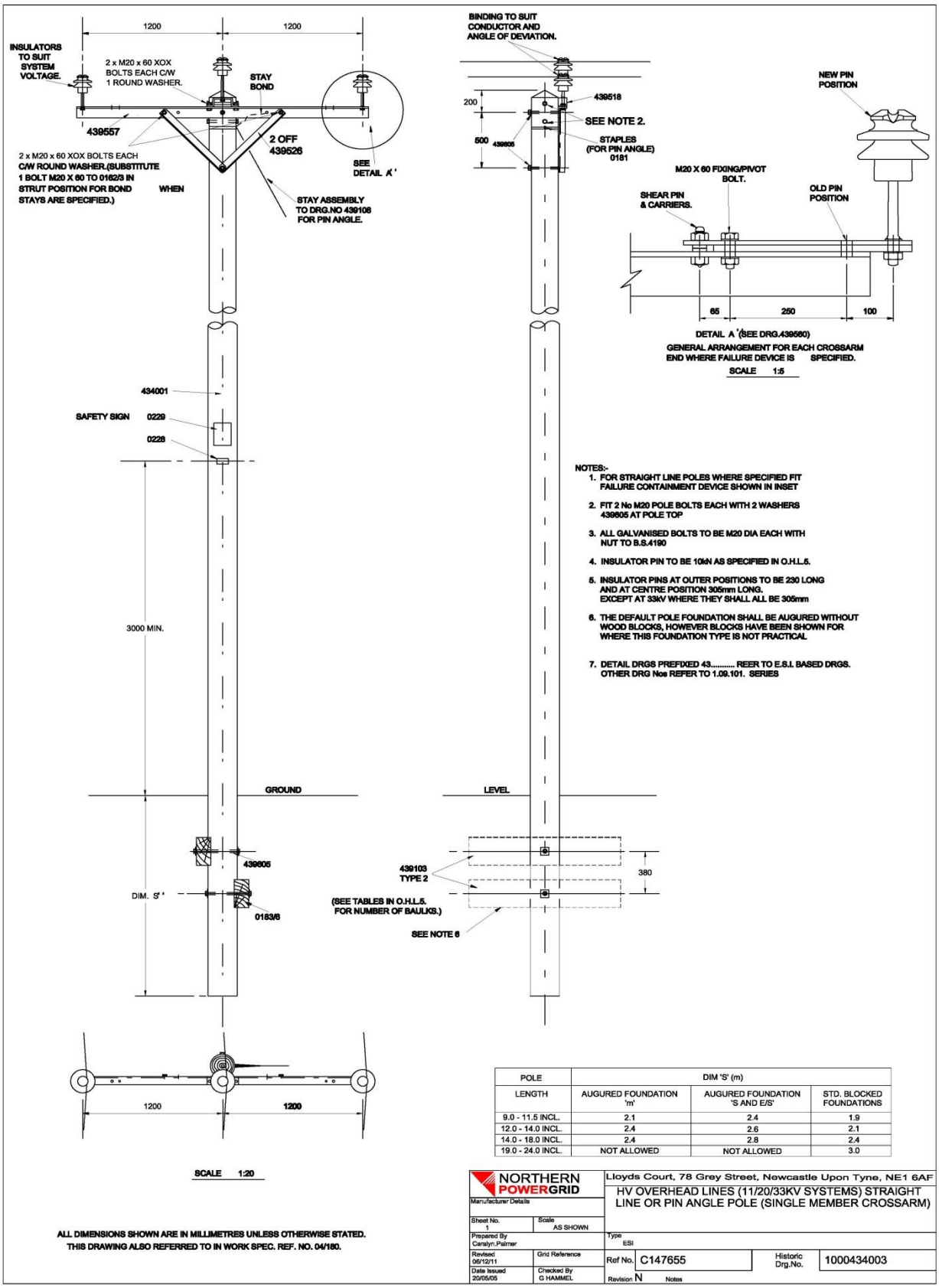
COMPONENT	DRAWING NO	QUANTITY				CAT NO
		11 & 20 kV		33 kV		
		Strt Line	Pin Angle	Strt Line	Pin Angle	
		(PS)	(PA)	(PS)	(PA)	
Wood Pole	434001	1	1	1	1	-
Kicking Blocks	439103 Type 2	2	2	2	2	235124
Bolts M20 x 400 (Medium)		2	2	2	2	372904 or
Bolts, M20 x 530 (Stout)	-	2	2	2	2	372815
Washer, Square, Flat	0183/6	2	2	2	2	368063
Washer, Square, Curved	439605	2	2	2	2	368078
Crossarm Member	439557	1	1	1	1	251470
Crossarm Strut	439526	2	2	2	2	237581
Insulator Bracket	439518	1	1	1	1	237539
Bolts, M20 x 220 (Medium)	-	4	4	4	4	378756 or
Bolts, M20 x 300 (Stout)	-	4	4	4	4	378794
Bolts, M20 x 60	-	4	3	4	3	378703
Bolts, M20 x 60 (Earthing)	0162/3	-	1	-	1	370504
Washers, Round, M20	-	4	4	4	4	375616
Washers, Square, Curved	439605	6	6	6	6	368078
Pin Insulators (as specified)						
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	3	3	-	-	253777
90kV Rating (33kV)	0486/4	-	-	3	3	253423
Insulator Pins, 50 mm shank (as specified)						
10 kN, 230 mm stalk	0527/1	2	2	-	-	261824
10 kN, 305 mm stalk	0527/2	1	1	3	3	261843
Distribution Ties (See Work Specs)						
04/043 PS (select pole type)	0660	3	-	3	-	See drawing for details
04/042 PA	0662	-	3	-	3	
Notices (See Work Spec 04/055)	-	As spcd	As spcd	As spcd	As spcd	See work spec
Stays (See Work Specs 04/027 & 04/028)	-	-	As spcd	-	As spcd	See work spec
Wood Plugs 24 mm x 75 mm Long (where required)	0247/3	2	2	2	2	263073
			11, 20 and 33 kV			
Failure Containment Device						
Bolts, M20 x 60	-		2			378703
Washers, Round M20	-		4			375616
Shear Pin Carrier	439561/1		2			253921
Shear Pin	439561/2		2			253993
Failure Containment Flats	439560/1 439560/2		2 2			251485 251502

11 kV, 20 kV & 33 kV OVERHEAD THREE PHASE LINES

STRAIGHT LINE OR PIN ANGLE POLE (SINGLE MEMBER CROSSARM)

Work Spec 04/180

Drg No 1.00.043.4003



POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

COMPONENT	DRAWING NO	QUANTITY	CAT NO

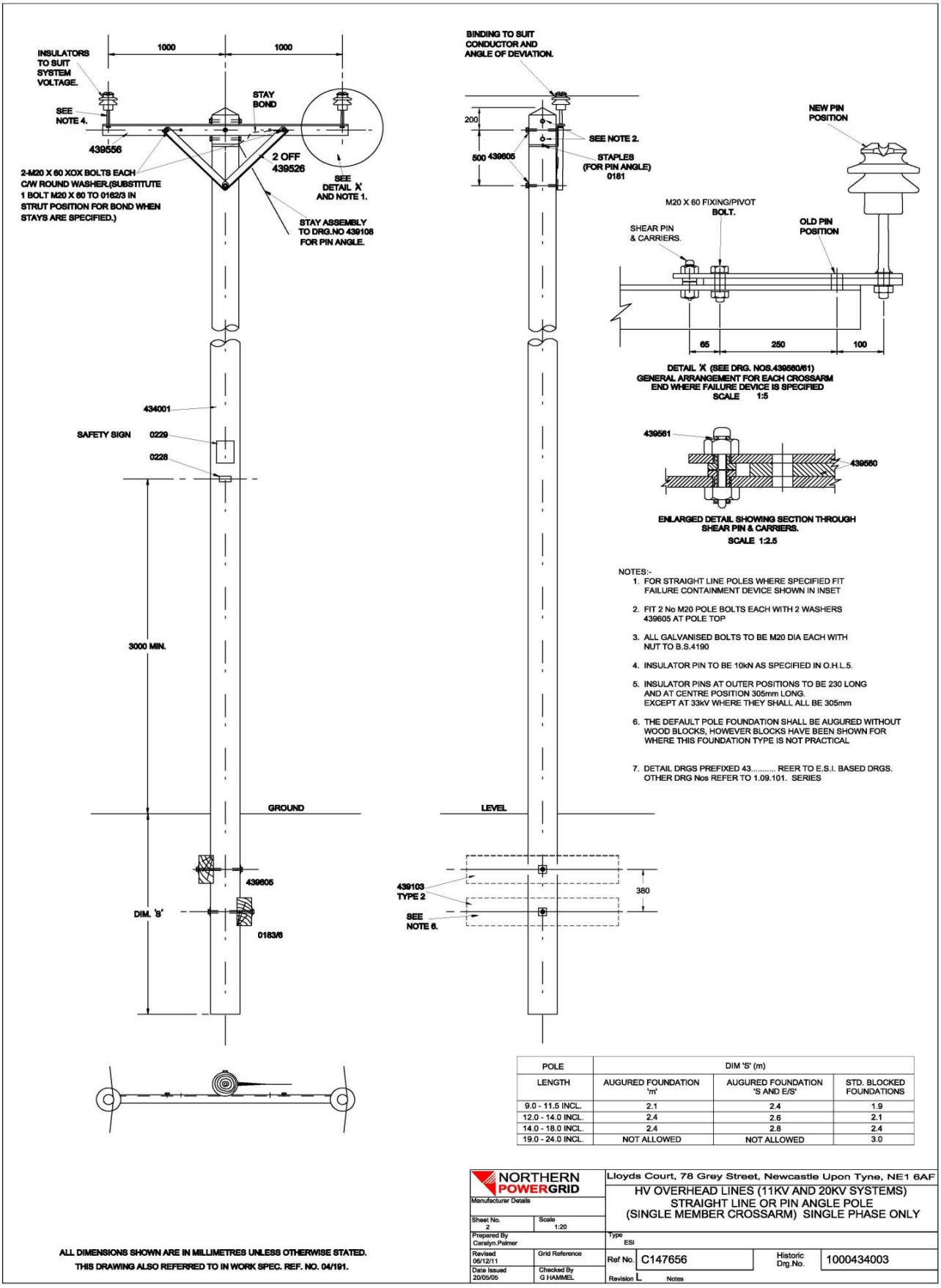
		11 & 20 kV		
		Strt Line (PS)	Pin Angle (PA)	
Wood Pole	434001	1	1	
Kicking Blocks	439103 Type 2	1	1	235124
Bolts M20 x 400 (Medium)	-	1	1	372904 or
Bolts M20 x 530 (Stout)	-	1	1	372815
Washer, Square, Flat	0183/6	1	1	368063
Washer, Square, Curved	439605	1	1	368078
Crossarm Member	439556	1	1	251466
Crossarm Strut	439526	2	2	237581
Bolts, M20 x 220 (Medium)	-	4	4	378756 or
Bolts, M20 x 300 (Stout)	-	4	4	378794
Bolts, M20 x 60	-	2	1	378703
Bolts, M20 x 60 (Earthing)	0162/3	-	1	370504
Washers, Round, M20	-	2	4	375616
Washers, Square, Curved	439605	6	6	368078
Bitumastic Paint	-	As rqd	As rqd	341840
Pin Insulators (as specified)				
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	2	2	253833
Insulator Pins, 50 mm shank (as specified)				
10 kN, 230 mm stalk	0527/1	2	2	261824
Distribution Ties (See Work Specs)				
04/043 PS	0660	2	-	See drawing
04/042 PA	0662	-	2	To suit
Notices (See Work Spec 04/055)	-	As spcd	As spcd	-
Stays (See Work Specs 04/027 & 04/028)	-	-	As spcd	-
Wood Plugs 24 mm x 75 mm Long Ø	0247/3	2	2	263073
		11 and 20 kV		
Failure Containment Device				
Bolts, M20 x 60	-	2		378703
Washers, Round M20	-	4		375616
Shear Pin Carrier	439561/1	2		253921
Shear Pin	439561/2	2		253993
Failure Containment Flats	439560/1	2		251485
	439560/2	2		251502

11 kV AND 20 kV OVERHEAD LINES

STRAIGHT LINE OR PIN ANGLE POLE (SINGLE MEMBER CROSSARM) FOR SINGLE PHASE ONLY

(Maximum Conductor Size 50 mm²)

Work Spec 04/191
Drg No 1.00.043.4003 Sheet 2



NOTES:-

1. FOR STRAIGHT LINE POLES WHERE SPECIFIED FIT FAILURE CONTAINMENT DEVICE SHOWN IN INSET
2. FIT 2 No M20 POLE BOLTS EACH WITH 2 WASHERS 439605 AT POLE TOP
3. ALL GALVANISED BOLTS TO BE M20 DIA EACH WITH NUT TO B.S.4190
4. INSULATOR PIN TO BE 10kN AS SPECIFIED IN O.H.L.5.
5. INSULATOR PINS AT OUTER POSITIONS TO BE 230 LONG AND AT CENTRE POSITION 305mm LONG. EXCEPT AT 33kV WHERE THEY SHALL ALL BE 305mm
6. THE DEFAULT POLE FOUNDATION SHALL BE AUGURED WITHOUT WOOD BLOCKS, HOWEVER BLOCKS HAVE BEEN SHOWN FOR WHERE THIS FOUNDATION TYPE IS NOT PRACTICAL
7. DETAIL DRGS PREFIXED 43..... REER TO E.S.I. BASED DRGS. OTHER DRG Nos REFER TO 1.09.101. SERIES

POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
THIS DRAWING ALSO REFERRED TO IN WORK SPEC. REF. NO. 04/191.

NORTHERN POWERGRID
Manufacturer Details

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

HV OVERHEAD LINES (11KV AND 20KV SYSTEMS)
STRAIGHT LINE OR PIN ANGLE POLE
(SINGLE MEMBER CROSSARM) SINGLE PHASE ONLY

Sheet No. 2	Scale 1:20	Type ESI	
Prepared By Caralyn.Palmer			
Revised 06/12/11	Grid Reference	Ref No. C147656	Historic Drg.No. 1000434003
Date Issued 20/05/05	Checked By G HAMMEL	Revision L Notes	

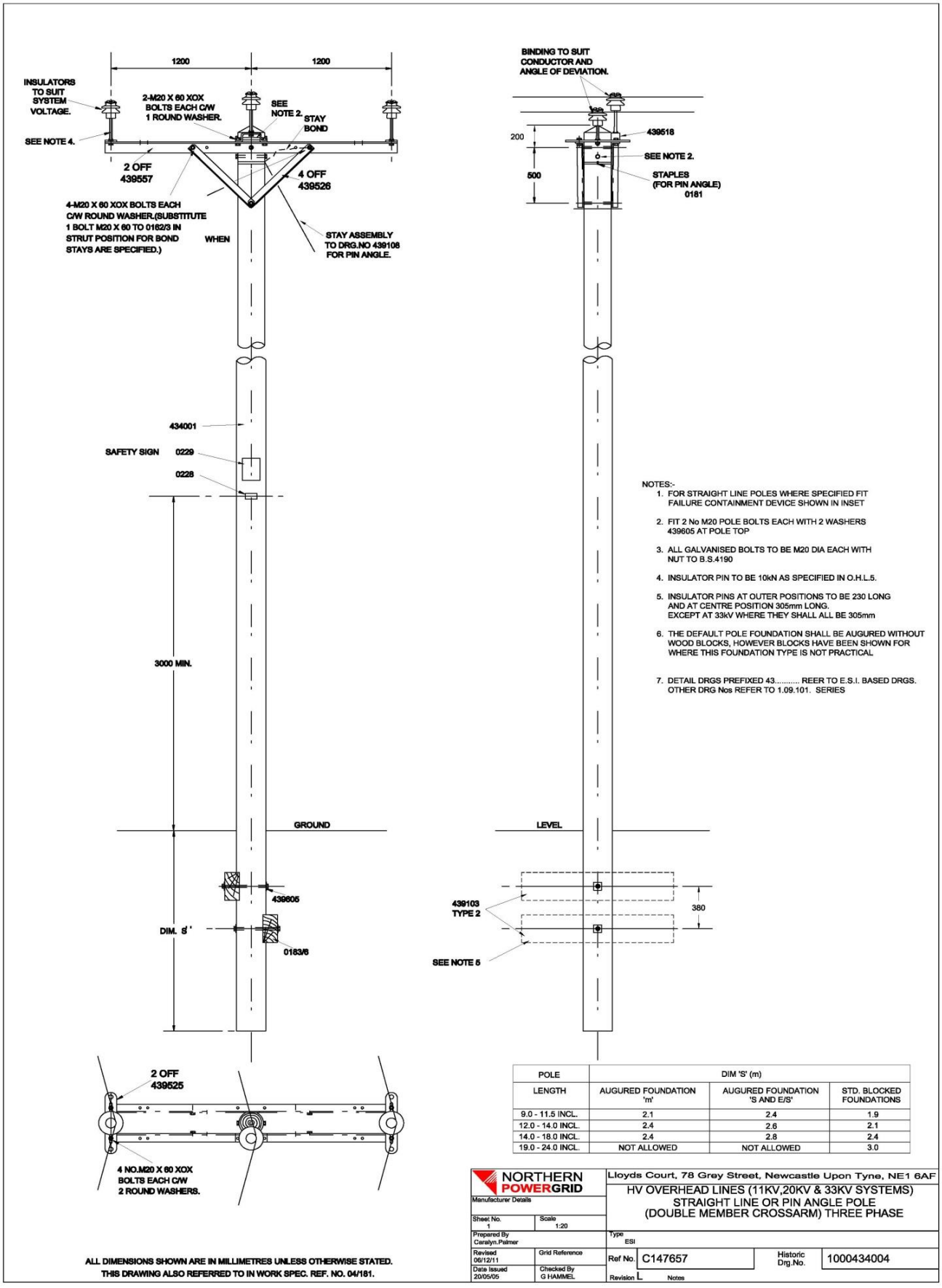
COMPONENT	DRAWING NO	QUANTITY				CAT NO
		11 & 20 kV		33 kV		
		Strt Line (PS)	Pin Angle (PA)	Strt Line (PS)	Pin Angle (PA)	
Wood Pole	434001	1	1	1	1	-
Kicking Blocks	439103 Type 2	2	2	2	2	235124
Bolts, M20 x 400 (Medium)		2	2	2	2	372904 or
Bolts, M20 x 530 (Stout)	-	2	2	2	2	372815
Washer, Square, Flat	0183/6	2	2	2	2	368063
Washer, Square, Curved	439605	2	2	2	2	368078
Crossarm Member	439557	2	2	2	2	251470
Crossarm Strut	439526	4	4	4	4	237581
Insulator Bracket	439518	1	1	1	1	237539
Section Strap	439525	2	2	2	2	237609
Bolts, M20 x 220 (Medium)	-	4	4	4	4	378756 or
Bolts, M20 x 300 (Stout)	-	4	4	4	4	378794
Bolts, M20 x 60 (Earthing)	0162/3	-	1	-	1	370504
Bolts, M20 x 60 (sc'd 46)	-	10	9	10	9	378703
Washers, Round, M20	-	16	16	16	16	375616
Washers, Square, Curved	439605	4	4	4	4	368078
Pin Insulators (as specified)						
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	3	3	-	-	253833 or
90kV Rating (33 kV)	0486/4	-	-	3	3	253423
Insulator Pins, (as specified)						
10 kN, 230 mm stalk	0527/1	2	2	-	-	261824
10 kN, 305 mm stalk	0527/2	1	1	3	3	261843
Distribution Ties (See Work Specs)	-					
04/043 PS 04/042 PA	0660 0662	3 -	- 3	3 -	- 3	See drawing for details
Notices (See Work Spec 04/055)	-	As spcd	As spcd	As spcd	As spcd	See work spec
Stays (See Work Specs 04/027 & 04/028)	-	As spcd	As spcd	As spcd	As spcd	See work spec
Wood Plugs 24 mm x 75 mm Long (if Required)	0247/3	2	2	2	2	263073

11 kV, 20 kV & 33 kV OVERHEAD LINES

THREE PHASE STRAIGHT LINE OR PIN ANGLE POLE (DOUBLE MEMBER CROSSARM)

Work Spec 04/181

Drg No 1.00.043.4004 Sheet 1



POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

COMPONENT	DRAWING NO	QUANTITY		CAT NO
		11 & 20 kV		
		Strt Line (PS)	Pin Angle (PA)	
Wood Pole	434001	1	1	-
Kicking Blocks	439103 Type 2	2	2	235124
Bolts, M20 x 400 (Medium)		2	2	372904 or
Bolts, M20 x 530 (Stout)		2	2	372815
Washer, Square, Flat	0183/6	2	2	368063
Washer, Square, Curved	439605	2	2	368078
Crossarm Member	439556	2	2	251466
Crossarm Strut	439526	4	4	237581
Section Strap	439525	2	2	237609
Bolts, M20 x 220 (Medium)	-	4	4	378756 or
Bolts, M20 x 300 (Stout)	-	4	4	378794
Bolts, M20 x 60 (Earthing)	0162/3	-	1	370504
Bolts, M20 x 60 (sc'd 46)	-	10	9	378703
Washers, Round, M20	-	16	16	375616
Washers, Square, Curved	439605	4	4	368078
Pin Insulators (as specified)				
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	2	2	253833
Insulator Pins, (as specified)				
10 kN, 230 mm stalk	0527/1	2	2	261824
Distribution Ties (See Work Specs)	-			
04/043 PS	0660	2	-	-
04/042 PA	0662	-	2	-
Notices (See Work Spec 04/055)	-	As spcd	As spcd	-
Stays (See Work Specs 04/027 & 04/028)	-	As spcd	As spcd	-
Wood Plugs 24 mm x 75 mm Long	0247/3	2	2	263073

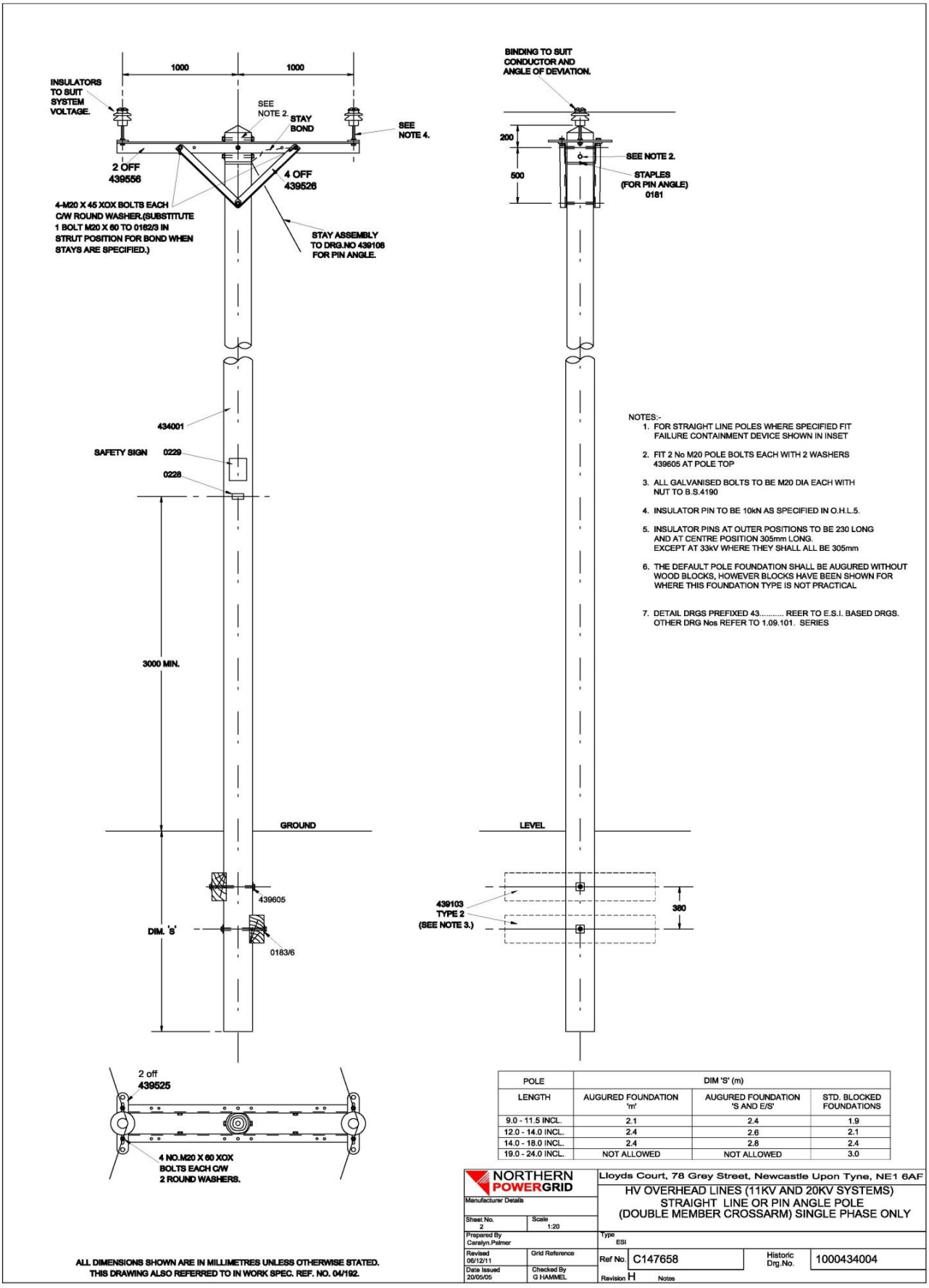
11 kV, 20 kV OVERHEAD LINES

SINGLE PHASE STRAIGHT LINE OR PIN ANGLE POLE (DOUBLE MEMBER CROSSARM)

(Maximum Conductor Size 50 mm^2)

Work Spec 04/192

Drg No 1.00.043.4004 Sheet 2

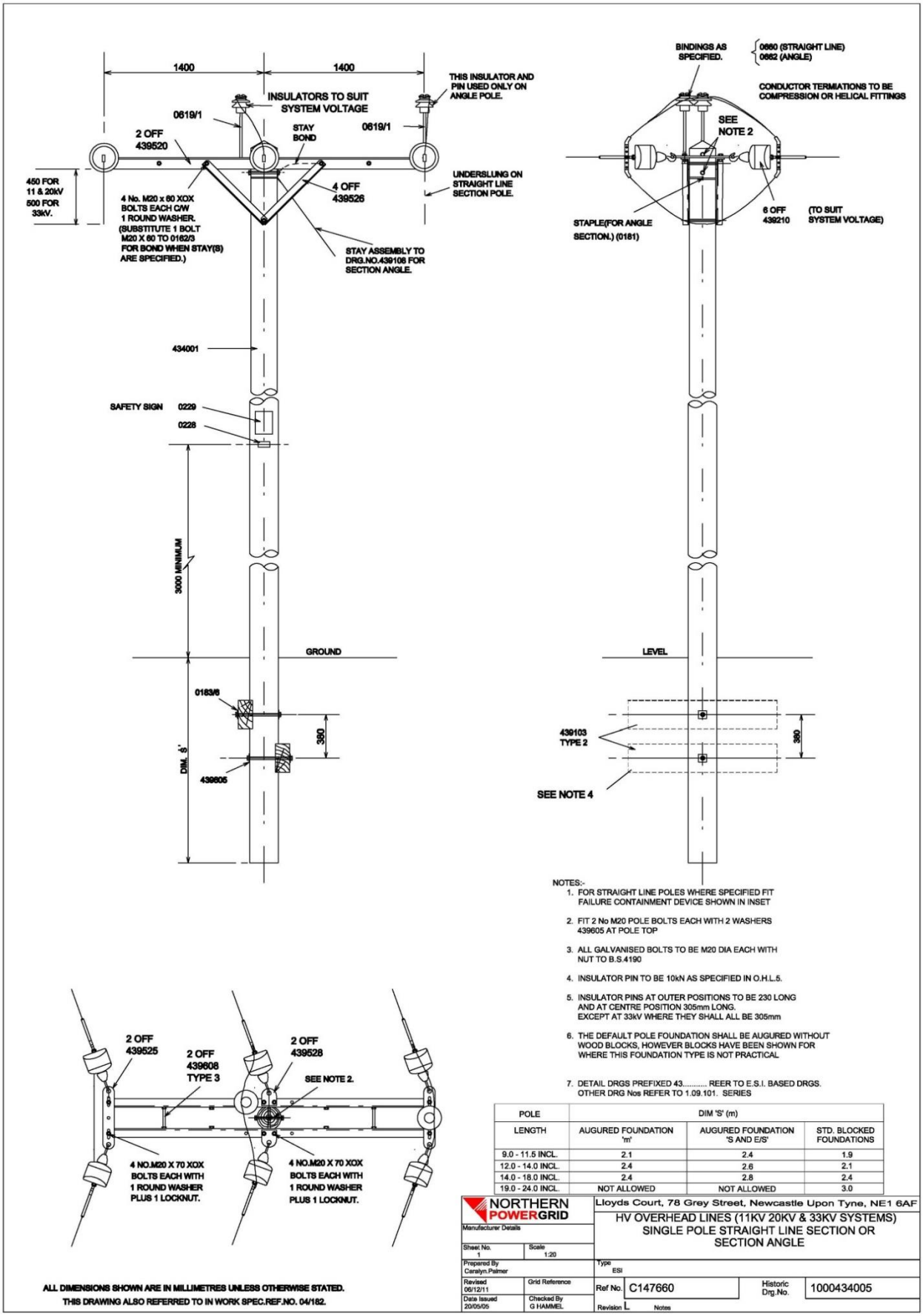


POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

COMPONENT	DRAWING NO	QUANTITY				CAT NO
		11 & 20 kV		33 kV		
		Strt Line (SS)	Sect Angle (SA)	Strt Line (SS)	Sect Angle (SA)	
Wood Pole	434001	1	1	1	1	-
Kicking Block	439103 Type 2	2	2	2	2	235124
Bolts, M20 x 400 (Medium)		2	2	2	2	372904 or
Bolts, M20 x 530 (Stout)	-	2	2	2	2	372815
Washer, Square, Flat	0183/6	2	2	2	2	368063
Washer, Square, Curved	439605	2	2	2	2	368078
Crossarm Member	439520	2	2	2	2	237558
Crossarm Strut	439526	4	4	4	4	237581
Section Strap	439525	2	2	2	2	237609
Terminating Plate	439528	2	2	2	2	237596
Bolts, M20 x 220 (Medium)	-	4	4	4	4	378756 or
Bolts, M20 x 300 (Stout)	-	4	4	4	4	378794
Bolts, M20 x 60 (sc'd 30)	-	4	3	4	3	378703
Bolts, M20 x 70 (sc'd 46)	-	8	8	8	8	373911
Bolts, M20 x 60 (Earthing)	0162/3	-	1	-	1	370504
Washers, Round, M20	-	22	22	22	22	375616
Washers, Square, Curved	439605	4	4	4	4	368078
Tie Rods, M20 x 330 each 4 std nuts	439608 Type 3	2	2	2	2	375828
Nuts M20	-	8	8	8	8	378915
Pin Insulators (as specified)						
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	1	2	-	-	253833
90kV Rating (33kV)	0486/4	-	-	1	2	253423
Pilot Pins	0619/1	1	2	1	2	261909
Distribution Ties	0660	1	2	1	2	-
Tension Set Assemblies Comprising:			**11 kV**	**20 kV**	**33 kV**	
70kV Composite Insulator (11 & 20kV)	0487/24		6	6		253706 or
90kV Composite Insulator (33kV)	0487/23				6	216150
439210 Assy 1 or 2 Comprising:						
Ball Ended Hook	0454		6	6	6	253071
Preformed Termination *	0425		6	6	6	As rqd
Socket Thimble *	0426/1 or 3		6	6	6	264682 or
OR						
Compression Termination *	0102/9		6	6	6	As rqd
Jumper Lug *	0102/9		6	6	6	As rqd
439210 Assy 3 Comprising: (33 kV only)						
Ball Ended Hook	0445		-	-	6	253086
Socket Tongue	0449		-	-	6	250779
Ball Clevis	0456		-	-	6	248586
Arc Horn	0494/4		-	-	6	240480
Arc Horn	0494/6		-	-	6	240264
Socket Thimble *	0426/3		-	-	6	264610
Preformed Terminations *	0425		-	-	6	As rqd
OR						
Compression Termination *	0102/5		-	-	6	As rqd
Jumper Lug *	0102/8		-	-	6	As rqd
Non-Tension Joints	-	-	-	3	-	To suit
Notices (See Work Spec 04/055)	-	As req	As req	As req	As req	-
Stays (See Work Specs 04/027 & 04/028)	-	As req	As req	As req	As req	-

11 kV 20 kV 33 kV OVERHEAD LINES
SINGLE POLE, STRAIGHT LINE SECTION OR SECTION ANGLE SUPPORT

Work Spec 04/182
Drg No 1.00.043.4005 Sheet 1



NOTES:-

1. FOR STRAIGHT LINE POLES WHERE SPECIFIED FIT FAILURE CONTAINMENT DEVICE SHOWN IN INSET
2. FIT 2 No M20 POLE BOLTS EACH WITH 2 WASHERS 439605 AT POLE TOP
3. ALL GALVANISED BOLTS TO BE M20 DIA EACH WITH NUT TO B.S.4190
4. INSULATOR PIN TO BE 10kN AS SPECIFIED IN O.H.L.5.
5. INSULATOR PINS AT OUTER POSITIONS TO BE 230 LONG AND AT CENTRE POSITION 305mm LONG. EXCEPT AT 33kV WHERE THEY SHALL ALL BE 305mm
6. THE DEFAULT POLE FOUNDATION SHALL BE AUGURED WITHOUT WOOD BLOCKS, HOWEVER BLOCKS HAVE BEEN SHOWN FOR WHERE THIS FOUNDATION TYPE IS NOT PRACTICAL
7. DETAIL DRGS PREFIXED 43..... REER TO E.S.I. BASED DRGS. OTHER DRG Nos REFER TO 1.09.101. SERIES

POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
THIS DRAWING ALSO REFERRED TO IN WORK SPEC.REF.NO. 04/182.

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

HV OVERHEAD LINES (11KV 20KV & 33KV SYSTEMS)
SINGLE POLE STRAIGHT LINE SECTION OR SECTION ANGLE

Sheet No. 1	Scale 1:20		
Prepared By Carolyn.Palmer		Type ESI	
Revised 06/12/11	Grid Reference	Ref No. C147660	Historic Drg.No. 1000434005
Date Issued 20/05/05	Checked By G HAMMEL	Revision L. Notes	

COMPONENT	DRAWING NO	QUANTITY		CAT NO
		11 & 20 kV		
		Strt Line (SS)	Sect Angle (SA)	
Wood Pole	434001	1	1	-
Kicking Block	439103 Type 2	2	2	235124
Bolts, M20 x 400 (Medium)		2	2	372904 or
Bolts, M20 x 530 (Stout)	-	2	2	372815
Washer, Square, Flat	0183/6	2	2	368063
Washer, Square, Curved	439605	2	2	368078
Crossarm Member	439556	2	2	251466
Crossarm Strut	439526	4	4	237581
Section Strap	439525	2	2	237609
Bolts, M20 x 220 (Medium)	-	4	4	378756 OR
Bolts, M20 x 300 (Stout)	-	4	4	378794
Bolts, M20 x 60 (sc'd 30)	-	4	3	378703
Bolts, M20 x 70 (sc'd 46)	-	4	4	373911
Bolts, M20 x 60 (Earthing)	0162/3	-	1	370504
Washers, Round, M20	-	18	18	375616
Washers, Square, Curved	439605	4	4	368078
Tie Rods, M20 x 330 each	439608 Type 3	2	2	375828
With 4 Standard Nuts				
Nuts M20	-	8	8	378915
Pin Insulators (as specified)				
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	1	2	253833
Pilot Pins	0619/1	1	2	261909
Distribution Ties	0660	1	2	-
Tension Set Assemblies Comprising:		11 kV / 20 kV		
70kV Composite Insulator (20kV)	0487/24	6		253706
439210 Assy 1 or 2 Comprising:				
Ball Ended Hook	0454	6		253071
Preformed Termination	0425	6		As rqd
Socket Thimble	0426/1 or 3	6		264682
Notices (See Work Spec 04/055)	-	As spcd		-
Stays (See Work Specs 04/027 & 04/028)	-	As spcd		-

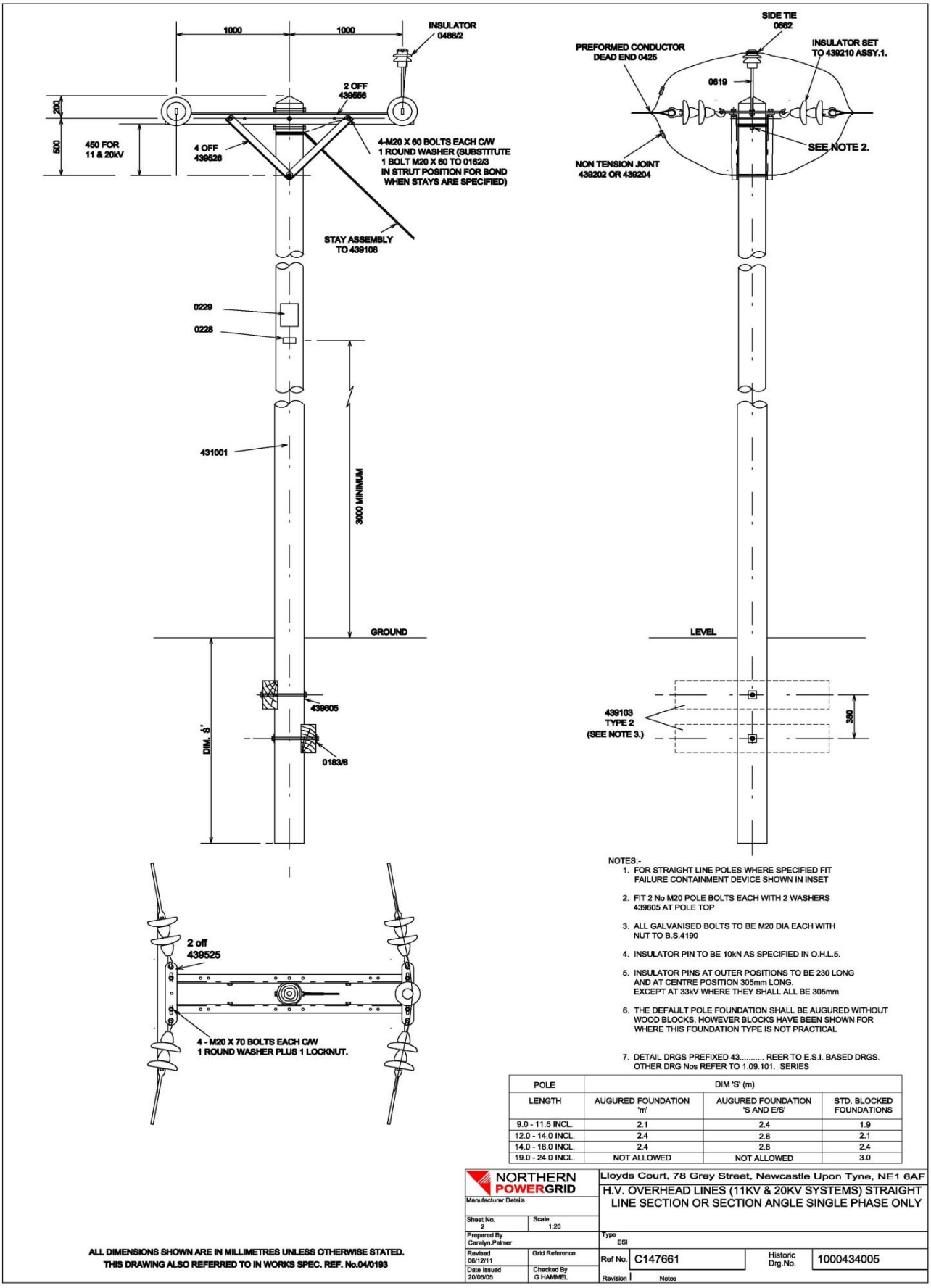
11 kV 20 kV OVERHEAD LINES

SINGLE PHASE, SINGLE POLE, STRAIGHT LINE SECTION OR SECTION ANGLE SUPPORT

(Maximum Conductor Size 50 mm^2)

Work Spec 04/193

Drg No 1.00.043.4005 Sheet 2



NOTES:-

1. FOR STRAIGHT LINE POLES WHERE SPECIFIED FIT FAILURE CONTAINMENT DEVICE SHOWN IN INSET
2. FIT 2 No M20 POLE BOLTS EACH WITH 2 WASHERS 439605 AT POLE TOP
3. ALL GALVANISED BOLTS TO BE M20 DIA EACH WITH NUT TO B.S.4190
4. INSULATOR PIN TO BE 10kN AS SPECIFIED IN O.H.L.5.
5. INSULATOR PINS AT OUTER POSITIONS TO BE 230 LONG AND AT CENTRE POSITION 305mm LONG. EXCEPT AT 33kV WHERE THEY SHALL ALL BE 305mm
6. THE DEFAULT POLE FOUNDATION SHALL BE AUGURED WITHOUT WOOD BLOCKS, HOWEVER BLOCKS HAVE BEEN SHOWN FOR WHERE THIS FOUNDATION TYPE IS NOT PRACTICAL
7. DETAIL DRGS PREFIXED 43..... REER TO E.S.I. BASED DRGS. OTHER DRG Nos REFER TO 1.09.101. SERIES

POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. No.04/0193

NORTHERN POWERGRID
Manufacturer Details

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

H.V. OVERHEAD LINES (11KV & 20KV SYSTEMS) STRAIGHT LINE SECTION OR SECTION ANGLE SINGLE PHASE ONLY

Sheet No. 2	Scale 1:20
Prepared By Carolyn.Palmer	Type ESI
Revised 06/12/11	Grid Reference
Date Issued 20/05/05	Checked By G HAMMEL
Ref No. C147661	Historic Drg.No. 1000434005
Revision	Notes

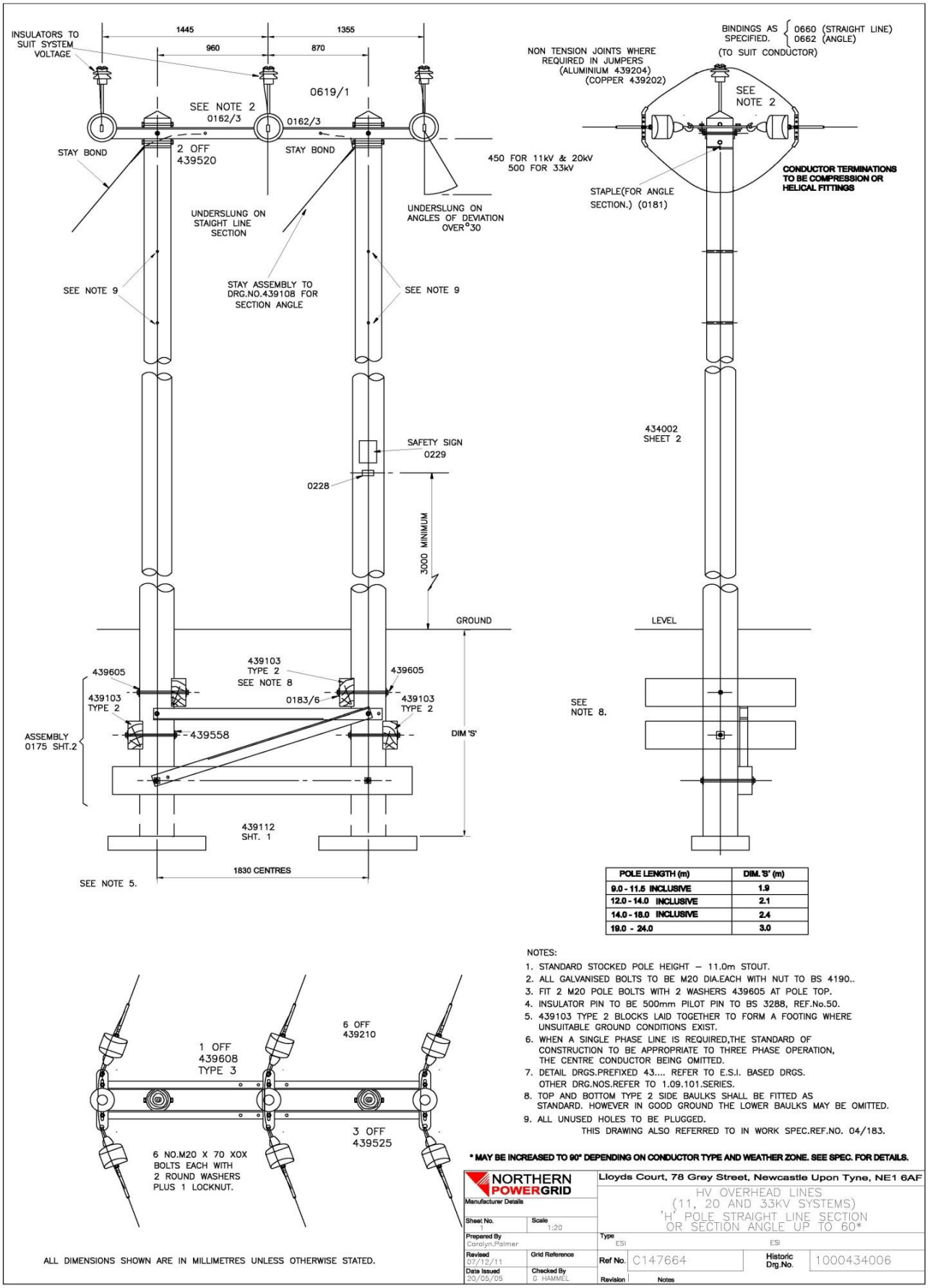
COMPONENT	DRAWING NO	QUANTITY				CAT NO
		11 & 20 kV		33 kV		
		Start Line	Sect Angle	Strt Line	Sect Angle	
Wood Pole, Legs	434002	2	2	2	2	-
Baulk	439112 Sht 1	1	1	1	1	234668
Baulks	439103 Type 2	4	4	4	4	235124
Steelwork, Foundation	439558	2	2	2	2	254657
Bolts, (Stout) M20 x 530	-	8	8	8	8	372815
Washer, Square, Flat	0183/6	6	6	6	6	368063
Washer, Square, Curved	439605	8	8	8	8	368078
Crossarm Member	439520 Sht 1	2	2	2	2	237558
Section Strap	439525	3	3	3	3	237609
Bolts, (Stout) M20 x 300	-	6	6	6	6	378794
Bolts, M20 x 70	-	6	6	6	6	373911
Tie Rod, M20 x 330 each with	439608 Type 3	1	1	1	1	375828
4 Standard Nuts						
Bolts, M20 x 60 (Earthing)	0162/3	-	2	-	2	370504
Washers, Round, M20	-	16	16	16	16	375616
Washers, Square, Curved	439605	8	8	8	8	368078
Nuts, M20	-	6	6	6	6	378915
Pin Insulators (as specified)						253781 or
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	2	2	-	-	253833
90kV Rating (33 kV)	0486/4	-	-	2	2	253423
Pilot Pins	0619/1	2	2	2	2	261909
Distribution Ties (See Work Specs 04/043)	0660	2	2	2	2	-
Tension Set Assemblies Comprising:		11 kV / 20 kV		33 kV		
70kV Composite Insulator (11 & 20kV)	0487/24	6				253706 or
90kV Composite Insulator (33kV)	0487/23			6		216150
439210 Assy 1 or 2 Comprising:						
Ball Ended Hook	0454	6		6		253071
Preformed Termination *	0425	6		6		As rqd
Socket Thimble *	0426/1 or 3	6		6		264682 OR
OR						
Compression Termination *	0102/5	6		6		As rqd
Jumper Lug *	0102/8	6		6		As rqd
439210 Assy 3 Comprising: (33 kV only)						
Ball Ended Hook	0445			-		253086
Socket Tongue	0449			6		250779
Ball Clevis	0456	-		6		248586
Arc Horn	0494/4	-		6		240480
Arc Horn	0494/6	-		6		240264
Socket Thimble *	0426/3	-		6		264610
Preformed Terminations *	0425	-		6		As rqd
OR						
Compression Termination *	0102/5	-		6		As rqd
Jumper Lug *	0102/8	-		6		As rqd
Non-tension Joint	-	As spc'd		As	As	-
Notices (See Work Spec 04/055)	-	As rqd		As rqd	As rqd	-
Stays (See Work Spec 04/027 & 04/028)	-	As spc'd		-	As	-

11 kV 20 kV & 33 kV OVERHEAD LINES

'H' POLE STRAIGHT LINE SECTION OR SECTION ANGLE SUPPORT

Work Spec 04/183

Drg No 1.00.043.4006 Sheet 1



POLE LENGTH (m)	DIM. 'S' (m)
9.0 - 11.5 INCLUSIVE	1.9
12.0 - 14.0 INCLUSIVE	2.1
14.0 - 18.0 INCLUSIVE	2.4
19.0 - 24.0	3.0

NOTES:

1. STANDARD STOCKED POLE HEIGHT – 11.0m STOUT.
2. ALL GALVANISED BOLTS TO BE M20 DIA.EACH WITH NUT TO BS 4190..
3. FIT 2 M20 POLE BOLTS WITH 2 WASHERS 439605 AT POLE TOP.
4. INSULATOR PIN TO BE 500mm PILOT PIN TO BS 3288, REF.No.50.
5. 439103 TYPE 2 BLOCKS LAID TOGETHER TO FORM A FOOTING WHERE UNSUITABLE GROUND CONDITIONS EXIST.
6. WHEN A SINGLE PHASE LINE IS REQUIRED,THE STANDARD OF CONSTRUCTION TO BE APPROPRIATE TO THREE PHASE OPERATION, THE CENTRE CONDUCTOR BEING OMITTED.
7. DETAIL DRGS.PREFIXED 43.... REFER TO E.S.I. BASED DRGS. OTHER DRG.NOS.REFER TO 1.09.101.SERIES.
8. TOP AND BOTTOM TYPE 2 SIDE BAULKS SHALL BE FITTED AS STANDARD. HOWEVER IN GOOD GROUND THE LOWER BAULKS MAY BE OMITTED.
9. ALL UNUSED HOLES TO BE PLUGGED.

THIS DRAWING ALSO REFERRED TO IN WORK SPEC.REF.NO. 04/183.

* MAY BE INCREASED TO 90° DEPENDING ON CONDUCTOR TYPE AND WEATHER ZONE. SEE SPEC. FOR DETAILS.

NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details
Sheet No. 1
Scale 1:20
Prepared By Carolyn.Palmer
Revised 07/12/11
Grid Reference
Date Issued 20/05/05
Checked By C HAMMEL
HV OVERHEAD LINES (11, 20 AND 33KV SYSTEMS) 'H' POLE STRAIGHT LINE SECTION OR SECTION ANGLE UP TO 60*
Type ESI ESI
Ref No. C147664
Historic Drg.No. 1000434006
Revision
Notes

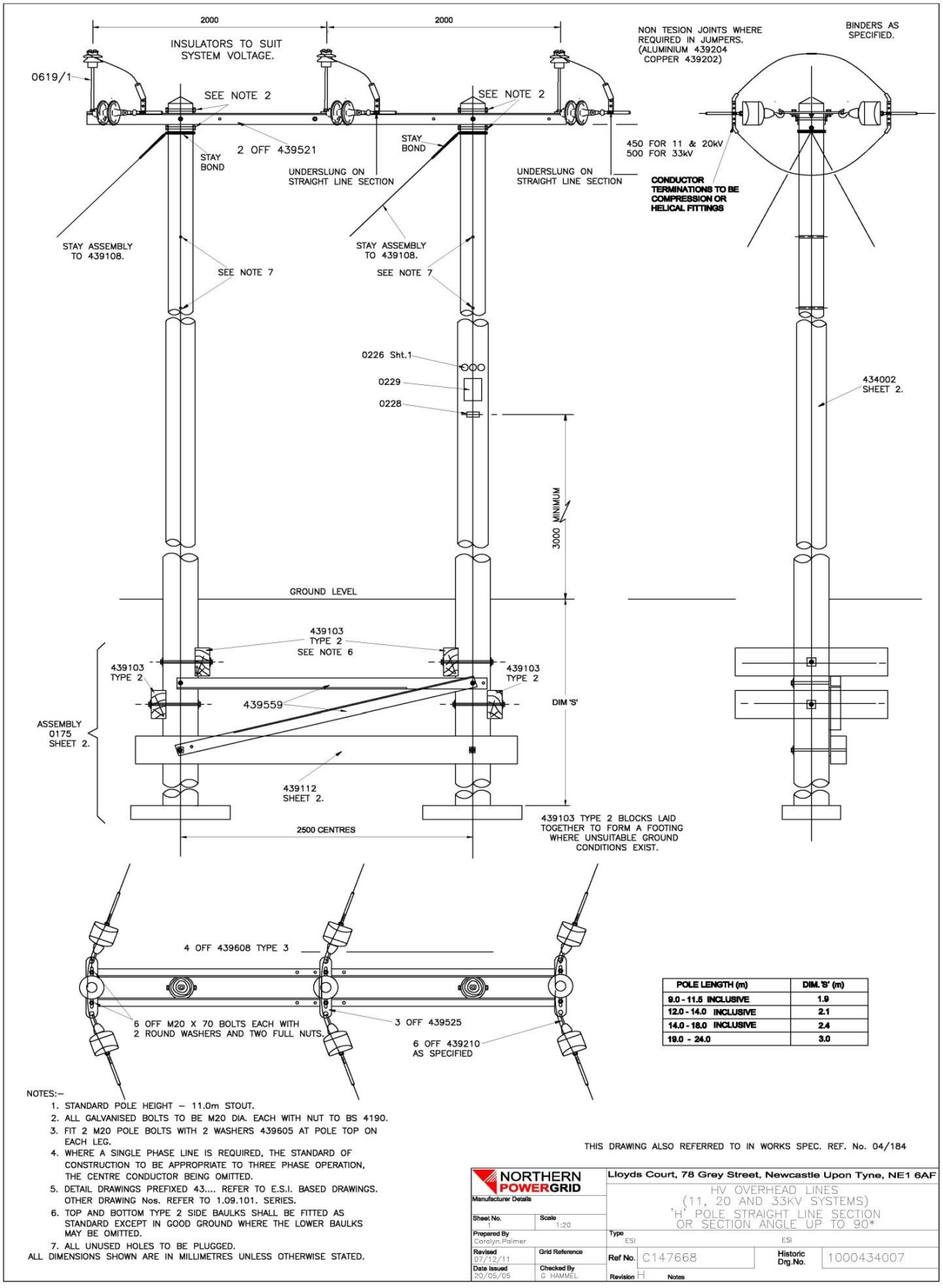
COMPONENT	DRAWING NO	QUANTITY		CAT NO
		11 & 20 kV	33 kV	
Wood Pole, Legs	434002	2	2	-
Baulk	439112 Sht 2	1	1	234704
Baulks	439103 Type 2	4	4	235124
Steelwork Foundation	439559	2	2	254680
Bolts, M20 x 530 XOX (Stout)	-	8	8	372815
Washer, Square, Flat	0183/6	6	6	368063
Washer, Square, Curved	439605	8	8	368078
Crossarm Member	439521	2	2	237562
Section Strap	439525	3	3	237609
Bolts, M20 x 30 (Stout)	-	6	6	378794
Bolts, M20 x 70	-	6	6	373911
Tie Rod, M20 x 330 each with 4 Standard Nuts	439608 Type 3	4	4	375828
Bolts, M20 x 60 (Earthing)	0162/3	2	2	370504
Washers, Round, M20	-	22	22	375616
Washers, Square, Curved	439605	8	8	368078
Nuts, M20	-	6	6	378915
Pin Insulators (as specified)				
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	*0486/13*	2	-	253833
90 kV Rating (33 kV)	0486/4	-	2	253423
Pilot Pins	0619/1	2	2	261909
Distribution Ties (See Work Specs 04/043	0660	2	2	-
Tension Set Assemblies Comprising:		11 kV / 20kV	33 kV	
70kV Composite Insulator (11 & 20kV)	0487/24	6		253706 or
90kV Composite Insulator (33kV)	0487/23		6	216150
439210 Assy 1 or 2 Comprising:				
Ball Ended Hook	0454	6	6	253071
Preformed Termination *	0425	6	6	As rqd
Socket Thimble *	0426/1 or 3	6	6	264682 OR 264610
OR				
Compression Termination *	0102/5	6	6	As rqd
Jumper Lug *	0102/8	6	6	As rqd
439210 Assy 3 Comprising: (33 kV				
Ball Ended Hook	0445	-	6	253086
Socket Tongue	0449	-	6	250779
Ball Clevis	0456	-	6	248586
Arc Horn	0494/4	-	6	240480
Arc Horn	0494/6	-	6	240264
Socket Thimble *	0426/3	-	6	264610
Preformed Terminations *	0425	-	6	As rqd
OR				
Compression Termination *	0102/5	-	6	As rqd
Jumper Lug *	0102/8	-	6	As rqd
Non-tension Joint	-	As spc'd	As spc'd	-
Notices (See Work Spec 04/055)	-	As rqd	As rqd	-
Stays (See Work Specs 04/027 &	-	As spc'd	As spc'd	-

11 kV 20 kV & 33 kV OVERHEAD LINES

'H' POLE STRAIGHT LINE SECTION OR SECTION ANGLE SUPPORT

Work Spec 04/184

Drg No 1.00.043.4007 Sheet 1



POLE LENGTH (m)	DIM. 'S' (m)
9.0 - 11.5 INCLUSIVE	1.9
12.0 - 14.0 INCLUSIVE	2.1
14.0 - 18.0 INCLUSIVE	2.4
19.0 - 24.0	3.0

NOTES:–
1. STANDARD POLE HEIGHT – 11.0m STOUT.
2. ALL GALVANISED BOLTS TO BE M20 DIA. EACH WITH NUT TO BS 4190.
3. FIT 2 M20 POLE BOLTS WITH 2 WASHERS 439605 AT POLE TOP ON EACH LEG.
4. WHERE A SINGLE PHASE LINE IS REQUIRED, THE STANDARD OF CONSTRUCTION TO BE APPROPRIATE TO THREE PHASE OPERATION, THE CENTRE CONDUCTOR BEING OMITTED.
5. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I. BASED DRAWINGS. OTHER DRAWING Nos. REFER TO 1.09.101. SERIES.
6. TOP AND BOTTOM TYPE 2 SIDE BAULKS SHALL BE FITTED AS STANDARD EXCEPT IN GOOD GROUND WHERE THE LOWER BAULKS MAY BE OMITTED.
7. ALL UNUSED HOLES TO BE PLUGGED.

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. No. 04/184

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

HV OVERHEAD LINES
(11, 20 AND 33KV SYSTEMS)
'H' POLE STRAIGHT LINE SECTION OR SECTION ANGLE UP TO 90*

Sheet No. 1	Scale 1:20	Type ESI	ESI
Prepared By Carolyn.Palmer			
Revised 07/12/11	Grid Reference	Ref No. C147668	Historic Drg.No. 1000434007
Date Issued 20/05/05	Checked By C HAMMEL	Revision H	Notes

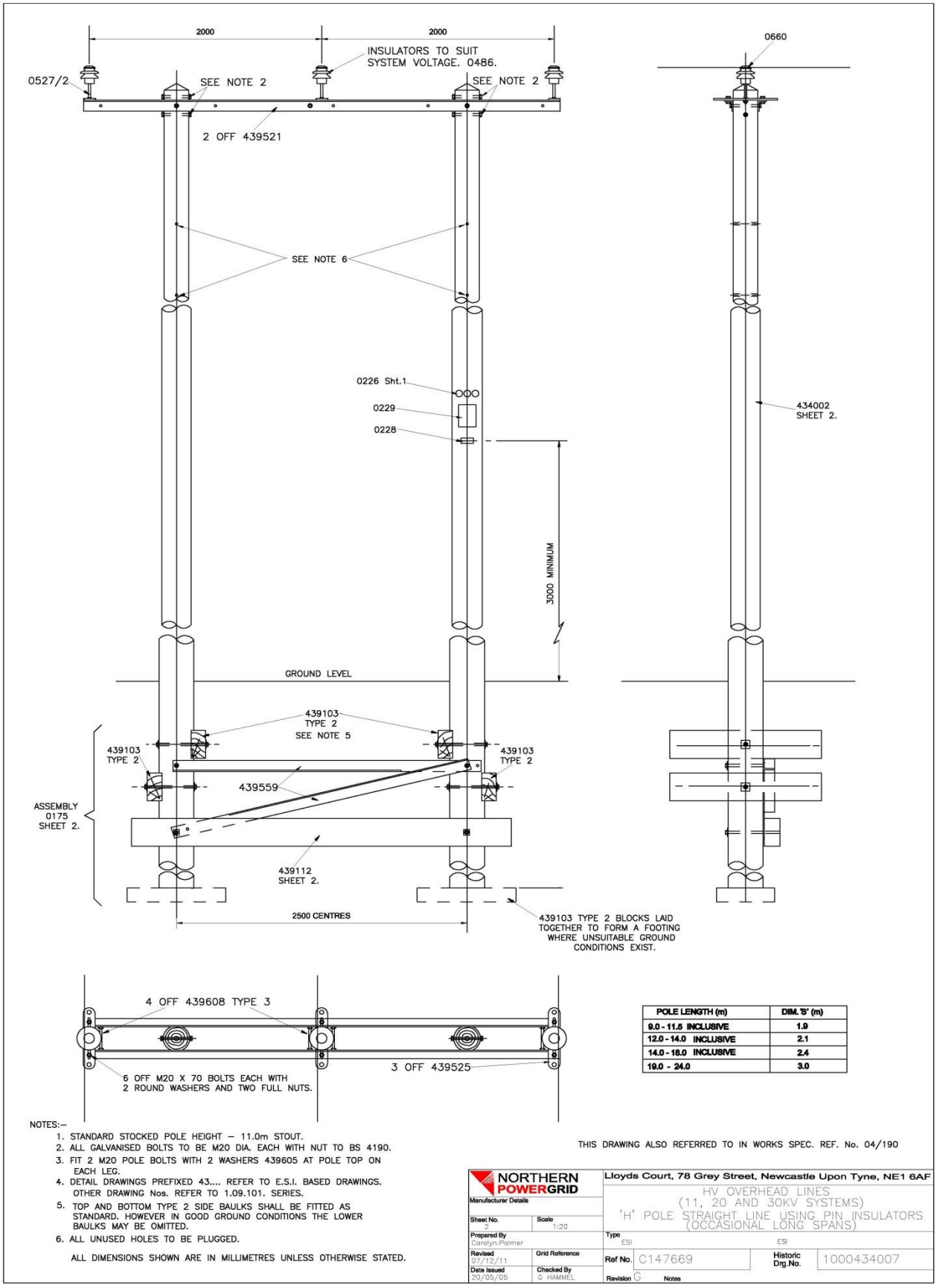
COMPONENT	DRAWING NO	QUANTITY		CAT NO
		11 & 20 kV	33 kV	
Wood Pole, Legs	434002	2	2	-
Baulk	439112 Sht 2	1	1	234704
Baulks	439103 Type 2	4	4	235124
Steelwork Foundation	439559	2	2	254680
Bolts, M20 x 530 XOX (Stout)	-	8	8	372815
Washer, Square, Flat	0183/6	6	6	368063
Washer, Square, Curved	439605	8	8	368078
Crossarm Member	439521	2	2	237562
Section Strap	439525	3	3	237609
Bolts, M20 x 300 (Stout)	-	6	6	378794
Bolts, M20 x 70	-	6	6	373911
Tie Rod, M20 x 330 each with	439608 Type 3	4	4	375828
4 Standard Nuts				
Bolts, M20 x 60 (Earthing)	0162/3	2	2	370504
Washers, Round, M20	-	22	22	375616
Washers, Square, Curved	439605	8	8	368078
Nuts, M20	-	6	6	378915
Pin Insulators (as specified)				
70kV Rating (All 11 and 20kV earthed & Unearthed Poles)	0486/13	2	-	253833 or
90kV Rating (33 kV)	0486/4	-	2	253423
Insulator Pins				
10kN, 230mm stalk	0527/1	2	-	261824
10kN, 305mm stalk	0527/2	1	3	261843
Distribution Ties				
(See Work Specs 04/043	0660	3	3	-
Notices (See Work Spec 04/055)	-	As rqd	As rqd	-

11 kV 20 kV & 33 kV OVERHEAD LINES

'H' POLE - THREE PHASE STRAIGHT LINE SUPPORT (2m Phase to Phase Centres)

Work Spec 04/190

Drg No 1.00.043.4007 Sheet 2



POLE LENGTH (m)	DIM. 'S' (m)
9.0 - 11.5 INCLUSIVE	1.9
12.0 - 14.0 INCLUSIVE	2.1
14.0 - 18.0 INCLUSIVE	2.4
19.0 - 24.0	3.0

MATERIALS LIST

(FOR TEE OFF ARRANGEMENT ONLY)

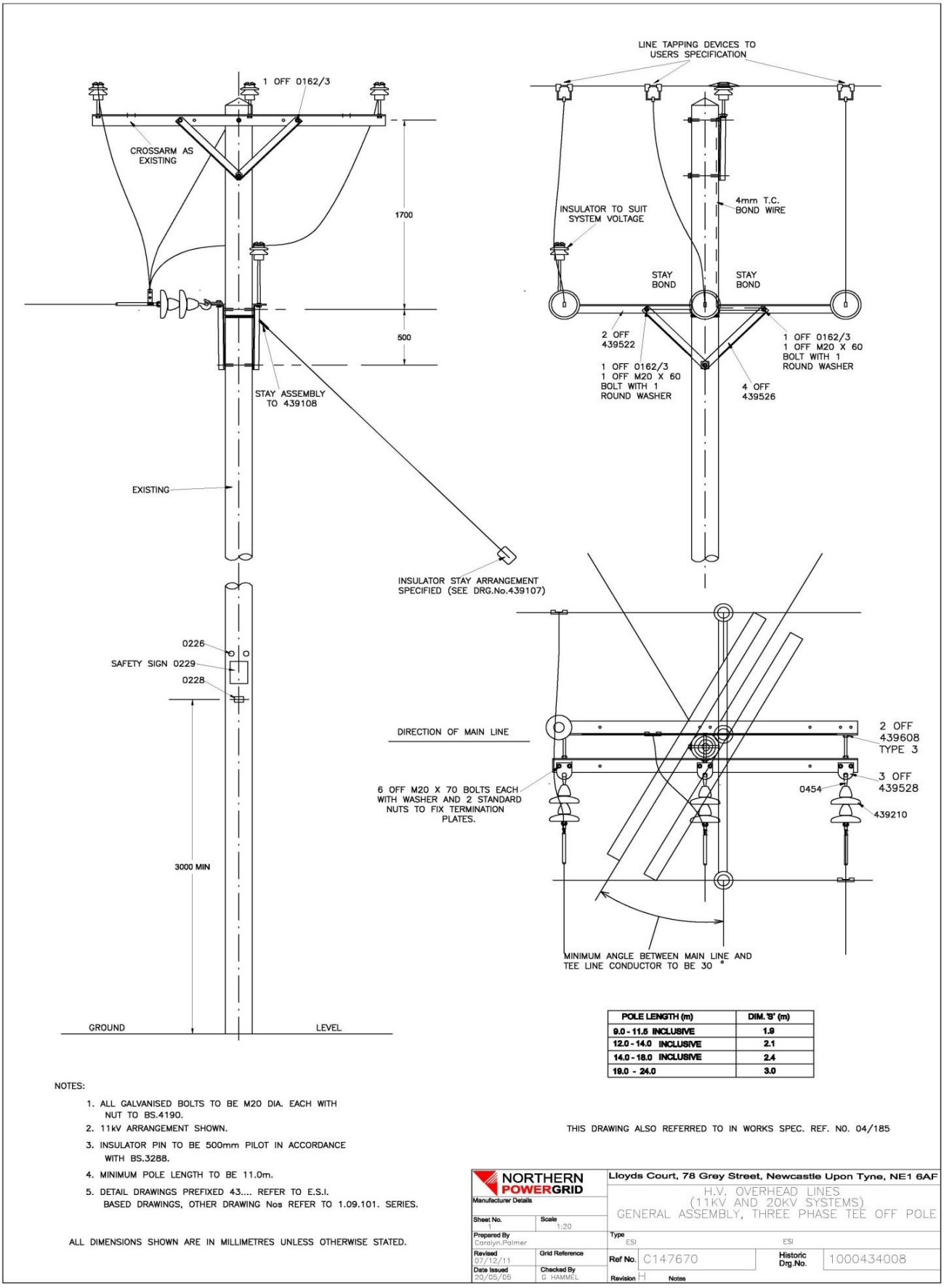
COMPONENT	DRAWING NO	QUANTITY	CAT NO
		2 WIRE	
Crossarm Members	0369 Sheet 2	1	245304
Crossarm Struts	439526	2	237581
Terminating Plate	439528	3	237596
Bolts, M20 x 60, Galvd	-	1	378703
Bolts, M20 x 60, Galvd, Earthing	0162/3	1	370504
Bolts, M20 x 70, Galvd	-	6	373911
Bolts, M20 x 300, Galvd	-	2	378794
Nuts, M20, Galvd	-	4	378915
Washers, M20, Round, Galvd	-	18	375616
Tension Insulator Sets Comprising:		11 kV / 20 kV	
70 kV Composite insulators (11 & 20kV)	0487/24	3	253706
Items listed for 50 mm AAAC, for			
alternative conductor order preform to suit			
439210 Assy 1 Comprising:			
Ball Ended Hook	0454	3	253071
Preformed Termination	0425	3	255414
Socket Thimble	0426/1	3	264682
Notices (see Work Specs 04/055 & 04/056)	-	As spec'd	-
Stays (see Work Specs 04/027 & 04/028)	-	2	-
70 kV Composite insulators (11 & 20kV)	0486/13	2	253833
Pilot Pin Ø	0619/1	2	261909
Distribution Ties (see Work Spec 04/043) Ø	0660	2	As rqd
Ø If required for jumper to remote phase.			

11 kV, AND 20 kV OVERHEAD LINES

THREE PHASE - TEE OFF POLE

Work Spec 04/185

Drg No 1.00.043.4008 Sheet 1



POLE LENGTH (m)	DIM. 'S' (m)
9.0 - 11.5 INCLUSIVE	1.9
12.0 - 14.0 INCLUSIVE	2.1
14.0 - 18.0 INCLUSIVE	2.4
19.0 - 24.0	3.0

NOTES:

1. ALL GALVANISED BOLTS TO BE M20 DIA. EACH WITH NUT TO BS.4190.
2. 11kV ARRANGEMENT SHOWN.
3. INSULATOR PIN TO BE 500mm PILOT IN ACCORDANCE WITH BS.3288.
4. MINIMUM POLE LENGTH TO BE 11.0m.
5. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I. BASED DRAWINGS, OTHER DRAWING Nos REFER TO 1.09.101. SERIES.

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. NO. 04/185

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

H.V. OVERHEAD LINES
(11KV AND 20KV SYSTEMS)
GENERAL ASSEMBLY, THREE PHASE TEE OFF POLE

Sheet No. 1	Scale 1:20	Type ESI	ESI
Prepared By Carolyn.Palmer			
Revised 07/12/11	Grid Reference	Ref No. C147670	Historic Drg.No. 1000434008
Date Issued 20/05/05	Checked By C HAMMEL	Revision H	Notes

MATERIALS LIST

(FOR TEE OFF ARRANGEMENT ONLY)

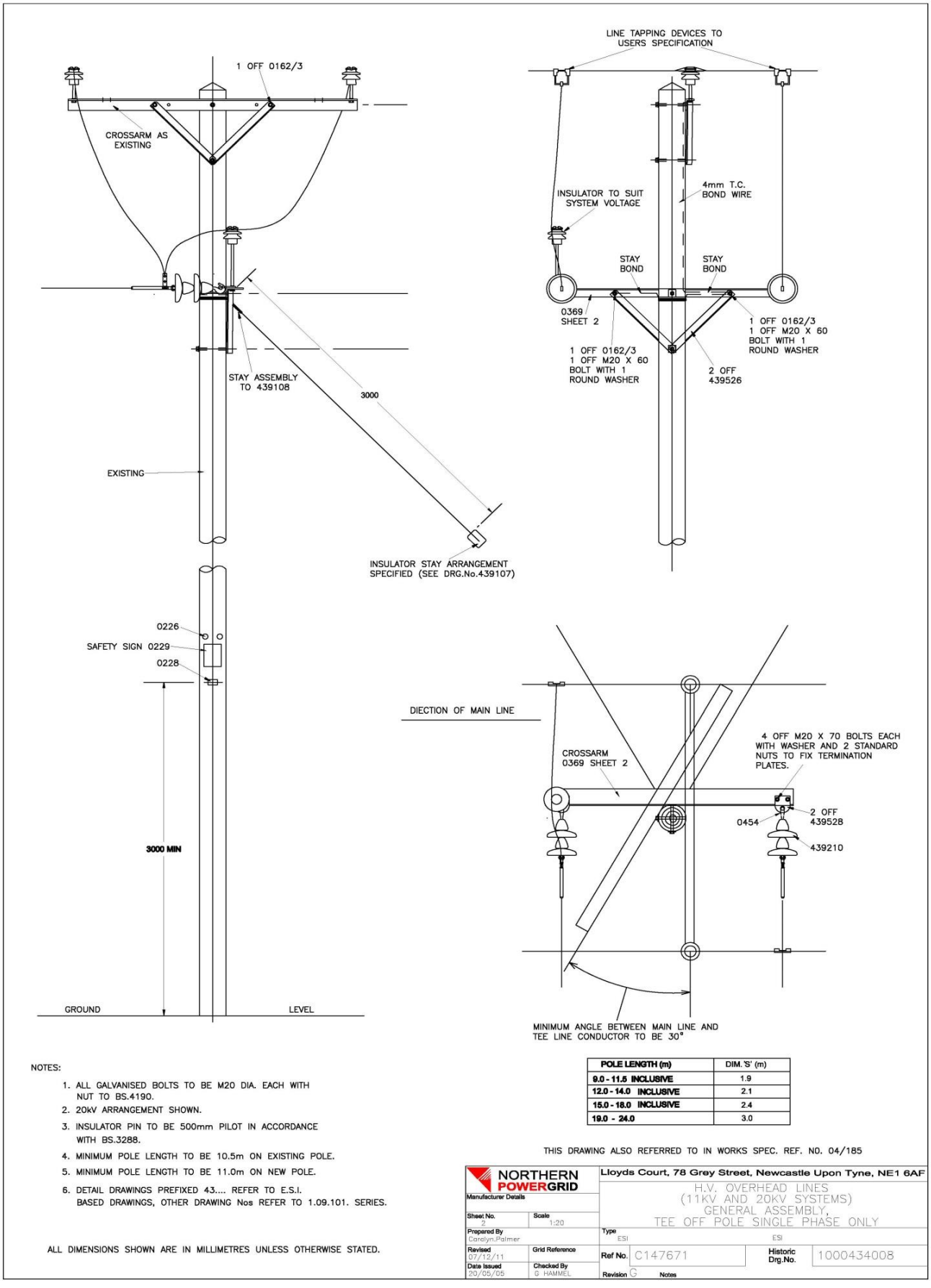
COMPONENT	DRAWING NO	QUANTITY	CAT NO
		2 WIRE	
Crossarm Members	0369 Sheet 2	1	245304
Crossarm Struts	439526	2	237581
Terminating Plate	439528	2	237596
Bolts, M20 x 60, Galvd	-	1	378703
Bolts, M20 x 60, Galvd, Earthing	0162/3	1	370504
Bolts, M20 x 70, Galvd	-	4	373911
Bolts, M20 x 300, Galvd	-	2	378794
Nuts, M20, Galvd	-	4	378915
Washers, M20, Round, Galvd	-	16	375616
Tension Insulator Sets Comprising:		11 kV / 20 kV	
70kV Composite Insulators (11 & 20kV)	0487/24		253706
Items listed for 50 mm AAAC, for			
alternative conductor order preform to suit			
439210 Assy 1 Comprising:			
Ball Ended Hook	0454	2	253071
Preformed Termination	0425	2	255414
Socket Thimble	0426/1	2	264682
Notices (see Work Specs 04/055 & 04/056)	-	As spec'd	-
Stays (see Work Specs 04/027 & 04/028)	-	2	-
70 kV Composite Pin Insulators (11 & 20kV)	0486/13	1	253833
Pilot Pin Ø	0619/1	1	261909
Distribution Ties (see Work Spec 04/043) Ø	0660	1	As rqd
Ø If required for jumper to remote phase.			

11 kV, AND 20 kV OVERHEAD LINES

SINGLE PHASE TEE OFF POLE

Work Spec 04/185

Drg No 1.00.043.4008 Sheet 2



NOTES:

1. ALL GALVANISED BOLTS TO BE M20 DIA. EACH WITH NUT TO BS.4190.
2. 20kV ARRANGEMENT SHOWN.
3. INSULATOR PIN TO BE 500mm PILOT IN ACCORDANCE WITH BS.3288.
4. MINIMUM POLE LENGTH TO BE 10.5m ON EXISTING POLE.
5. MINIMUM POLE LENGTH TO BE 11.0m ON NEW POLE.
6. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I. BASED DRAWINGS, OTHER DRAWING Nos REFER TO 1.09.101. SERIES.

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

POLE LENGTH (m)	DIM. 'S' (m)
9.0 - 11.5 INCLUSIVE	1.9
12.0 - 14.0 INCLUSIVE	2.1
15.0 - 18.0 INCLUSIVE	2.4
19.0 - 24.0	3.0

THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. NO. 04/185

NORTHERN POWERGRID
Manufacturer Details

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

H.V. OVERHEAD LINES (11KV AND 20KV SYSTEMS) GENERAL ASSEMBLY, TEE OFF POLE SINGLE PHASE ONLY

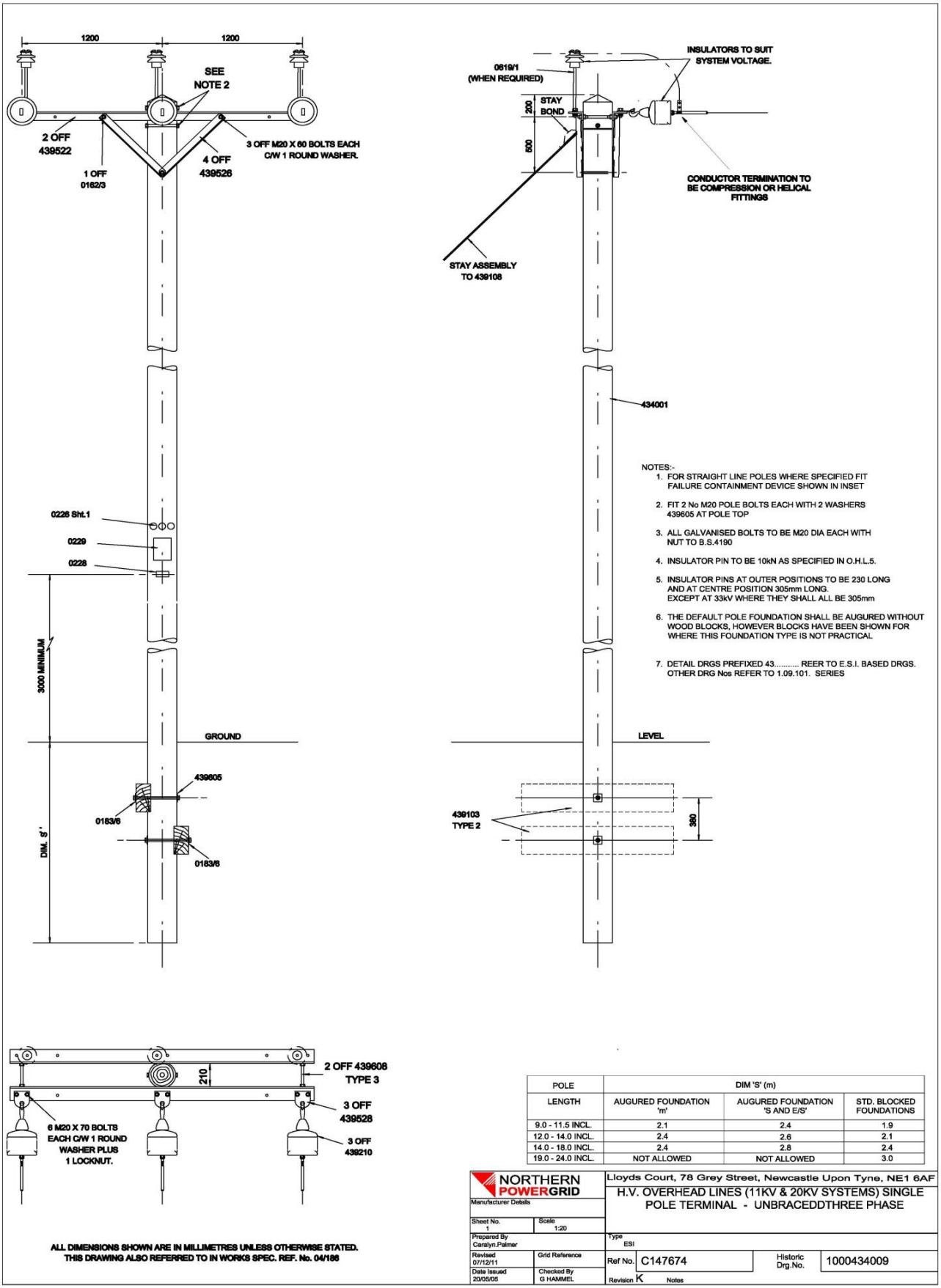
Sheet No. 2	Scale 1:20	Type ESI	ESI
Prepared By Carolyn.Palmer			
Revised 07/12/11	Grid Reference	Ref No. C147671	Historic Drg.No. 1000434008
Date Issued 20/05/05	Checked By G HAMMEL	Revision C	Notes

COMPONENT	DRAWING	QUANTITY		CAT NO
		2 WIRE	3 WIRE	
Wood Pole	434001	1	1	As rqd
Wood Blocks	439103	2	2	235124
Bolts, M20 x 400 (Medium)	-	2	2	372904 or
Bolts, M20 x 530, Galvd (Stout)	-	2	2	372815
Washers, M20, Square, Flat, Galvd	0183/6	2	2	368063
Washers, M20, Square, Curved, Galvd	439605	2	2	368078
Crossarm Members	439522	2	2	237577
Crossarm Struts	439526	4	4	237581
Terminating Plate	439528	2	3	237596
Bolts, M20 x 60, Galvd	-	3	3	378703
Bolts, M20 x 60, Galvd, Earthing	0162/3	1	1	370504
Bolts, M20 x 70, Galvd	-	4	6	373911
Bolts, M20 x 220, (Medium) Galvd	-	4	4	378756 or
Bolts, M20 x 300, (Stout) Galvd		4	4	378794
Tie Rods, M20 x 330, Galvd	439608/3	2	2	375828
Nuts, M20, Galvd	-	4	6	378915
Washers, M20, Round, Galvd	-	17	19	375616
Washers, M20, Square, Curved, Galvd	439605	4	4	368078
Tension Set Assemblies comprising:				
70 kV Composite insulators (11 & 20kV)	0487/24	2	3	253706
439210 Assy 1 or 2 comprising:				
Ball Ended Hook	0454	2	3	253071
Preformed Termination *	0425	2	3	As rqd
Socket Thimble *	0426/1 or 3	2	3	264682 OR
				264610
OR				
Compression Termination	0102/5	2	3	As rqd
Jumper Lug	0102/8	2	3	As rqd
439210 Assy 3 comprising (33 kV only):				
Ball Ended Hook	0445	-	3	253086
Socket Tongue	0449	-	3	250779
Ball Clevis	0456	-	3	248586
Arc Horn	0494/4	-	3	240480
Arc Horn	0494/6	-	3	240264
Socket Thimble (to suit conductor)	0426/3	-	3	As rqd
Preformed Terminations (to suit conductor)	0425	-	3	As rqd
OR				
Compression Termination *	0102/5	-	3	As rqd
Jumper Lug *	0102/8	-	3	As rqd
Notices (see Work Specs 04/055 & 04/056)	-	As spec'd	As spec'd	-
Stays (see Work Specs 04/027 & 04/028)	-	2	2	-
70 kV Composite Pin Insulators (11 & 20kV)	0486/13	2	3	253833
Pilot Pin Ø	0619/1	2	3	261909
Distribution Ties (see Work Spec 04/043) Ø	0660	2	3	As rqd

11 kV AND 20 kV OVERHEAD LINES

THREE PHASE SINGLE POLE TERMINAL (UNBRACED DOUBLE CROSSARM)

Work Spec 04/186
Drg No 1.00.043.4009 Sheet 1


1200
1200
SEE NOTE 2
2 OFF 439522
1 OFF 0162/3
4 OFF 439526
3 OFF M20 X 60 BOLTS EACH C/W 1 ROUND WASHER.
0819/1 (WHEN REQUIRED)
INSULATORS TO SUIT SYSTEM VOLTAGE.
STAY BOND
200
600
CONDUCTOR TERMINATION TO BE COMPRESSION OR HELICAL FITTINGS
STAY ASSEMBLY TO 439108
434001
0226 Sht.1
0229
0228
3000 MINIMUM
GROUND
439605
0183/6
0183/6
DIM. 'S'
LEVEL
439103 TYPE 2
380
NOTES:-
1. FOR STRAIGHT LINE POLES WHERE SPECIFIED FIT FAILURE CONTAINMENT DEVICE SHOWN IN INSET
2. FIT 2 No M20 POLE BOLTS EACH WITH 2 WASHERS 439605 AT POLE TOP
3. ALL GALVANISED BOLTS TO BE M20 DIA EACH WITH NUT TO B.S.4190
4. INSULATOR PIN TO BE 10kN AS SPECIFIED IN O.H.L.5.
5. INSULATOR PINS AT OUTER POSITIONS TO BE 230 LONG AND AT CENTRE POSITION 305mm LONG. EXCEPT AT 33kV WHERE THEY SHALL ALL BE 305mm
6. THE DEFAULT POLE FOUNDATION SHALL BE AUGURED WITHOUT WOOD BLOCKS, HOWEVER BLOCKS HAVE BEEN SHOWN FOR WHERE THIS FOUNDATION TYPE IS NOT PRACTICAL
7. DETAIL DRGS PREFIXED 43..... REER TO E.S.I. BASED DRGS. OTHER DRG Nos REFER TO 1.09.101. SERIES
210
2 OFF 439608 TYPE 3
3 OFF 439528
3 OFF 439210
6 M20 X 70 BOLTS EACH C/W 1 ROUND WASHER PLUS 1 LOCKNUT.
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. No. 04/186
POLE LENGTH
DIM 'S' (m)
AUGURED FOUNDATION 'm'
AUGURED FOUNDATION 'S AND E/S'
STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL. 2.1 2.4 1.9
12.0 - 14.0 INCL. 2.4 2.6 2.1
14.0 - 18.0 INCL. 2.4 2.8 2.4
19.0 - 24.0 INCL. NOT ALLOWED NOT ALLOWED 3.0
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
H.V. OVERHEAD LINES (11KV & 20KV SYSTEMS) SINGLE POLE TERMINAL - UNBRACEDDTHREE PHASE
Sheet No. 1
Scale 1:20
Prepared By Carolyn.Palmer
Type ESI
Revised 07/12/11
Grid Reference
Ref No. C147674
Historic Drg.No. 1000434009
Date Issued 20/05/05
Checked By G HAMMEL
Revision K
Notes

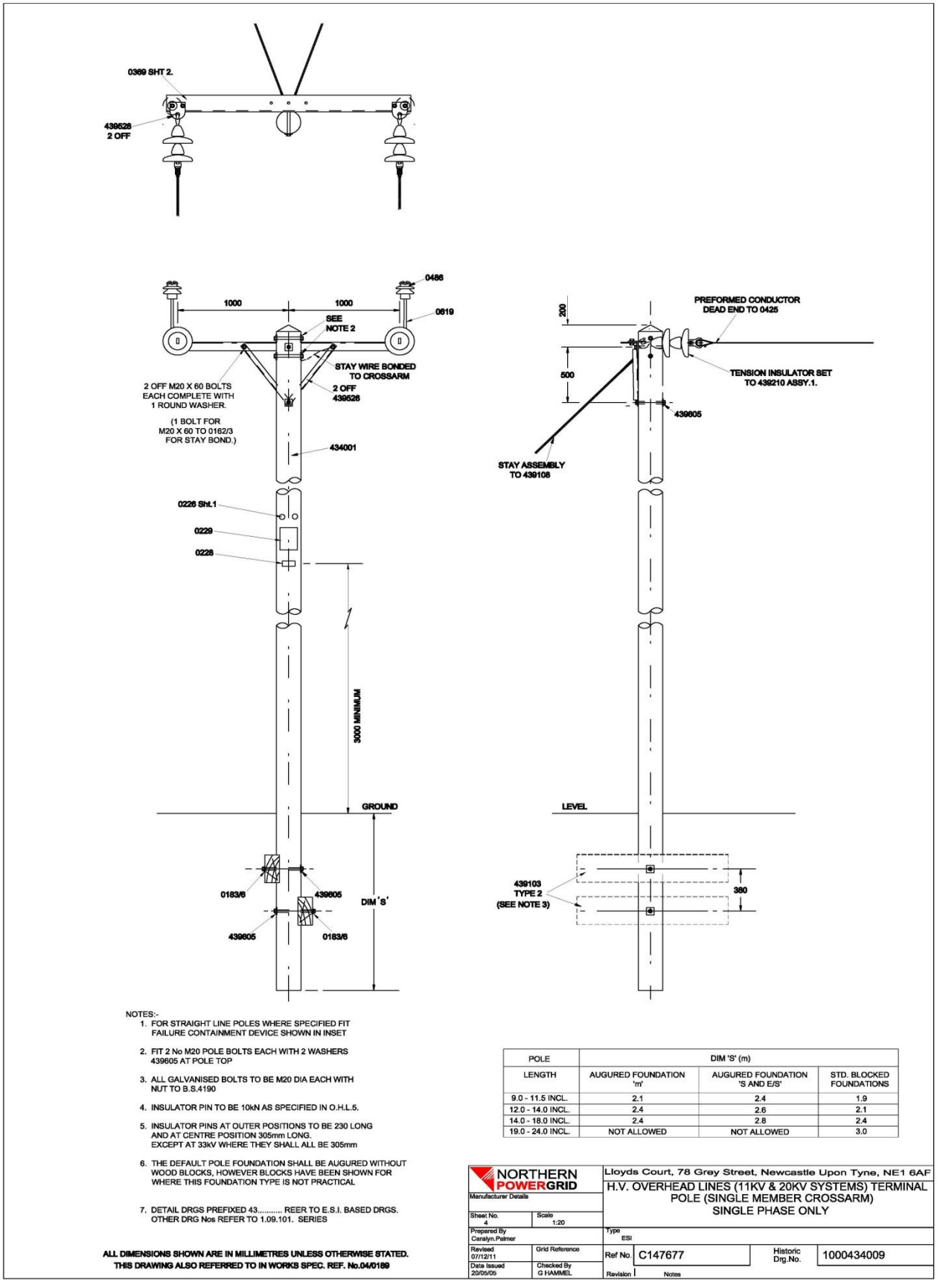
COMPONENT	DRAWING NO	QUANTITY	CAT NO
		2 WIRE	
Wood Pole	434001	1	As rqd
Wood Blocks	439103 Type 2	2	235124
Bolts, M20 x 400 (Medium)	-	2	372904 or
Bolts, M20 x 530, Galvd (Stout)	-	2	372815
Washers, M20, Square, Flat, Galvd	0183/6	2	368063
Washers, M20, Square, Curved, Galvd	439605	2	368078
Crossarm Members	0369 Sheet 2	1	245304
Crossarm Struts	439526	2	237581
Terminating Plate	439528	2	237596
Bolts, M20 x 60, Galvd	-	3	378703
Bolts, M20 x 60, Galvd, Earthing	0162/3	1	370504
Bolts, M20 x 70, Galvd	-	4	373911
Bolts, M20 x 220, (Medium) Galvd	-	4	378756 or
Bolts, M20 x 300, (Stout) Galvd		4	378794
Nuts, M20, Galvd	-	4	378915
Washers, M20, Round, Galvd	-	17	375616
Washers, M20, Square, Curved, Galvd	439605	4	368078
Tension Set Assemblies comprising:			
70kV Composite Insulators (11kV & 20kV)	0487/24	2	253706
439210 Assy 1 or 2 comprising:			
Ball Ended Hook	0454	2	253071
Preformed Termination *	0425	2	As rqd
Socket Thimble *	0426/1 or 3	2	264682 OR
			264610
OR			
Compression Termination	0102/5	2	As rqd
Jumper Lug	0102/8	2	As rqd
Notices (see Work Specs 04/055 & 04/056)	-	As spec'd	-
Stays (see Work Specs 04/027 & 04/028)	-	2	-
70 kV Composite Pin Insulators (11 & 20kV)	0486/13	2	253833
Pilot Pin Ø	0619/1	2	261909
Distribution Ties (see Work Spec 04/043) Ø	0660	2	As rqd

11 kV AND 20 kV OVERHEAD LINES

SINGLE PHASE, SINGLE POLE TERMINAL

Work Spec 04/186

Drg No 1.00.043.4009 Sheet 4



NOTES:-

1. FOR STRAIGHT LINE POLES WHERE SPECIFIED FIT FAILURE CONTAINMENT DEVICE SHOWN IN INSET
2. FIT 2 No M20 POLE BOLTS EACH WITH 2 WASHERS 439605 AT POLE TOP
3. ALL GALVANISED BOLTS TO BE M20 DIA EACH WITH NUT TO B.S.4190
4. INSULATOR PIN TO BE 10kN AS SPECIFIED IN O.H.L.5.
5. INSULATOR PINS AT OUTER POSITIONS TO BE 230 LONG AND AT CENTRE POSITION 305mm LONG. EXCEPT AT 33kV WHERE THEY SHALL ALL BE 305mm
6. THE DEFAULT POLE FOUNDATION SHALL BE AUGURED WITHOUT WOOD BLOCKS, HOWEVER BLOCKS HAVE BEEN SHOWN FOR WHERE THIS FOUNDATION TYPE IS NOT PRACTICAL
7. DETAIL DRGS PREFIXED 43..... REER TO E.S.I. BASED DRGS. OTHER DRG Nos REFER TO 1.09.101. SERIES

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. No.04/0189

POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

NORTHERN POWERGRID
Manufacturer Details
Sheet No. 4 | Scale 1:20
Prepared By Carralyn.Palmer
Revised 07/12/11 | Grid Reference
Date Issued 20/05/05 | Checked By G HAMMEL

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

H.V. OVERHEAD LINES (11KV & 20KV SYSTEMS) TERMINAL POLE (SINGLE MEMBER CROSSARM) SINGLE PHASE ONLY

Type ESI
Ref No. C147677
Historic Drg.No. 1000434009
Revision | Notes

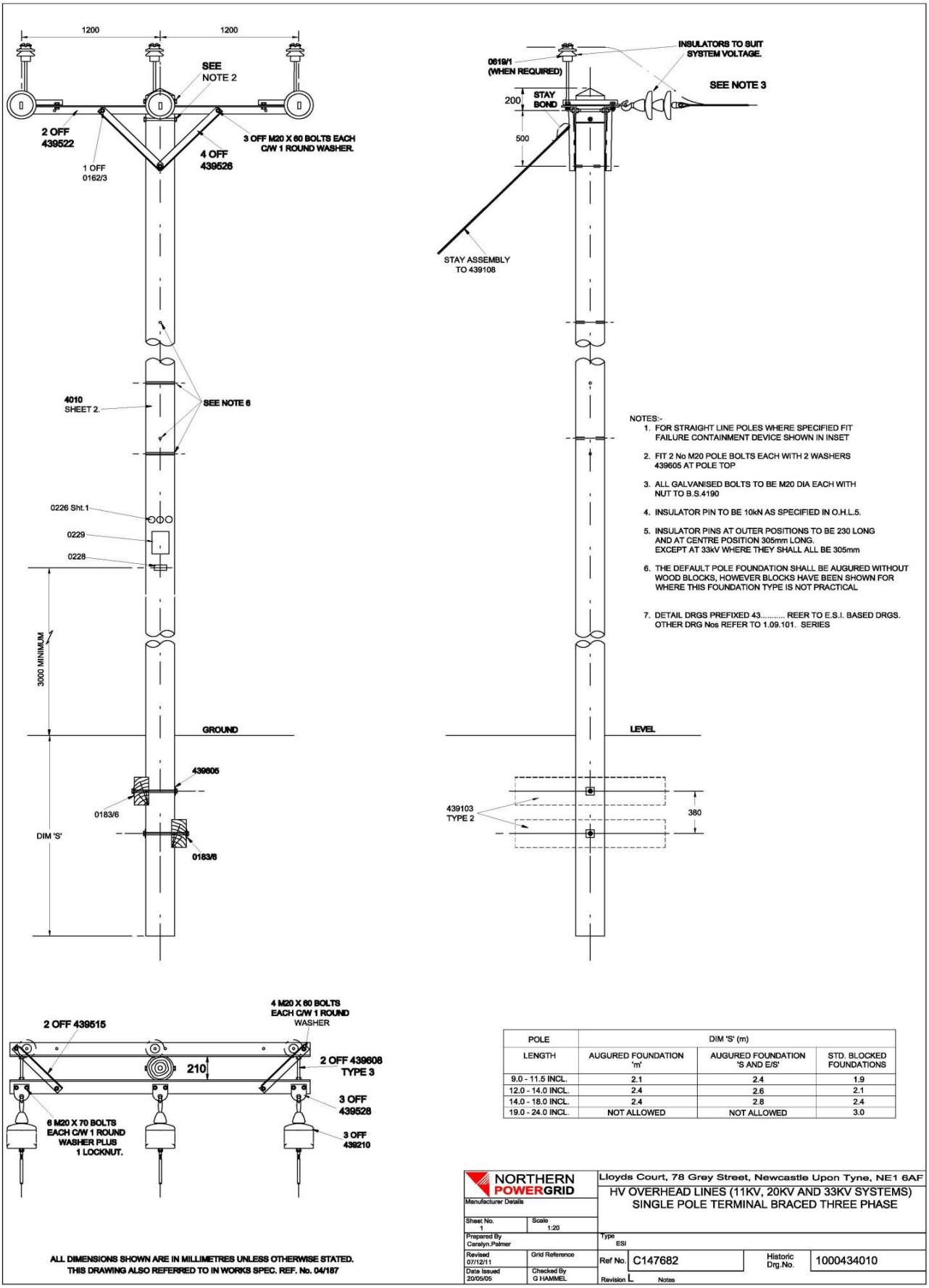
COMPONENT	DRAWING NO	QUANTITY			CAT NO
		2 WIRE	3 WIRE		
Wood Pole, Stout Grade	434010 Sht	1	1		As rqd
Wood Blocks	439103 Type	2	2		235124
Bolts, M20 x 530, Galvd (Stout)	-	2	2		372815
Washers, M20, Square, Flat, Galvd	0183/6	2	2		368063
Washers, M20, Square, Curved, Galvd	439605	2	2		368078
Crossarm Members	439522	2	2		237577
Crossarm Struts	439526	4	4		237581
Crossarm Braces	439515	2	2		237524
Terminating Plate	439528	2	3		237596
Bolts, M20 x 60, Galvd	-	7	7		378703
Bolts, M20 x 60, Galvd, Earthing	0162/3	1	1		370504
Bolts, M20 x 70, Galvd	-	4	6		373911
Bolts, M20 x 300, Galvd	-	4	4		378794
Tie Rods, M20 x 330, Galvd	439608/3	2	2		375828
Nuts, M20, Galvd	-	4	6		378915
Washers, M20, Round, Galvd	-	21	23		375616
Washers, M20, Square, Curved, Galvd	439605	4	4		368078
Tension Set Assemblies comprising:			11 kV / 20kV	33 kV	
70kV Composite Insulators (11 & 20kV)	0487/24	2	3		253706 or
90kV Composite Insulators (33kV)	0487/23	2		3	216150
439210 Assy 1 or 2 comprising:					
Ball Ended Hook	0454	2	3		253071
Preformed Termination *	0425	2	3		As rqd
Socket Thimble *	0426/1 or 3	2	3		264682 or
					264610
OR					
Compression Termination	0102/5	2	3		As rqd
Jumper Lug	0102/8	2	3		As rqd
439210 Assy 3 comprising (33 kV only):					
Ball Ended Hook	0445	-	3		253086
Socket Tongue	0449	-	3		250779
Ball Clevis	0456	-	3		248586
Arc Horn	0494/4	-	3		240480
Arc Horn	0494/6	-	3		240264
Preformed Terminations (to suit conductor)	0425	-	3		As rqd
Socket Thimble (to suit conductor)	0426/3	-	3		As rqd
OR					
Compression Termination *	0102/5	-	3		As rqd
Jumper Lug *	0102/8	-	3		As rqd
Notices (see Specs 04/055 & 04/056)					
Number Plate	-		-		To suit
Base Plate	-		1		243258
Safety Sign	0229 sht1		1		363318
Fibre Washer 9/16 in dia x 1/4 thick			6		374581
Fibre Washer 9/16 in dia x 1/16 thick			6		374577
Screws 1 in x No 8 brass			6		375777
Or					
Screw Nails, Hardened			2		371738
Stays (see Work Specs 04/027 & 04/028)	-	As rqd	As rqd		-
70kV Composite Pin Insulators (11 & 20kV)	0486/13	2	3		253833 or
90kV Rating Pin Insulator (33kV)	0486/4	2	3		253423
Pilot Pin	0619/1	2	3		261909
Distribution Ties (see Work Spec 04/043) O	0660	2	3		As rqd

11 kV, 20 kV AND 33 kV OVERHEAD LINES

SINGLE POLE TERMINAL (BRACED DOUBLE CROSSARM)

Work Spec 04/187

Drg No 1.00.043.4010 Sheet 1



NOTES:-

1. FOR STRAIGHT LINE POLES WHERE SPECIFIED FIT FAILURE CONTAINMENT DEVICE SHOWN IN INSET
2. FIT 2 No M20 POLE BOLTS EACH WITH 2 WASHERS 439605 AT POLE TOP
3. ALL GALVANISED BOLTS TO BE M20 DIA EACH WITH NUT TO B.S.4190
4. INSULATOR PIN TO BE 10kN AS SPECIFIED IN O.H.L.5.
5. INSULATOR PINS AT OUTER POSITIONS TO BE 230 LONG AND AT CENTRE POSITION 305mm LONG. EXCEPT AT 33kV WHERE THEY SHALL ALL BE 305mm
6. THE DEFAULT POLE FOUNDATION SHALL BE AUGURED WITHOUT WOOD BLOCKS, HOWEVER BLOCKS HAVE BEEN SHOWN FOR WHERE THIS FOUNDATION TYPE IS NOT PRACTICAL
7. DETAIL DRGS PREFIXED 43..... REER TO E.S.I. BASED DRGS. OTHER DRG Nos REFER TO 1.09.101. SERIES

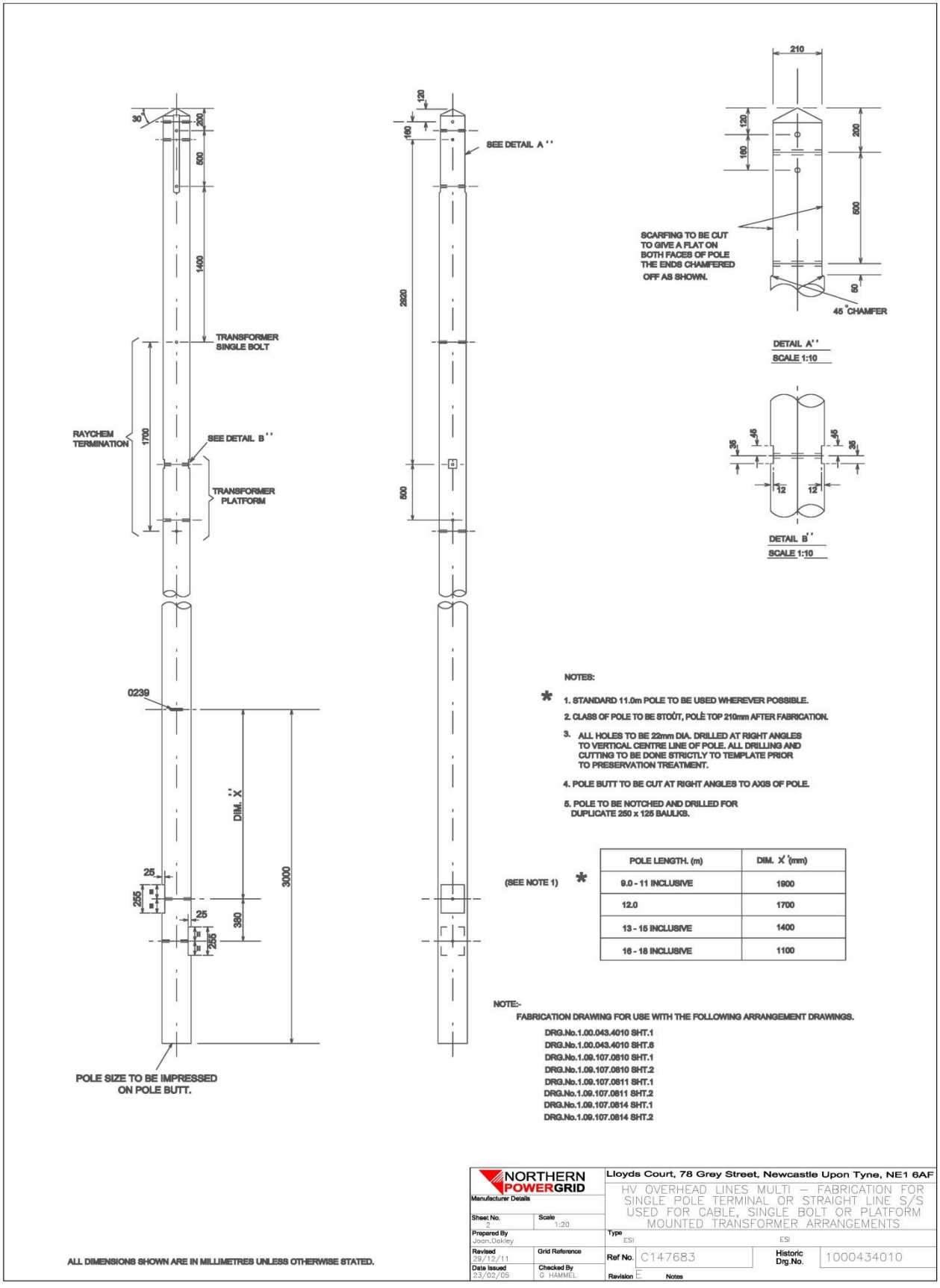
POLE LENGTH	DIM 'S' (m) AUGURED FOUNDATION 'm'	AUGURED FOUNDATION 'S AND E/S'	STD. BLOCKED FOUNDATIONS
9.0 - 11.5 INCL.	2.1	2.4	1.9
12.0 - 14.0 INCL.	2.4	2.6	2.1
14.0 - 18.0 INCL.	2.4	2.8	2.4
19.0 - 24.0 INCL.	NOT ALLOWED	NOT ALLOWED	3.0

NORTHERN POWERGRID
Manufacturer Details

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

HV OVERHEAD LINES (11KV, 20KV AND 33KV SYSTEMS)
SINGLE POLE TERMINAL BRACED THREE PHASE

Sheet No. 1	Scale 1:20		
Prepared By Carolyn.Palmer		Type ESI	
Revised 07/12/11	Grid Reference	Ref No. C147682	Historic Drg.No. 1000434010
Date Issued 20/05/05	Checked By G HAMMEL	Revision L Notes	


30
200
600
1400
TRANSFORMER SINGLE BOLT
RAYCHEM TERMINATION
1700
SEE DETAIL B''
TRANSFORMER PLATFORM
0239
DIM. X''
3000
25
255
380
POLE SIZE TO BE IMPRESSED ON POLE BUTT.
120
160
SEE DETAIL A''
2920
600
210
SCARFING TO BE CUT TO GIVE A FLAT ON BOTH FACES OF POLE THE ENDS CHAMFERED OFF AS SHOWN.
45° CHAMFER
DETAIL A''
SCALE 1:10
45
35
12
DETAIL B''
SCALE 1:10
NOTES:
1. STANDARD 11.0m POLE TO BE USED WHEREVER POSSIBLE.
2. CLASS OF POLE TO BE STOUT, POLE TOP 210mm AFTER FABRICATION.
3. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO PRESERVATION TREATMENT.
4. POLE BUTT TO BE CUT AT RIGHT ANGLES TO AXIS OF POLE.
5. POLE TO BE NOTCHED AND DRILLED FOR DUPLICATE 250 x 125 BAULKS.
(SEE NOTE 1)
POLE LENGTH. (m) | DIM. X'' (mm)
9.0 - 11 INCLUSIVE | 1900
12.0 | 1700
13 - 15 INCLUSIVE | 1400
16 - 18 INCLUSIVE | 1100
NOTE:-
FABRICATION DRAWING FOR USE WITH THE FOLLOWING ARRANGEMENT DRAWINGS.
DRG.No.1.00.043.4010 SHT.1
DRG.No.1.00.043.4010 SHT.8
DRG.No.1.09.107.0810 SHT.1
DRG.No.1.09.107.0810 SHT.2
DRG.No.1.09.107.0811 SHT.1
DRG.No.1.09.107.0811 SHT.2
DRG.No.1.09.107.0814 SHT.1
DRG.No.1.09.107.0814 SHT.2
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 2
Scale 1:20
Prepared By Jean.Oakley
Revised 29/12/11
Grid Reference
Date Issued 23/02/05
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
HV OVERHEAD LINES MULTI – FABRICATION FOR SINGLE POLE TERMINAL OR STRAIGHT LINE S/S USED FOR CABLE, SINGLE BOLT OR PLATFORM MOUNTED TRANSFORMER ARRANGEMENTS
Type ESI
ESI
Ref No. C147683
Historic Drg.No. 1000434010
Revision E
Notes

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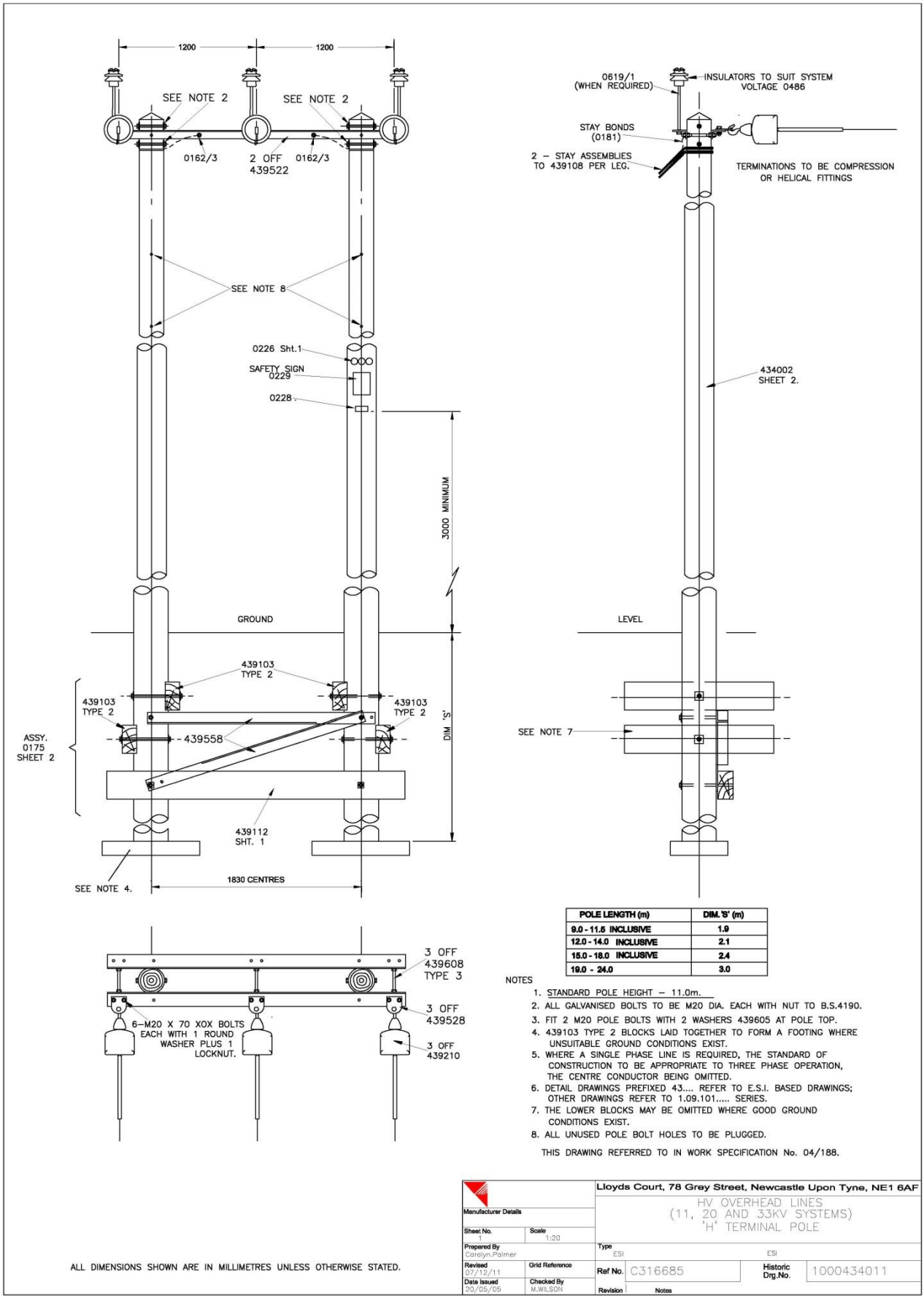
COMPONENT	DRAWING No.	QUANTITY		CAT NO
Wood 'H' Pole	434002 Sht 2	1		As rqd
Wood Blocks +	439103 Type 2	4		235124
Wood Brace Block	439112 Sht 1	1		234668
Foundation Braces	439558	2		254657
Bolts, M20 x 530, Galvd (Stout)	-	8		372815
Washers, M20, Square, Flat Galvd	0183/6	5		368063
Washers, M20, Square, Curved, Galvd	439605	8		368078
Crossarm Members	439522	2		237577
Terminating Plate	439528	3		237596
Bolts, M20 x 60, Galvd, Earthing	0162/3	2		370504
Bolts, M20 x 70, Galvd	-	6		373911
Bolts, M20 x 300	-	6		378794
Tie Rods, M20 x 330, Galvd	439608/3	4		375828
Nuts, M20, Galvd	-	6		378915
Washers, M20, Round, Galvd	-	16		375616
Washers, M20, Square, Curved, Galvd	439605	8		368078
Tension Set Assemblies comprising:		11 kV & 20 kV	33 kV	
70kV Composite Insulators (11kV & 20kV)	0487/24	3		253706 or
90kV Composite Insulators (33kV	0487/23		3	216150
439210 Assy 1 or 2 comprising:				
Ball Ended Hook	0454	3		253071
Preformed Termination *	0425	3		As rqd
Socket Thimble *	0426/1 or 3	3		264682 or 264610
OR				
Compression Termination	0102/5	3		As rqd
Jumper Lug	0102/8	3		As rqd
439210 Assy 3 comprising (33 kV only):				
Ball Ended Hook	0454	3		253086
Socket Tongue	0449	3		253071
Preformed Terminations (to suit conductor)	0425	3		As rqd
Socket Thimble (to suit conductor)	0426/3	3		As rqd
OR				
Compression Termination *	0102/5	3		As rqd
Jumper Lug *	0102/8	3		As rqd
Notices (see Work Specs 04/055 & 04/056)	-	As spec'd		-
Safety Sign	-	1		363318
Fibre Washer 9/16 in dia x 1/4 thick		6		374581
Fibre Washer 9/16 in dia x 1/16 thick		6		374577
Screws 1 in x No 8 brass		6		375777
OR				
Screw Nails, Hardened				
B2P 2 in x 10 G		2		371738
Stays (see Work Specs 04/027 & 04/028)	-	As rqd		-
55kV rating Pin Insulator (11kV or 20kV)	0486/13	3		253833 or
90kV rating Pin Insulator (33kV)	0486/4	3		253423
Pilot Pin Ø	0619/1	3		261909
Distribution Ties (see Work Spec 04/043)	0660	3		As rqd
Wood Plugs 24 mm x 75 mm Long	0247/3	8		263073

11 kV, 20 kV AND 33 kV OVERHEAD LINES

'H' POLE TERMINAL

Work Spec 04/188

Drg No 1.00.043.4011 Sheet 1



POLE LENGTH (m)	DIM. 'S' (m)
9.0 - 11.5 INCLUSIVE	1.9
12.0 - 14.0 INCLUSIVE	2.1
15.0 - 18.0 INCLUSIVE	2.4
19.0 - 24.0	3.0

NOTES

1. STANDARD POLE HEIGHT - 11.0m.
2. ALL GALVANISED BOLTS TO BE M20 DIA. EACH WITH NUT TO B.S.4190.
3. FIT 2 M20 POLE BOLTS WITH 2 WASHERS 439605 AT POLE TOP.
4. 439103 TYPE 2 BLOCKS LAID TOGETHER TO FORM A FOOTING WHERE UNSUITABLE GROUND CONDITIONS EXIST.
5. WHERE A SINGLE PHASE LINE IS REQUIRED, THE STANDARD OF CONSTRUCTION TO BE APPROPRIATE TO THREE PHASE OPERATION, THE CENTRE CONDUCTOR BEING OMITTED.
6. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I. BASED DRAWINGS; OTHER DRAWINGS REFER TO 1.09.101..... SERIES.
7. THE LOWER BLOCKS MAY BE OMITTED WHERE GOOD GROUND CONDITIONS EXIST.
8. ALL UNUSED POLE BOLT HOLES TO BE PLUGGED.

THIS DRAWING REFERRED TO IN WORK SPECIFICATION No. 04/188.

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

Manufacturer Details

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

HV OVERHEAD LINES
(11, 20 AND 33KV SYSTEMS)
'H' TERMINAL POLE

Sheet No. 1	Scale 1:20	Type ESI	ESI
Prepared By Carolyn.Palmer			
Revised 07/12/11	Grid Reference	Ref No. C316685	Historic Drg.No. 1000434011
Date Issued 20/05/05	Checked By M.WILSON	Revision	Notes

Appendix 13 – Renovation - Summary of Conductor Clashing Performance

Design Spec.	Clash Zone	Cond CSA & Pole Grade	Design Basic Span (m)	Design allowable Max Span (m)	Existing spacing	Max existing clashing span (m)	Improved clashing span (m)
Oak Xarms	2B	.05" HDBC L or M Poles	110	130	686mm (h) 700mm (v)	88	106
Oak Xarms	3C	.05" HDBC L or M Poles	110	130	686mm (h) 700mm (v)	83	100
Oak Xarms	2B	.017" CadCu L or M Poles	110	130	686mm (h) 700mm (v)	80	96
Oak Xarms	3C	.017" CADCU L or M Poles	110	130	686mm (h) 700mm (v)	75	91
Std Wishbone	2B	.05" HDBC Stout Poles	90	110	686mm (h) 731mm (v)	85	102
Std Wishbone	3C	.05" HDBC Stout Poles	90	110	686mm (h) 731mm (v)	80	96
Std Wishbone	2B	.05" HDBC Med Poles	110	130	686mm (h) 731mm (v)	88	106
Std Wishbone	3C	.05" HDBC Med Poles	110	130	686mm (h) 731mm (v)	84	100
Std Wishbone	2B	.017" CADCU Med Poles	100	120	686mm (h) 731mm (v)	80	96
Std Wishbone	3C	.017" CADCU Med Poles	100	120	686mm (h) 731mm (v)	75	91
BS1320	2B	.025" HDBC Med Poles	100	120	750mm	71	90
BS1320	3C	.025" HDBC Med Poles	100	120	750mm	67	86
BS1320	2B	.05" HDBC Med Poles	100	120	750mm	82	104
BS1320	3C	.05" HDBC Med Poles	100	120	750mm	77	98
BS1320	2B	.017" CADCU Med Poles	100	120	750mm	75	96
BS1320	3C	.017" CADCU Med Poles	100	120	750mm	69	91
BS1320	2B	.05" HDBC Med Poles	120	140	1050mm	101	108
BS1320	3C	.05" HDBC Med Poles	120	140	1050mm	96	102
BS1320	2B	.017" CADCU Med Poles	120	140	1050mm	92	96
BS1320	3C	.017" CADCU Med Poles	120	140	1050mm	87	91
BS1320	2B	.05" AAAC Med Poles	120	140	1050mm	95	102
BS1320	3C	.05" AAAC Med Poles	120	140	1050mm	88	95
Design Spec.	Clash Zone	Cond CSA & Pole Grade	Design Basic Span (m)	Design allowable Max Span (m)	Existing spacing	Max existing clashing span (m)	Improved clashing span (m)
43-10	2B	.05" HDBC	120	140	1000mm	98	104

		Med Poles					
43-10	3C	.05" HDBC Med Poles	120	140	1000mm	93	102
43-10	2B	.017" CADCU Med Poles	100	120	1000mm	86	92
43-10	3C	.017" CADCU Med Poles	100	120	1000mm	80	86
43-10	2B	.05" AAAC Med Poles	120	140	1000mm	100	110
43-10	3C	.05" AAAC Med Poles	120	140	1000mm	94	103
Std Wishbone	2B	.1" HDBC Stout Poles	90	105	686mm (h) 731mm (v)	103	125
Std Wishbone	3C	.1" HDBC Stout Poles	90	105	686mm (h) 731mm (v)	92	112
Heavy Duty Wishbone	2B	.1" HDBC A Poles	100	120	838mm (h) 600mm (v)	111	125
Heavy Duty Wishbone	3C	.1" HDBC A Poles	100	120	838mm (h) 600mm (v)	100	112
Heavy Duty Wishbone	2B	.15" HDBC A Poles	90	105	838mm (h) 600mm (v)	120	136
Heavy Duty Wishbone	3C	.15" HDBC A Poles	90	105	838mm (h) 600mm (v)	105	119
Heavy Duty Wishbone	2B	.2" HDBC A Poles	90	105	838mm (h) 600mm (v)	115	131
Heavy Duty Wishbone	3C	.2" HDBC A Poles	90	105	838mm (h) 600mm (v)	102	117
43-20 / OHL2/69	2B	70mm HDBC Stout Poles	100	120	1200mm	126	126
43-20 / OHL2/69	3C	70mm HDBC Stout Poles	100	120	1200mm	113	113
43-20 / OHL2/69	2B	100mm HDBC Stout Poles	100	120	1200mm	137	137
43-20 / OHL2/69	3C	100mm HDBC Stout Poles	100	120	1200mm	120	120
43-20 / OHL2/69	2B	125mm HDBC Stout Poles	100	120	1200mm	137	137
43-20 / OHL2/69	3C	125mm HDBC Stout Poles	100	120	1200mm	120	120
43-20 / OHL2/69	2B	100mm AAAC Stout Poles	100	120	1200mm	117	117
43-20 / OHL2/69	3C	100mm AAAC Stout Poles	100	120	1200mm	107	107
43-20 / OHL2/69	2B	100mm ACSR Stout Poles	100	120	1200mm	120	120
43-20 / OHL2/69	3C	100mm ACSR Stout Poles	100	120	1200mm	110	110
Design Spec.	Clash Zone	Cond CSA & Pole Grade	Design Basic Span (m)	Design allowable Max Span (m)	Existing spacing	Max existing clashing span (m)	Improved clashing span (m)
43-20 / OHL2/69	3C	150mm ACSR Stout Poles	100	120	1200mm	116	116
43-20 / OHL2/69	2B	175mm ACSR Stout Poles	100	120	1200mm	123	123

43-20 / OHL2/69	3C	175mm ACSR Stout Poles	100	120	1200mm	115	115
CE/C/31	2B	70mm HDBC Stout Pole	100	100	1140mm	123	127
CE/C/31	3C	70mm HDBC Stout Pole	100	100	1140mm	112	115
CE/C/31	2B	100mm AAAC Stout Pole	100	100	1400mm	114	116
CE/C/31	3C	100mm AAAC Stout Pole	100	100	1140mm	105	107
CE/C/31	2B	175mm ACSR Stout Pole	90	108	1140mm	119	122
CE/C/31	3C	175mm ACSR Stout Pole	90	108	1140mm	110	113
CE/C/31	2B	100mm HDBC Stout Pole	90	108	1140mm	132	136
CE/C/31	3C	100mm HDBC Stout Pole	90	108	1140mm	116	119
CE/C/31	2B	125mm HDBC Stout Pole	90	108	1140mm	128	131
CE/C/31	3C	125mm HDBC Stout Pole	90	108	1140mm	114	117
CE/C/36	2B	175mm ACSR Stout Pole	75	90	1140mm	130	133
CE/C/36	3C	175mm ACSR Stout Pole	75	90	1140mm	114	117
CE/C/36	2B	100mm HDBC Stout Pole	75	90	1140mm	129	133
CE/C/36	3C	100mm HDBC Stout Pole	75	90	1140mm	112	115
CE/C/36	2B	125mm HDBC Stout Pole	75	90	1140mm	128	131
CE/C/36	3C	125mm HDBC Stout Pole	75	90	1140mm	114	117

This table has been prepared to highlight the relative clashing performance of historical lines. The table has been constructed using conductor design tensions and spacing relative to the original design specifications.

The light shaded cells in the table identify those conductor / design specification combinations that are at most risk from clashing and would benefit from crossarm upgrades.

Note:-

The improved clashing span column identifies the possible improvement in conductor clashing through the use of modern replacement ENATS 43-40 crossarms.

Appendix 14 – 22 - Guidance on the Renovation of varying Historical Design Types

Appendix 14 - Specific Guidance on the Renovation of Lines designed to (CE/C/31) (YEDL 11kV Heavy Construction)

Design details for a typical intermediate support associated with this specification: -

Stout grade poles sunk a minimum of 1.8m with a normal max span of 99m.

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

100mm^2 AAAC - Normal altitude = 114m, High altitude = 105m (Appendix 3 & 7)

175mm^2 ACSR - Normal altitude = 119, High altitude = 110m (Appendix 33 & 34)

70mm^2 HDBC - Normal altitude = 123m, High altitude = 112m (Appendix 25 & 26)

100mm^2 HDBC - Normal altitude = 132m, High altitude = 116m (Appendix 27 & 28)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

- Pole Inspection and boron rod treatment.
- Retain existing crossarm steelwork unless severe signs of corrosion are apparent. (If steelwork is corroded badly but the pole is in good condition, the steelwork shall be replaced by drilling new mounting holes (175mm and 675mm from the pole top for intermediate poles and by using the existing top hole with a new hole 500mm lower down for section & terminal poles). The re-fabricated pole shall be dressed in accordance with the appropriate arrangement detailed in Appendix 1. The existing holes shall be used as anti-split holes and filled accordingly. In most cases the crossarm will be able to be replaced without effecting statutory ground clearances due to the historical additional clearance allowances provided for long term creep. Where this refurbishment option is used the line must be resurveyed to confirm ground clearance and uplift issues will not be created.
- Replace any defective structures with new poles dressed in accordance with Appendix 1.
- Replace all signs and notices. - See NSP/004/109
- Replace all stays and stay insulators that do not comply with NSP/004/104
- Replace all ACD's - See NSP/004/109
- Replace all insulators & binders. See NSP/004/127 & NSP/004/106
- Inspect/replace all non-compliant jumpers and connectors. See NSP/004/106 & NSP/004/107
- Inspect/replace obsolete Drop out Expulsion Fuses or ABSD's as necessary. See NSP/004/120

Appendix 15 - Specific Guidance on the Renovation of Lines designed to (CE/C/36) (YEDL 33kV Construction)

Design details for a typical intermediate support associated with this specification: -

Intermediate Structures - Stout grade poles, Section Structures - Twin bolted stout class poles with normal max span of 76m or 91m). (Typical pole sinking depth 1.8m minimum)

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

175mm^2 ACSR - Normal altitude = 130m, High altitude = 114m (Appendix 35)

125mm^2 HDBC - Normal altitude = 128m, High altitude = 114m (Appendix 36)

MWT Design Tensions	Min Tension Fitting Rating
.2" / 125mm HDBC – erected pre 1974 = 25kN	25kN Tension Fittings
.175" / 175mm ACSR – erected pre 1974 = 22.27kN, Post 1974 = 22.85kN	70kN Tension Fittings
.150" / 150mm ACSR – erected Post 1974 = 19.68kN	70kN Tension Fittings
.15" / 100mm HDBC erected pre 1974 = 18.97kN, Post 1974 = 18.81kN	70kN Tension fittings
.1" / 70mm HDBC – erected pre 1974 = 13kN, post 1974 = 13.43kN	70kN tension fittings

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

- Pole Inspection and boron rod treatment.
- Retain existing crossarm steelwork unless severe signs of corrosion are apparent. (If steelwork is corroded badly but the pole is in good condition, the steelwork shall be replaced by drilling new mounting holes (175mm and 675mm from the pole top for intermediate poles). The existing holes on the re-fabricated pole shall be used as anti-split holes and filled accordingly. Section crossarms on twin bolted structures will not be replaced. Instead, the complete structure will be replaced with an extra stout single pole. The re-fabricated pole shall be dressed in accordance with Appendix 1. In most cases the crossarm will be able to be replaced without effecting statutory ground clearances due to the historical additional clearance allowances provided for long term creep. Where this refurbishment option is used the line must be resurveyed to confirm ground clearance and uplift issues will not be created.
- Replace any defective structures with new poles dressed in accordance with Appendix 1. (See replacement of twin bolted structures above)
- Replace all signs and notices. - See NSP/004/109
- Replace all stays and stay insulators - See NSP/004/104
- Replace all ACD's - See NSP/004/109
- Replace all insulators & binders. - See NSP/004/127 & NSP/004/106
- Inspect/replace all non-compliant jumpers and connectors. See NSP/004/106 & NSP/004/107
- Inspect/replace obsolete Drop out Expulsion Fuses or ABSD's as necessary, see NSP/004/120

Appendix 16 - Specific Guidance on the Renovation of Lines designed to (0HL2-69) – (NEDL 11/20&33 KV Heavy Construction)

Design details for a typical intermediate support associated with this specification: -

Stout grade poles sunk a minimum of 1.8m with max span of 105M)

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

100mm^2 ACSR - Normal altitude = 120m,	High altitude = 110m	(Appendix 31 & 32)
175mm^2 ACSR - Normal altitude = 123m,	High altitude = 115m	(Appendix 33 & 34)
100mm^2 AAAC - Normal altitude = 117m,	High altitude = 107m	(Appendix 3 & 7)
70mm^2 HDBC - Normal altitude = 123m,	High altitude = 112m	(Appendix 25 & 26)
100mm^2 HDBC - Normal altitude = 132m,	High altitude = 116m	(Appendix 27 & 28)
125mm^2 HDBC - Normal altitude = 137m,	High altitude = 120m	(Appendix 29 & 30)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

- Pole Inspection and boron rod treatment
- Retain existing crossarm steelwork unless severe signs of corrosion are apparent. (If steelwork is corroded badly but the pole is in good condition, the steelwork shall be replaced with steelwork in accordance with Appendix 1.
- Where new steelwork is fitted the pole shall be drilled to incorporate anti-split bolts.
- Replace any defective structures with new poles dressed in accordance with Appendix 1.
- Replace all signs and notices. - See NSP/004/109
- Replace all stays and stay insulators - See NSP/004/104
- Replace all ACD's - See NSP/004/109
- Replace all insulators & binders. - See NSP/004/127 & NSP/004/106
- Inspect/replace all non-compliant jumpers and connectors. See NSP/004/106 & NSP/004/107
- Inspect/replace obsolete Drop out Expulsion Fuses or ABSD's as necessary, see NSP/004/120

Appendix 17 - Specific Guidance on the Renovation of Lines designed to (Heavy Duty Wishbone) (NEDL 11 or 20kV Heavy Construction)

Design description and conductor types used including (Phase to phase spacing)

(0.1" HDBC conductor supported on Stout grade poles with max span of 105m)

(0.1" HDBC conductor supported on 'A' poles with max span of 120m)

(0.15" HDBC conductor supported on 'A' poles with max span 105m)

(.2" HDBC conductor supported on 'A' poles with max span 105m)

Typical pole sinking depth, min 1.8m

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

.1" HDBC - Normal altitude = 103m,	High altitude = 92m, (appendix 25 to 26)
.1" HDBC - Normal altitude = 111m,	High altitude = 100m, (appendix 25 to 26)
.15" HDBC - Normal altitude = 120m,	High altitude =105m, (appendix 27 to 28)
.2" HDBC - Normal altitude = 115m,	High altitude =102m, (appendix 29 to 30)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

- Pole Inspection and boron rod treatment. (Particular attention being paid to the lower tiebolt position on ‘A’ poles for signs of decay).
- Retain the existing crossarm steelwork unless severe signs of corrosion are apparent. (If steelwork is corroded the complete structure shall be replaced with a new structure chosen from Appendix 1. To retain the high strength available within the original design, replacement supports on 'A poles shall be of extra stout grade.
- As can be seen from the existing clashing performance, lines constructed with .1" HDBC may suffer from clashing related failures when located in high altitudes. Where signs of previous clashing are evident, it is recommended that spans in excess of the maximum clashing span shown should have their support changed in line with the requirements of the associated appendices 15 to 16.
- Replace all flying angle poles (dressed to previous *.499 drawing no's) with wide 'H' pole structures in line with this specification.
- Replace all signs and notices and ACD’s. See NSP/004/109
- Replace all insulators and binders. See NSP/004/127 & NSP/004/106
- Replace all stays and stay insulators. See NSP/004/104
- Inspect conductors for signs of damage. - Replace any mechanical tension connectors with compression connectors.
- Inspect conductor termination fittings – replace insulators, spacer bars and scissor straps with modern equivalent fittings if required. (Where it is found necessary to replace bolted clamps or compression fittings, modern conductor termination arrangements shall be utilised (i.e. spacer straps etc. removed).
- Pilot/telephone wires removed – alternative communication methods established where route still required.
- Inspect/replace obsolete J&P or Aerial switches (see NSP/004/120).

Appendix 18 - Specific Guidance on the Renovation of Lines designed to (CE/C/18/LS) - (YEDL 11/33kV 43-40 derivative Spec for long spans)

This specification may be utilised solely as a renovation option for historical 11/33kV woodhouse masts designed to CE/C/18. Its use will be limited to discrete sections of line and only with 100mm AAAC conductor. This arrangement may only be utilised in areas below 300m above sea level.

This renovation option involves a complete line rebuild. However its use allows the existing support locations to be retained by offering a design that is suitable in terms of support strength, conductor strength and clashing performance for the large spans associated with the old design.

Design details for a typical new intermediate supports associated with this specification: -

(100mm AAAC conductor supported on E/Stout grade poles with max span of 160m) The conductor attachment points have been arranged to provide 2000mm phase to phase spacing.

The calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

100mm^2 AAAC - Normal altitude = 154m

Intermediate Support –	Y003X1111
Angle / Section Support -	Y003X1112
Additional Pole top steelwork	Y003X3328
Pole Fabrication Drawing	Y003X3117

Appendix 19 - Specific Guidance on the Renovation of Lines designed to (43-10) - (NEDL 11/20kV light duty flat formation)

Design description and conductor types used

(0.05"/ 32mm^2 HDBC conductor, Medium grade poles with max span of 140m)

(0.05" / 50mm^2 AAAC" conductor, Medium grade poles with max span of 140m)

(0.017" CADCU conductor, Medium grade poles with max span of 140m)

Typical minimum pole sinking depth 1.5m increasing to 1.8m for poles > 11.0m high

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

.05" / 32mm^2 HDBC - Norma altitude = 98m, High altitude = 93m, (appendix 36 to 39)

.05" / 50mm^2 AAAC - Normal altitude = 100m, High altitude = 94m, (appendix 2, 6 10 & 11)

.017" CADCU - Normal altitude = 86, High altitude =80m, (appendix 40 to 42)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

This design specification highlights a number of issues with these lines

a) Conductor clashing issues

b) Reduced conductor strength issues

The line schedules shall be reviewed to determine the basic span / max span combination that best describes this overhead line. This information shall then be compared against the appropriate design tables to benchmark the likely possible performance improvement of this line design if new crossarms are installed. Where clashing or RCSF is identified as an issue, reference shall be made to the network investment policy paper to determine the acceptability of retaining these conductors.

Where the likely performance risks are identified as acceptable, the following refurbishment process shall be followed.

- Inspect pole in accordance with NSP/004/112 and apply boron rod treatment. - Minimum acceptable pole grade medium, sunk at least 1.5m
- Replace all existing pole top steelwork using the existing pole top drillings. The poles shall be fitted with steelwork detailed in Appendix 1 as directed by the design table for the conductor.
  (1200mm spacing for three phase & 2000mm spacing for single phase lines) See conversion drawing 1091020792 & 0793 on the company Intranet.

  All structures to be fitted with Failure Containment Devices

- Where the condition assessment of the pole identifies the pole as being not suitable. The pole shall be replaced in accordance with the appropriate design table.
- Replace all insulators and binders. See NSP/004/127 & NSP/004/106
- Replace all signs and notices & ACD's. See NSP/004/109
- Replace all stays and stay insulators. See NSP/004/104

- Inspect conductors for signs of damage.
- Inspect conductor termination fittings – replace insulators, pigtail ball hooks with modern equivalent fittings.
- Inspect/replace obsolete J&P or Aerial switches - see NSP/004/120
- Retained lines may have their clashing performance enhanced further through the application of Limited Contact Spacers or through interpoling long occasional spans.

Continued…

Where the likely performance risks are identified as un-acceptable, the following refurbishment process is recommended.

Note. Both new and retained supports would require new steelwork to be installed in line with the appropriate design table for the new conductor.

Refurbishment of 13mm^2 CadCu conductor lines

Two options

Re-conductor with 50mm^2 AAAC using the existing poles

50mm^2 AAAC conductor has an increase in sag of approx. 140mm @ 50°C (100m Basic) over 13mm^2 CadCu conductor, hence a ground profile would be required to consider this option. If additional clearance is available, then the re-conductored spans would be limited to 112m on medium grade poles and 200+m on stout grade poles. This option will improve the maximum available clashing span to the following: - 100m basic = 106m & 120m basic = 110m

Re-conductor with 100mm^2 AAAC replacing all poles with stout grade poles

100mm^2 AAAC will allow the majority of exiting pole positions to be utilised but would require all poles to be replaced with Stout grade poles. A ground profile would be required to confirm the replacement pole heights as the approx sag increase will be 410mm @ 50°C. The new windspan limit would be 134m with the following improvements in maximum available clashing spans:-

100m basic = 117m, 120m basic = 122m.

Refurbishment of 32mm^2 HDBC or 50mm^2 AAAC conductor lines

Re-conductor with 100mm^2 AAAC replacing all poles with stout grade poles

100mm^2 AAAC will allow the majority of exiting pole positions to be utilised but would require all poles to be replaced with Stout grade poles. A ground profile would be required to confirm the replacement pole heights as the approx sag increase will be 410mm @ 50°C. The new windspan limit would be 134m with the following improvements in maximum available clashing spans:-

100m basic = 117m, 120m basic = 122m.

Appendix 20 - Specific Guidance on the Renovation of Lines designed to (BS1320 Construction 2'6" Spacing) or (BS1320 Construction 3'6" Spacing)

Design description and conductor types used:

(0.25" / 16mm^2 HDBC conductor, Medium or light grade poles with max span of 120m or 140m)

(0.05"/ 32mm^2 HDBC conductor, Medium grade poles with max span of 120m or 140m)

(0.017" CADCU conductor, Medium or light grade poles with max span of 120mor 140m)

Typical minimum pole sinking depth 1.5m increasing to 1.8m for poles > 11.0m high

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

.025" / 16mm^2 HDBC - Normal altitude = 71m	High altitude = 67m, (No design table)
.05" / 32mm^2 HDBC - Normal altitude = 98m,	High altitude = 93m, (appendix 36 to 39)
.017" CADCU - Normal altitude = 86,	High altitude =80m, (appendix 40 to 42)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type. - No design table has been created for .25" / 16mm^2 HDBC since it has been recommended for replacement with larger conductor.

Work requirement

This design specification highlights a number of issues with these lines

a) Conductor clashing issues

b) Reduced conductor strength issues

The line schedules shall be reviewed to determine the basic span / max span combination that best describes this overhead line. This information shall then be compared against the appropriate design tables to benchmark the likely possible performance improvement of this line design if new crossarms are installed. Where clashing or RCSF is identified as an issue, reference shall be made to the network investment policy paper to determine the acceptability of retaining these conductors.

Where the likely performance risks are identified as acceptable, the following refurbishment process shall be followed.

- Inspect pole in accordance with NSP/004/112 and apply boron rod treatment. - Minimum acceptable pole grade medium.
  Replace all existing pole top steelwork using the existing pole top drilling for the crossarm and by the addition of a M20 hole located 500mm below the crossarm hole for the tie strap. The poles shall be fitted with steelwork detailed in Appendix 1 as directed by the design table for the conductor. (1200mm spacing for three phase & 2000mm spacing for single phase lines) See conversion drawing 1091020792 & 0793 on the company intranet.

  All structures to be fitted with Failure Containment Devices

- Where the condition assessment of the pole identifies the pole as being not suitable. The pole shall be replaced in accordance with the appropriate design table.
- Replace all insulators and binders. See NSP/004/127 & NSP/004/106

- Replace all signs and notices & ACD's See NSP/004/109
- Replace all stays and stay insulators. See NSP/004/104
- Inspect conductors for signs of damage.
- Inspect conductor termination fittings – replace insulators, pigtail ball hooks with modern equivalent fittings.
- Inspect/replace obsolete J&P or Aerial switches - see NSP/004/120
- Retained lines may have their clashing performance enhanced further through the application of Limited Contact Spacers or through interpoling long occasional spans.

Where the likely performance risks are identified as un-acceptable, the following refurbishment process is recommended. (Note .025" /16mm HDBC is no longer a suitable conductor.

Note. Both new and retained supports would require new steelwork to be installed in line with the appropriate design table for the new conductor.

Refurbishment of .025" / 16mm^2 HDBC conductor lines

Two options

Re-conductor with 50mm^2 AAAC using the existing poles

50mm^2 AAAC conductor has a decrease in sag of approx. 730mm @ 50°C (100m Basic) over 16mm^2 CadCu conductor, hence a ground profile would be required to consider this option. Re-conductored spans would be limited to 112m on medium grade poles and 200+m on stout grade poles (light poles must be replaced) This option will improve the maximum available clashing span to the following:- 100m basic = 106m & 120m basic = 110m

Re-conductor with 100mm^2 AAAC replacing all poles with stout grade poles

100mm^2 AAAC will allow the majority of exiting pole positions to be utilised but would require all poles to be replaced with Stout grade poles. A ground profile would be required to confirm the replacement pole heights as the approx sag increase will be 410mm @50°C. The new windspan limit would be 134m with the following improvements in maximum available clashing spans:-

100m basic = 117m, 120m basic = 122m.

Refurbishment of 13mm^2 CadCu conductor lines

See comments for the refurbishment of 13mm^2 CadCu conductor in appendix 20.

Refurbishment of 32mm^2 HDBC or 50mm^2 AAAC conductor lines

See comments for the refurbishment of 32mm^2 HDBC conductor in appendix 20.

Appendix 21 - Specific Guidance on the Renovation of Lines designed to (Standard Duty Wishbone) - NEDL 11 or 20kV (2'3" Spacing)

Design details for a typical intermediate support associated with this specification: -

(0.05"/ 32mm HDBC - Stout grade poles with max span of 110m or 88m with AEW)

(0.05"/ 32mm HDBC - Medium grade poles with max span of 130M)

(0.017"/ 13mm CadCu - Medium grade poles with max span of 120M)

Typical minimum pole sinking depth 1.5m increasing to 1.8m for poles > 11.0m high

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

.05" / 32mm^2 HDBC - Stout Poles - Normal altitude = 85m, High altitude = 80m, (appendix 36 to 39)

.05" / 32mm^2 HDBC - Med Poles - Normal altitude = 88m, High altitude = 84m, (appendix 36 to 39)

.017" / 13mm^2 CadCu - Med Poles - Normal altitude = 80m, High altitude = 75m, (appendix 40 to 42)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

This design specification highlights a number of issues with these lines

a) Conductor clashing issues

b) Reduced conductor strength issues

The line schedules shall be reviewed to determine the basic span / max span combination that best describes this overhead line. This information shall then be compared against the appropriate design tables to benchmark the likely possible performance improvement of this line design if new crossarms are installed. Where clashing or RCSF is identified as an issue, reference shall be made to the network investment policy paper to determine the acceptability of retaining these conductors.

Where the likely performance risks are identified as acceptable, the following refurbishment process shall be followed.

- Inspect pole in accordance with NSP/004/112 and apply boron rod treatment. - Minimum acceptable pole grade medium.
  Replace all existing pole top steelwork using the existing pole top drilling for the crossarm and by the addition of a M20 hole located 500mm below the crossarm hole for the tie strap. The poles shall be fitted with steelwork detailed in Appendix 1 as directed by the design table for the conductor. (1200mm spacing for three phase & 2000mm spacing for single phase lines) See conversion drawing 1091020792 & 0793 on the company intranet.

  All structures to be fitted with Failure Containment Devices

- Replace all flying angle poles (dressed to previous *.499 drawing no's) with wide 'H' pole structures in line with this specification.
- Where the condition assessment of the pole identifies the pole as being not suitable. The pole shall be replaced in accordance with the appropriate design table.

- Replace all insulators and binders. See NSP/004/127 & NSP/004/106
- Replace all signs and notices and ACD's See NSP/004/109
- Replace all stays and stay insulators. See NSP/004/104
- Inspect conductors for signs of damage.
- Inspect conductor termination fittings – replace insulators, pigtail ball hooks with modern equivalent fittings.
- Inspect/replace obsolete J&P or Aerial switches - see NSP/004/120
- Retained lines may have their clashing performance enhanced further through the application of Limited Contact Spacers or through interpoling long occasional spans.

Where the likely performance risks are identified as un-acceptable, the following refurbishment process is recommended.

Note. Both new and retained supports would require new steelwork to be installed in line with the appropriate design table for the new conductor.

Refurbishment of 13mm^2 CadCu conductor lines

See comments for the refurbishment of 13mm^2 CadCu conductor in appendix 20.

Refurbishment of 32mm^2 HDBC or 50mm^2 AAAC conductor lines

See comments for the refurbishment of 32mm^2 HDBC conductor in appendix 20.

Appendix 22 - Specific Guidance on the Renovation of Lines designed to (Nesco Oak Crossarms - 2'3" Spacing)

Design details for a typical intermediate support associated with this specification:-

(0.05"/ 32mm^2 HDBC conductor, Medium or light grade poles with max span of 130m)

(0.017" CADCU conductor, Medium or light grade poles with max span of 130m)

Typical minimum pole sinking depth 1.5m increasing to 1.8m for poles > 11.0m high

The existing calculated clashing performance associated with each conductor type normally utilised with this design specification has been listed below.

.05" / 32mm^2 HDBC - Normal altitude = 88m, High altitude = 83m, (appendix 36 to 39)

.017" CADCU - Normal altitude = 80, High altitude =75m, (appendix 40 to 42)

The Appendices shown in bracket's detail design tables applicable to the renovation of the supports associated with each conductor type.

Work requirement

This design specification highlights a number of issues with these lines

a) Conductor clashing issues

b) Reduced conductor strength issues

The line schedules shall be reviewed to determine the basic span / max span combination that best describes this overhead line. This information shall then be compared against the appropriate design tables to benchmark the likely possible performance improvement of this line design if new crossarms are installed. Where clashing or RCSF is identified as an issue, reference shall be made to the network investment policy paper to determine the acceptability of retaining these conductors.

Where the likely performance risks are identified as acceptable, the following refurbishment process shall be followed.

- Inspect pole in accordance with NSP/004/112 and apply boron rod treatment. - Minimum acceptable pole grade medium.
  Replace all existing pole top steelwork using the existing pole top drilling for the crossarm and by the addition of a M20 hole located 500mm below the crossarm hole for the tie strap. The poles shall be fitted with steelwork detailed in Appendix 1 as directed by the design table for the conductor. (1200mm spacing for three phase & 2000mm spacing for single phase lines) See conversion drawing 1091020792 & 0793 on the company intranet.

  All structures to be fitted with Failure Containment Devices

- Replace all flying angle poles (dressed to previous *.499 drawing no's) with wide 'H' pole structures in line with this specification.
- Where the condition assessment of the pole identifies the pole as being not suitable. The pole shall be replaced in accordance with the appropriate design table.
- Replace all insulators and binders. See NSP/004/127 & NSP/004/106
- Replace all signs and notices & ACD's. See NSP/004/109
- Replace all stays and stay insulators. See NSP/004/104
- Inspect conductors for signs of damage.

- Inspect conductor termination fittings – replace insulators, pigtail ball hooks with modern equivalent fittings.
- Inspect/replace obsolete J&P or Aerial switches - see OHI 20
- Retained lines may have their clashing performance enhanced further through the application of Limited Contact Spacers or through interpoling long occasional spans.

Where the likely performance risks are identified as un-acceptable, the following refurbishment process is recommended.

Note. Both new and retained supports would require new steelwork to be installed in line with the appropriate design table for the new conductor.

Refurbishment of 13mm^2 CadCu conductor lines

See comments for the refurbishment of 13mm^2 CadCu conductor in appendix 20.

Refurbishment of 32mm^2 HDBC or 50mm AAAC conductor lines

See comments for the refurbishment of 32mm^2 HDBC conductor in appendix 20.

Appendix 23 - Renovation of Main Lines Appendix 24 - 34

Notes

- The following tables assume the existing conductors are retained at their existing sag & tension; hence clashing performance is based on existing conductors with replacement 1.2m or 2.0m phase spacing crossarms.
- The resultant conductor strength factor represents the reduced conductor factor of safety when operating the conductor in a given ENATS 43-40 weather environment (see clause 3.1.1). The % figure represents this factor compared to the traditional 2.0 factor of safety employed on wind and ice loaded conductors.
- The windspan capability of supports illustrates a poles capacity to carry the ENATS 43-40 weather loading. The maximum windspan level for poles has been defined as the maximum span normally associated with the specification. In many cases significantly higher spanning capabilities will be available.
- Replacement supports for CE/C/36 poles shall default to stout grade poles for intermediate structures and extra stout grade poles for section supports.
- Replacement supports for 'A' or 'Rutter' pole lines shall default to extra stout grade poles.

Appendix 24 - Design Tables 70mm² / .1" HDBC - Three Phase Normal Altitude

Basic Design Span	100	120
Max Clashing Span ***	120 (126)	144 (127)
Occasional Long Span (2.0m phase to phase)	164	165
Resultant conductor strength factor	2.0	2.0
FCD Required	No	Yes
Clashing Weather Load	2B	2B
Windspan factor of Safety applied to Wood poles	2.5	2.5
Strut Load factor of Safety applied to Wood poles	2.5	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Stout	10kN	148m
434007/2 *	Intermediate	Stout 'H'	10kN	148+m
434005	Section	Stout	-	148m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	18°	1 @ 45°
434004	Pin Angle	Stout <=12m	10kN	18°	1 @ 30°
434005	Sect Angle	Stout <=12m	-	40°	2 @ 45°
434005	Sect Angle	E/Stout	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=13m	-	45°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=14m	-	60°	4 @ 35°
434007	H Sect Angle	Stout H <=15m	-	90°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off	Stout (Tee-off cond size 50mm AAAC)	1 @ 45°
434008	Tee off	E/Stout (Tee-off cond size 100mm AAAC)	2 @ 45°
434008	Tee off	E/Stout <=15m (Tee-off cond size 100mm AAAC)	2 @ 35°
434010	Terminal	E/Stout	2 @ 45°
434010	Terminal	E/Stout <=15m	2 @ 35°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 35°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to Existing 'A' or Rutter Poles

Appendix 25 - Design Tables 70mm² / .1" HDBC - Three Phase High Altitude

Basic Design Span	90
Max Clashing Span ***	108 (104)
Occasional Long Span (2.0m phase to phase)	135
Resultant conductor strength factor	1.67 (83%)
FCD Required	Yes
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	2.0
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	100m
434007/2 *	Intermediate	Stout 'H'	10kN	200+m
434005	Section	Stout	-	100m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	15°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	15°	2 @ 30°
434005	Sect Angle	Stout <=13m	-	35°	2 @ 45°
434005	Sect Angle	E/Stout	-	45°	2 @ 45°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 35°
434007	H Sect Angle	Stout H	-	90°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off	Stout (Tee-off cond size 50mm AAAC)	1 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 35°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- Replacement supports may provide increased spanning capabilities
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to 'A' or Rutter Poles

Appendix 26 - Design Tables 100mm² / .15" HDBC - Three Phase Normal Altitude

Basic Design Span	100
Max Clashing Span ***	120 (136)
Occasional Long Span (2.0m phase to phase)	177
Resultant conductor strength factor	2.12 (106%)
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of Safety applied to Wood poles	2.5
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	137m
434007 *	Section	Stout 'H'	10kN	200+m
434005	Section	Stout	-	137m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	14°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	14°	1 @ 30°
434005	Sect Angle	Stout <=13m	-	30°	2 @ 45°
434005	Sect Angle	E/Stout	-	35°	2 @ 30°
434005	Sect Angle	E/Stout <=13m	-	40°	2 @ 35°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to 'A' or Rutter Poles

Appendix 27 - Design Tables 100mm² / .15" HDBC - Three Phase High Altitude

Basic Design Span	90
Max Clashing Span ***	108 (112)
Occasional Long Span (2.0m phase to phase)	144
Resultant conductor strength factor	1.83 (91%)
FCD Required	No
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	2.0
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	94m
434004	Intermediate	E/Stout	10kN	127m
434007 *	Section	Stout 'H'	-	127+m
434005	Section	Replacement Stout	-	94m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	10°	1 @ 45°
434004	Pin Angle	Stout <=12m	10kN	10°	1 @ 30°
434005	Sect Angle	Stout <=12m	-	25°	2 @ 45°
434005	Sect Angle	E/Stout	-	33°	2 @ 45°
434005	Sect Angle	E/Stout	-	33°	2 @ 30°
434005	Sect Angle	E/Stout	-	45°	4 @ 30°
434006	H Sect Angle	Stout H <=15m	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=12m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H <=15m	4 @ 45°
434011	Terminal	Stout H <=12m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to 'A' or Rutter Poles

Appendix 28 - Design Tables 125mm² / .2" HDBC - Three Phase Normal Altitude

Basic Design Span	100
Max Clashing Span ***	120 (132)
Occasional Long Span (2.0m phase to phase)	171
Resultant conductor strength factor	2.71 (135%)
FCD Required	No
Clashing Weather Zone	2C
Windspan factor of Safety applied to Wood poles	2.5
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	131m
434004	Intermediate	E/Stout	10kN	176m
434007 *	Section	Stout 'H'	-	176+m
434005	Section	Stout	-	131m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	13°	1 @ 45°
434004	Pin Angle	Stout	10kN	13°	1 @ 30°
434005	Sect Angle	Stout <=13m	-	25°	2 @ 45°
434005	Sect Angle	E/Stout	-	36°	2 @ 45°
434005	Sect Angle	E/Stout	-	36°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=12m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=12m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to 'A' or Rutter Poles

Appendix 29 - Design Tables 125mm² / .2" HDBC - Three Phase High Altitude

Basic Design Span	90
Max Clashing Span ***	108 (109)
Occasional Long Span (2.0m phase to phase)	140
Resultant conductor strength factor	2.29 (114%)
FCD Required	No
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	2.0
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	90m
434004	Intermediate	E/Stout	10kN	122m
434007 *	Section	Stout 'H'	-	122+m
434005	Section	Stout	-	90m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	10°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	10°	1 @ 35°
434005	Sect Angle	E/Stout	-	33°	2 @ 45°
434005	Sect Angle	E/Stout <=14m	-	33°	2 @ 45°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=14m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=12m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to 'A' or Rutter Poles

Appendix 30 - Design Tables 100mm² / .1" ACSR - Three Phase Normal Altitude

Basic Design Span	100
Max Clashing Span ***	120 (120)
Occasional Long Span (2.0m phase to phase)	144
Resultant conductor strength factor	2.63 (131%)
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of Safety applied to Wood poles	2.5
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Stout	10kN	132m
434003	Intermediate	E/Stout	10kN	183m
434007 *	Section	Stout 'H'	-	183+m
434005	Section	Stout	-	132m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	20°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	20°	1 @ 30°
434005	Sect Angle	Stout <=13m	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=15m	-	45°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	3 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 30°
434006	H Sect Angle	Stout H <=14m	-	90°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off	Stout	1 @ 45°
434010	Terminal	E/Stout	2 @ 45°
434011	Terminal	Stout H	4 @ 30°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.
- E/Stout poles are considered as equivalent to 'A' or Rutter Poles

Appendix 31 - Design Tables 100mm² / .1" ACSR - Three Phase High altitude

Basic Design Span	90
Max Clashing Span ***	108 (108)
Occasional Long Span (2.0m phase to phase)	139
Resultant conductor strength factor	2.09 (104%)
FCD Required	No
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	2.0
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	91m
434004	Intermediate	E/Stout	10kN	122m
434007 *	Section	Stout 'H'	-	122+m
434005	Section	Stout	-	91m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	12°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	12°	2 @ 30°
434005	Sect Angle	Stout <=13m	-	30°	2 @ 45°
434005	Sect Angle	E/Stout	-	45°	2 @ 45°
434005	Sect Angle	E/Stout <=12m	-	45°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=12m	-	60°	4 @ 35°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee off **	Stout	1 @ 45°
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=12m	4 @ 35°

- * Used for occasional long spans.
- ** Max conductor size for Full Span T-off conductor limited to 50mm AAAC.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 32 - Design Tables 150 - 175mm² / .15 -.175" ACSR Three Phase Normal Altitude

Basic Design Span	100
Max Clashing Span ***	120 (124)
Occasional Long Span (2.0m phase to phase)	144
Resultant conductor strength factor	3.88 (194%)
FCD Required	No
Clashing Weather Zone	2B
Windspan factor of Safety applied to Wood poles	2.5
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout <=13m	10kN	114m
434007 *	Section	Stout 'H'	-	144+m
434005	Section	Stout	-	114m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	13°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	13°	1 @ 30°
434005	Sect Angle	Stout <=14m	-	25°	2 @ 45°
434005	Sect Angle	E/Stout	-	36°	2 @ 45°
434005	Sect Angle	E/Stout <=13m	-	36°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 33 - Design Tables 150 - 175mm² / .15 -.175" ACSR Three Phase High Altitude

Basic Design Span	90
Max Clashing Span ***	108 (106)
Occasional Long Span (2.0m phase to phase)	137
Resultant conductor strength factor	3.16 (160%
FCD Required	Yes
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	2.0
Strut Load factor of Safety applied to Wood poles	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout <=12m	10kN	80m
434004	Intermediate	E/Stout	10kN	108m
434007 *	Section	Stout 'H'	-	160m
434005	Section	Stout	-	80m
434005	Section	E/Stout	-	108m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434004	Pin Angle	Stout	10kN	9°	1 @ 45°
434004	Pin Angle	Stout <=13m	10kN	9°	1 @ 30°
434005	Sect Angle	E/Stout	-	32°	2 @ 45°
434005	Sect Angle	E/Stout <=13m	-	32°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	4 @ 45°
434006	H Sect Angle	Stout H <13m	-	60°	4 @ 40°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 34 - Design Tables - 175mm2 ACSR - (LYNX) Normal Altitude Designed for the Higher Tensions associated with CE/C/36 Construction

MWT	22.85 kN
Basic Design Span	90
Max Clashing Span ***	108 (135)
Occasional Long Span (2.0m Phase to Phase)	160
FCD Required	No
Clashing Weather Zone	2C
Windspan factor of safety applied to Wood Poles	2.5
Strut load factor of safety applied to Wood Poles	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	114m
434004	Intermediate	E/Stout	10kN	153m
434007/2 *	Intermediate	Stout 'H'	-	156+m
434005	Section	Stout	-	114m
434005	Section	E/Stout	-	153m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	6°	1 @ 45º
434004	Pin Angle	Stout <=12m	10kN	6°	1 @ 30°
434005	Sect Angle	E/Stout	-	28°	2 @ 45°
434005	Sect Angle	E/Stout	-	43°	2 @ 45°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Notes

This table is for use with lines located in Normal environments i.e. lines located in altitudes above below 300m sea level.

Appendix 35- Design Tables - 125mm2 HDBC Normal Altitude Designed for the Higher Tensions associated with CE/C/36 Construction

MWT	25 kN
Basic Design Span	90
Max Clashing Span ***	108 (135)
Occasional Long Span (2.0m Phase to Phase)	160
FCD Required	No
Clashing Weather Zone	2C
Windspan factor of safety applied to Wood Poles	2.5
Strut load factor of safety applied to Wood Poles	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434004	Intermediate	Stout	10kN	114m
434004	Intermediate	E/Stout	10kN	153m
434007/2 *	Intermediate	Stout 'H'	-	156+m
434005	Section	Stout	-	114m
434005	Section	E/Stout	-	153m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	Stays
434004	Pin Angle	Stout	10kN	8°	1 @ 45º
434004	Pin Angle	Stout <=12m	10kN	8°	1 @ 30°
434005	Sect Angle	E/Stout	-	34°	2 @ 45°
434005	Sect Angle	E/Stout	-	18°	2 @ 30°
434006	H Sect Angle	Stout H <=13m	-	60°	4 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434011	Terminal	Stout H	4 @ 45°
434011	Terminal	Stout H <=13m	4 @ 40°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Notes

This table is for use with lines located in Normal environments i.e. lines located in altitudes above below 300m sea level.

**** Tension Fittings must utilise 125kN insulators and fittings****

Appendix 36 – 43 Light Lines - Designed on a Wind Only Basis (clashing and support reliability improvements only)

Notes

- The following tables assume the existing conductors are retained at their existing sag & tensions; hence clashing performance is based on existing conductors with replacement 1.2m or 2.0m phase spacing crossarms.
- The resultant conductor strength factor represents the reduced conductor factor of safety when operating the conductor in a given ENATS 43-40 weather environment. The % figure represents this factor compared to the traditional 2.5 factor of safety employed on wind only loaded conductors.
- The windspan capability of supports illustrates a pole's capacity to carry the ENATS 43-40 weather loading.
- Lines that are refurbished in line with these tables will be resistant to pole failure but will still be susceptible to conductor breakages due to the reduced factors of safety employed with the conductors.

Appendix 36 - Design Tables 32mm² HDBC Three Phase Normal Altitude

Basic Design Span	80	100
Max Clashing Span *** 1.2m Phase to phase	96 (97)	120 (101)
Occasional Long Span (2.0m phase to phase)	129	129
Resultant Conductor Strength Factor	2.27 (90%)	2.22 (88%)
FCD Required	No	Yes
Clashing Weather Zone	2B	2B
Windspan factor of Safety applied to Wood poles	2.5	2.5
Strut Load factor of Safety applied to Wood poles	2.5	2.5

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	124m
434007/2 *	Intermediate	Stout 'H'	10kN	150+m
434005	Section	Stout	-	150+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	45°	1 @ 45°
434003	Pin Angle	Medium <=13m	10kN	15°	1 @ 30º
434003	Pin Angle	Stout	10kN	50°	1 @ 30º
434005	Sect Angle	Stout	-	60°	1 @ 45°
434005	Sect Angle	Stout <=14m	-	60°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	3 @ 30°
434007	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout <=14m	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434010	Terminal	Stout	1 @ 45°
434010	Terminal	Stout <=14m	2 @ 30°

Notes

Structure loadings have been derived using the appropriate ENATS 43-40 weather loads however existing lines shall be re-sagged back to their original wind only design criteria.

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 37 - Design Tables 32mm² HDBC - Three Phase High Altitude

Basic Design Span	80	100
Max Clashing Span ***	96 (92)	120 (96)
Occasional Long Span (2.0m phase to phase)	120	127
Resultant Conductor Strength Factor	2.27 (90%)	2.22 (88%)
FCD Required	Yes	Yes
Clashing Weather Zone	3C	3C
Windspan factor of Safety applied to Wood poles	3.0	3.0
Strut Load factor of Safety applied to Wood poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	100m
434007/2 *	Intermediate	Stout 'H'	10kN	198+m
434005	Section	Stout	-	198+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	30°	1 @ 45°
434003	Pin Angle	Medium <=13m	10kN	15°	1 @ 30°
434003	Pin Angle	Stout	10kN	45°	1 @ 30°
434005	Sect Angle	Stout	-	60°	1 @ 45°
434005	Sect Angle	Stout <=15m	-	60°	2 @ 30°
434006	H Sect Angle	Stout H	-	60°	3 @ 30°
434007	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout <=15m	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434010	Terminal	Stout	1 @ 45°
434010	Terminal	Stout	2 @ 30°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 39 Design Tables - 32mm2 HDBC Single Phase - Normal Altitude

Basic Design Span	100	120
Max Clashing Span ***	120 (135)	144 (140)
Occasional Long Span (2.0m phase to phase)	135	140
Resultant Conductor Strength Factor	2.22 (88%)	2.19 (87%)
FCD Required	No	Yes
Clashing Weather Zone	2B	2B
Windspan factor of Safety applied to Wood poles	3.0	3.0
Strut Load factor of Safety applied to Wood poles	3.0	3.0

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	152m
434005	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	50°	1 @ 45°
434003	Pin Angle	Medium <=15m	10kN	15°	1 @ 30º
434003	Pin Angle	Stout	10kN	50°	1 @ 30º
434005	Sect Angle	Stout <=17m	-	60°	2 @ 30°
434006	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434009	Terminal	Stout	2 @ 30°

Notes

Structure loadings have been derived using the ENATS 43-40 weather loads however existing lines shall be re-sagged back to their original wind only design criteria.

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 40 - Design Tables - 32mm² HDBC Single Phase - High Altitude

Basic Design Span	100
Max Clashing Span ***	120 (127)
Occasional Long Span (2.0m phase to phase)	127
Resultant Conductor Strength Factor	2.22 (88%)
FCD Required	No
Clashing Weather Zone	3C
Windspan factor of Safety applied to Wood poles	3.5
Strut Load factor of Safety applied to Wood poles	3.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	125m
434003	Intermediate	Stout	10kN	200+m
434005	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium <=13m	10kN	45°	1 @ 45°
434003	Pin Angle	Stout	10kN	50°	1 @ 30°
434005	Sect Angle	Stout <=14	-	60°	2 @ 30°
434006	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout <=14m	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434010	Terminal	Stout <=14m	2 @ 30°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 41 Design Tables - 13mm2 CADCU - Three Phase - Normal Altitude

Basic Design Span	80	100
Max Clashing Span ***	96 (89)	120 (94)
Occasional Long Span (2.0m phase to phase)	116m	122m
Resultant Conductor Strength Factor	2.13 (85%)	2.04 (81%)
FCD Required	Yes	Yes
Clashing Weather Zone	2B	2B
Windspan factor of Safety applied to Wood poles	2.5	2.5
Strut Load factor of Safety applied to Wood poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	148m
434007/2 *	Intermediate	Stout 'H'	10kN	200+m
434005	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	50°	1 @ 45°
434003	Pin Angle	Medium <=13m	10kN	30°	1 @ 30°
434003	Pin Angle	Stout	10kN	50°	1 @ 30°
434005	Sect Angle	Medium	-	60°	1 @ 45°
434005	Sect Angle	Stout	-	60°	2 @ 30°
434007	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434009	Terminal	Stout	2 @ 30°

Notes

Structure loadings have been derived using the ENATS 43-40 weather loads however existing lines shall be re-sagged back to their original wind only design criteria.

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 42 Design Tables - 13mm2 CADCU - Three Phase - High Altitude

Basic Design Span	80	100
Max Clashing Span ***	96 (82)	120 (89)
Occasional Long Span (2.0m phase to phase)	106	115
Resultant Conductor Strength Factor	2.13 (85%)	2.04 (81%)
FCD Required	Yes	Yes
Weather	3C	3C
Windspan factor of Safety applied to Wood poles	3.0	3.0
Strut Load factor of Safety applied to Wood poles	2.5	2.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	120m
434007/2 *	Intermediate	Stout 'H'	10kN	200+m
434005	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	45°	1 @ 45°
434003	Pin Angle	Medium	10kN	30°	1 @ 35º
434003	Pin Angle	Stout	10kN	50°	1 @ 30º
434005	Sect Angle	Stout	-	60°	1 @ 45°
434005	Sect Angle	Stout	-	60°	2 @ 30°
434007	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434010	Terminal	Stout	1 @ 45°
434010	Terminal	Stout	2 @ 30°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 43 - Design Tables - 13mm² CADCU -Single Phase - Normal Altitude

Basic Design Span	80	100	120
Max Clashing Span ***	96 (116)	120 (122)	144 (128)
Occasional Long Span (2.0m phase to phase)	116	122	128
Resultant Conductor Strength Factor	2.13 (85%)	2.04 (81%)	1.98 (79%)
FCD Required	Yes	Yes	Yes
Clashing Weather Zone	2B	2B	2B
Windspan factor of Safety applied to Wood poles	3.0	3.0	3.0
Strut Load factor of Safety applied to Wood poles	3.0	3.0	3.0

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	182m
434007/2 *	Intermediate	Stout 'H'	10kN	200+m
434005	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	50°	1 @ 45°
434003	Pin Angle	Medium <=13m	10kN	30°	1 @ 30°
434003	Pin Angle	Stout	10kN	50°	1 @ 30°
434005	Sect Angle	Medium	-	60°	1 @ 45°
434005	Sect Angle	Stout	-	60°	2 @ 30°
434007	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434009	Terminal	Stout	2 @ 30°

Notes

Structure loadings have been derived using the ENATS 43-40 weather loads however existing lines shall be re-sagged back to their original wind only design criteria.

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 44 - Design Tables - 13mm² CADCU Single Phase - High Altitude

Basic Design Span	80	90	100
Max Clashing Span ***	96 (108)	108 (112)	120 (116)
Occasional Long Span (2.0m phase to phase)	108	112	116
Resultant Conductor Strength Factor	2.13 (85%)	2.09 (84%)	2.04 (81%)
FCD Required	Yes	Yes	Yes
Weather	3C	3C	3C
Windspan factor of Safety applied to Wood poles	3.5	3.5	3.5
Strut Load factor of Safety applied to Wood poles	3.5	3.5	3.5

In Line Structures

Drawing No	Support Type	Support Class	Pin Type	Windspan Limit
434003	Intermediate	Medium	10kN	152m
434007/2 *	Intermediate	Stout 'H'	10kN	200+m
434005	Section	Stout	-	200+m

Angle Structures

Drawing No.	Support Type	Support Class	Pin Type	Line Deviation	No of Stays
434003	Pin Angle	Medium	10kN	45°	1 @ 45°
434003	Pin Angle	Stout	10kN	50°	1 @ 30º
434005	Sect Angle	Stout	-	60°	1 @ 45°
434005	Sect Angle	Stout	-	60°	2 @ 30°
434007	H Sect Angle	Stout H	-	90°	3 @ 45°

Terminal Structures

Drawing No.	Support Type	Support Class	Stays
434008	Tee Off	Stout	1 @ 45°
434008	Tee Off	Stout	2 @ 30°
434009	Terminal (No Plant)	Stout	1 @ 45°
434010	Terminal	Stout	1 @ 45°
434010	Terminal	Stout	2 @ 30°

- * Used for occasional long spans.
- *** (value in brackets = actual clashing limit for given basic span)
- See requirements on achieving 90° Dev
- Stay requirements are based on the total number of 7/4.00mm Grade 1150 stays per structure.

Appendix 45 - Wood Pole Condition Report Q&A together with the associated "CR" Rating

Notes:-

Table cells that are heavily greyed out contain condition ratings that are likely to require a pole to be replaced. All other lightly greyed out cells are condition ratings that must be resolved as part of any refurbishment works but are unlikely to cause the overall line condition rating to move from "Extensive Maintenance" or "Line Strengthening" into a "Line Rebuild"

Table Question No	Question	As found condition	"CR No
Q21	Pole Condition	Pole OK	1
Q21	Pole Condition	Minor Damage	2
Q21	Pole Condition	Decayed - OK > 1 Year	3
Q21	Pole Condition	Severely Decayed/Damaged	4
Q22	Boron Treatment	Not Boron Treated	1
Q22	Boron Treatment	Boron Treatment Recharged	2
Q22	Boron Treatment	Re-visit Req. Caps Accessible	3
Q22	Boron Treatment	Re-visit Req. Caps NOT Accessible	4
Q23	Pole Leaning	OK	1
Q23	Pole Leaning	Leaning < 1 Head	2
Q23	Pole Leaning	Leaning 1 -2 Heads	3
Q23	Pole Leaning	Leaning > 3 Heads	4
Q24	Scarf Mark Condition	OK @ Correct Height	1
Q24	Scarf Mark Condition	Mark Not Visible	3
Q24	Scarf Mark Condition	Mark too High	4
Q25	Steel Pole Thickness	Thickness > 95% of Original	1
Q25	Steel Pole Thickness	80 % - 90% of Original	2
Q25	Steel Pole Thickness	70% - 80% of Original	3
Q25	Steel Pole Thickness	< 70% of Original	4
Q28	ACD	No ACD Fitted to this Pole	1
Q28	ACD	ACD is OK	2

Q28	ACD	ACD/Barbed Wire Rusty but OK	3
Q28	ACD	ACD is Ineffective	4
Q29	Phase Colour Plates	Phase Colour Plates Not Changed	1
Q29	Phase Colour Plates	Phase Colour Plate Changed	2
Q29	Phase Colour Plates	No Phase Plates Fitted	3
Q30	DOD Condition	DOD OK to Specification	1
Q30	DOD Condition	DOD Faded but Legible	2
Q30	DOD Condition	Non Standard DOD Fitted	3
Q30	DOD Condition	DOD Unreadable or Missing	4
Q31	DOD Replacement	DOD Replaced && Old Removed	1
Q31	DOD Replacement	DOD Replace && Old Not Removed	2
Q31	DOD Replacement	DOD Restricted && Old Removed	3
Q31	DOD Replacement	DOD Restricted && Old Not Removed	4
Q31	DOD Replacement	DOD Not Replaced	5
Q32	Property Plate Condition	Label OK	1
Q32	Property Plate Condition	Label Faded but Legible	2
Q32	Property Plate Condition	Label Damaged/Unreadable	3
Q32	Property Plate Condition	Label Missing	4
Q32	Property Plate Condition	Property Plate Not Required	5
Q33	Property Plate Replacement	Property Label Replaced	1
Q33	Property Plate Replacement	Property Label Not Replaced	2
Q33	Property Plate Replacement	Reason for Not Replacing Label	10
Q33	Property Plate Replacement	Not Required	3
Q34	Double Circuits	ID Plates OK	1
Q34	Double Circuits	ID Plates Faded but Legible	2
Q34	Double Circuits	ID Plates Damaged/Unreadable	3
Q34	Double Circuits	ID Plates Missing	4
Q34	Double Circuits	Single Circuit	5

Q35	Equipment Name Plate	Name Plate OK	1
Q35	Equipment Name Plate	Name Plate Faded but Legible	2
Q35	Equipment Name Plate	Name Plate Damaged/Unreadable	3
Q35	Equipment Name Plate	Name Plate Missing	4
Q35	Equipment Name Plate	No Equipment On Pole	5
Q36	Pole Number	Pole Number Replaced	1
Q36	Pole Number	Pole Num Replaced with Map Number	2
Q36	Pole Number	Pole Number NOT Replaced	3
Q36	Pole Number	Reason for not Replacing Number	10
Q37	Number of Pole Cables	Select Number of Cables	1
Q37_1	Cable Condition for Cable	Cable OK	1
Q37_1	Cable Condition for Cable	Cable Damaged but no Immediate Danger	2
Q37_1	Cable Condition for Cable	Cable Badly Deteriorated	3
Q37_1	Cable Condition for Cable	Cable Damaged. Danger to Public	4
Q38	Qty of Cable Guards that should be fitted	Select Number of Cable Guards	1
Q38_1	Cable Guard Condition for Guard	Cable Guard OK	1
Q38_1	Cable Guard Condition for Guard	Damaged but no Immediate Danger	2
Q38_1	Cable Guard Condition for Guard	Damage/Missing. Danger to Public	4
Q39	Number of Cable Boxes	Select Number of Cable Boxes	1
Q39_1	Cable Box Conditions for Box	Cable Box OK	1
Q39_1	Cable Box Conditions for Box	Box Rusty/Corroded	2
Q39_1	Cable Box Conditions for Box	Leaking Compound	3
Q39_1	Cable Box Conditions for Box	Arching/Burning at Cable Box	4
Q40	Quantity of Pole Earths	Select Number of Pole Earths	1
Q40_1	Earth Condition of Earth	Earth Wire OK	1
Q40_1	Earth Condition of Earth	Damaged above 3m from Ground	2
Q40_1	Earth Condition of Earth	Damaged below 3m from Ground	3
Q40_1	Earth Condition of Earth	Earth Wire Severed/Missing	4

Q41	HV Earth/Op Handle Separation	Separation is Minimum 90 deg	1
Q41	HV Earth/Op Handle Separation	Separation is < 90 deg	4
Q41	HV Earth/Op Handle Separation	No Handle Fitted	5
Q42	Neutral/HV Earth Separation	Separation is Minimum 90 deg	1
Q42	Neutral/HV Earth Separation	Separation is < 90 deg	4
Q42	Neutral/HV Earth Separation	No Applicable	5
Q43	Number of Stays	Select Number of Stays	1
Q43_1	Wire Condition for Stay	Stay Wire OK	1
Q43_1	Wire Condition for Stay	Minor Corrosion	2
Q43_1	Wire Condition for Stay	Severely Corroded or Slack	3
Q43_1	Wire Condition for Stay	Broken or Missing	4
Q43_2	Insulator Condition for Stay	Stay Insulator OK	1
Q43_2	Insulator Condition for Stay	Insulator Damaged	2
Q43_2	Insulator Condition for Stay	Insulator too High or too Low	3
Q43_2	Insulator Condition for Stay	No Stay Insulator	4
Q43_3	Rod Condition for Stay	Stay Rod OK	1
Q43_3	Rod Condition for Stay	Rod Bent but OK	2
Q43_3	Rod Condition for Stay	Rod Severely Corroded	3
Q43_3	Rod Condition for Stay	Rod Broken or all below Ground	4
Q44	Number of Cross Arms	Select Number of Xarms	1
Q44_1	Condition of Crossarm	Steelwork OK	1
Q44_1	Condition of Crossarm	Light Rusting/Corrosion/Damage	2
Q44_1	Condition of Crossarm	Heavy Rusting/Corrosion/Damage	3
Q44_1	Condition of Crossarm	De-lamination Present or Badly Damaged	4
Q44_2	Orientation of Crossarm	Crossarm OK	1
Q44_2	Orientation of Crossarm	Crossarm Leaning	2
Q44_2	Orientation of Crossarm	Crossarm Twisted. Not at 90 deg	3
Q45	Angle of Deviation	Select Angle of Deviation	1

Q46	Condition of Fittings	Fittings OK	1
Q46	Condition of Fittings	Wear/Corrosion <25% Area	2
Q46	Condition of Fittings	Wear/Corrosion 25% - 75% Area	3
Q46	Condition of Fittings	Wear/Corrosion > 75% Area	4
Q47	Insulator Type	Pin Insulator	1
Q47	Insulator Type	Dish Insulator	2
Q47	Insulator Type	Bracket Type Insulator	3
Q47	Insulator Type	Other Type of Insulator	4
Q48	Condition of Insulators	Insulator(s) OK	1
Q48	Condition of Insulators	One Insulator Cracked/Chipped	2
Q48	Condition of Insulators	>1 Ins in String Cracked/Chip	3
Q48	Condition of Insulators	Insulator(s) Missing	4
Q49	Insulator Orientation	Insulator(s) OK	1
Q49	Insulator Orientation	Pin Insulator Loose/Leaning	2
Q49	Insulator Orientation	String Pulled/Not Vertical	3
Q50	Condition Of Binders	Conductor Binders/Ties OK	1
Q50	Condition Of Binders	Conductor Binders/Ties Damaged	2
Q50	Condition Of Binders	Conductor Not Secure	4
Q50	Condition Of Binders	No Binders Present	5
Q51	Proximity Of Trees To Pole/Span	No Trees or Trees > 3.6m from Line	1
Q51	Proximity Of Trees To Pole/Span	Trees Within 2m - 3.6m of Line	2
Q51	Proximity Of Trees To Pole/Span	Trees Within 1m - 2m of Line	3
Q51	Proximity Of Trees To Pole/Span	Trees Within < 1m of Line	4
Q52	Proximity of Climbable Trees By Pole or Span	No Climbable Trees	1
Q52	Proximity of Climbable Trees By Pole or Span	Climbable Limbs within 2m -3.6m	2
Q52	Proximity of Climbable Trees By Pole or Span	Climbable Limbs within 1m - 2m	3

Q52	Proximity of Climbable Trees By Pole or Span	Climbable Limbs <1m or Touching	4
Q53	Third Party Interference	No Third Party Interference	1
Q53	Third Party Interference	Third Party Attachments on Pole	2
Q53	Third Party Interference	Evidence of Vandalism	4
Q61	Transformer	Pole Transformer OK	1
Q61	Transformer	Tx Tank > 50% Surface Rust	2
Q61	Transformer	Tx Bushing Damaged (HV or LV)	3
Q61	Transformer	Oil leaking from Tx	4
Q62	Transformer(2)	Tx Supporting Structure OK	1
Q62	Transformer(2)	Tx Support Rusty but OK	2
Q62	Transformer(2)	Tx Support Severely Rusty/Damaged	3
Q62	Transformer(2)	Tx to low < 4.3m to live parts	4
Q63	Isolator/Switch	Isolator/Switch OK	1
Q63	Isolator/Switch	Isolator/Switch Unit Damaged	2
Q63	Isolator/Switch	Isolator/Switch Handle Insulator damaged	4
Q64	Auto Recloser	Auto Recloser OK	1
Q64	Auto Recloser	Recloser Rusty but OK	2
Q64	Auto Recloser	Recloser Severely Corroded	3
Q64	Auto Recloser	Recloser Bushing Damaged/Leaking	4
Q65	Static Balancer/Regulator	Static Balancer/Regulator OK	1
Q65	Static Balancer/Regulator	Corrosion >50% of Surface Area	2
Q65	Static Balancer/Regulator	Bushing Damaged	3
Q65	Static Balancer/Regulator	Oil Leaking from Equipment	4
Q66	HV Fuses	Fuses/Carrier Damaged not OK	3
Q66	HV Fuses	Too low < 4.3m	4
Q66	HV Fuses	Fuse & Carried OK	1
Q66	HV Fuses	Fuses/Carrier Damaged but OK	2
Q67	LV Fuses	Fuse & Carrier OK	1

Q67	LV Fuses	Fuses/Carrier Damaged but OK	2
Q67	LV Fuses	Fuses/Carrier Damaged not OK	3
Q67	LV Fuses	Too low < 3m	4
Q67	LV Fuses	Fuses/Carrier Damaged but OK	2
Q68	Fuse Box	Fuse Box OK	1
Q68	Fuse Box	Fuse Box Damaged/Decayed	4
Q71	Trigged Spark Gap	TSG OK	1
Q71	Trigged Spark Gap	Evidence of Minor Burning/Arching	2
Q71	Trigged Spark Gap	Evidence of Severe Burning/Arching	3
Q71	Trigged Spark Gap	TSG Broken or Missing	4
Q72	Fault Flow Indicator	Fault Flow Indicator OK	1
Q72	Fault Flow Indicator	FFI Damaged/Broken	4
Q73	Surge Diverter	Surge Diverter OK	1
Q73	Surge Diverter	Evidence of Slight Damage	2
Q73	Surge Diverter	Badly Damaged or Missing	4
Q74	Sealing End	Sealing End OK	1
Q74	Sealing End	SE/Support Slight Damage but OK	2
Q74	Sealing End	SE/Support Badly Damaged/Rusty	3
Q74	Sealing End	Evidence of Oil/Compound Leakage	4
Q75	Conductor Ground Clearance	Ground Clearance In Span OK	1
Q75	Conductor Ground Clearance	Clearance Less than Statutory	4
Q76	Over Road Clearances	No Road/Vehicular Track in Span	1
Q76	Over Road Clearances	Span Crosses Road/Vehicular Track	2
Q77	Over Drive Clearances	No Driveway in Span < 2.5m wide	1
Q77	Over Drive Clearances	Span Crosses Driveway <2.5m wide	2
Q77	Over Drive Clearances	Driveway in span > 2.5m	3
Q77	Over Drive Clearances	No Driveway in this span	4
Q78	Building Clearances (to side)	No Buildings in Clearance Limits	1

Q78	Building Clearances (to side)	Buildings within Clearance Limits	4
Q79	Building Clearances (Under the Line)	No Buildings Under the Line	1
Q79	Building Clearances (Under the Line)	Buildings under Line but OK	2
Q79	Building Clearances (Under the Line)	Buildings under line NOT OK	4
Q79	Building Clearances (Under the Line)	No Span on Pole	5
Q80	Conductor Type	Bare Conductor	1
Q80	Conductor Type	PVC Covered Conductor	2
Q80	Conductor Type	ABC	3
Q80	Conductor Type	VIR Insulated	4
Q80	Conductor Type	Mixed - Bare and Insulated	5
Q81	Conductor Material	Copper	1
Q81	Conductor Material	Aluminium	2
Q81	Conductor Material	Unknown or Covered Conductor	3
Q82	Conductor Insulation Condition	Conductor Insulation OK	1
Q82	Conductor Insulation Condition	Insulation Damaged/Defective	4
Q82	Conductor Insulation Condition	Not Applicable (bare conductors)	5
Q83	Conductor Regulation	Sag Within Span OK	1
Q83	Conductor Regulation	Sag Within Span Unequal	2
Q83	Conductor Regulation	Conductors out of Regulation	3
Q83	Conductor Regulation	No Span on Pole	4
Q84	Conductor Condition (Inc Earth Wire)	Conductor Condition in Span OK	1
Q84	Conductor Condition (Inc Earth Wire)	Evidence of Conductor Damage in Span	4
Q84	Conductor Condition (Inc Earth Wire)	No Span on Pole	5
Q85	Conductor Attachments	No Attachments in Span	1
Q85	Conductor Attachments	Bird Diverters	2

Q85	Conductor Attachments	Spacers	3
Q85	Conductor Attachments	Foreign Objects	4
Q85	Conductor Attachments	No Span on Pole	5
Q86	Conductor Joints	No Joints in Span	1
Q86	Conductor Joints	1 Joint in Span	2
Q86	Conductor Joints	2 Joints in Span	3
Q86	Conductor Joints	> 2 Joints in Span	4
Q87	Phases with > 2 Joints in Span	< 2 Joints in Any Phase	1
Q87	Phases with > 2 Joints in Span	=> 2 Joints in any Phase	4
Q87	Phases with > 2 Joints in Span	No Joints In span	5

Appendix 46 - Feeder Condition Data Assessment Template

Feeder Name		***No of Phases***		***Conductor Size / Type***	*E.g. 32mm HDBC*	***Climate***	*Normal or Severe*	***No of Poles in Feeder***			
Specification	*E.g. Heavy Duty Wishbone or BS 1320 etc.*	***Basic Span***	*E.g. 100m*	***Max Span***	*E.g. 120m*	***Pole Grade***	*e.g. M*	***Voltage***	*E.g. 11kV*		
Recommendation	*E.g. Extensive maintenance, Line strengthening or rebuild/conductor replacement*										

Pole or conductor replacement

Pole Changes	***Pole No's affected***	**Conductor work**	**Pole No's of spans effected**
Due to Pole Condition	*Pole Condition (Q21) = 3 or 4* *Steel Pole Thickness (Q25) = 3 or 4*	***Due to Conductor Condition***	*Conductor condition (inc earth wire) (Q84) = 4* *Conductor regulation (Q83) = 3* *Conductor type (Q80) = 4*
Due to Scarf Mark	*Scarf mark condition (Q24) = 4* *(depth less than 1.5m not acceptable)*	***Span with > 2 joints per phase***	*Conductor joints (Q86) = 4* *Phases with > 2 joints in span (Q87) = 4*
Due to Ground/Building Clearance	*Conductor ground clearance (Q75) = 4* *Building Clearance - under the line (Q79) = 4* *Building clearance - to side (Q78) = 4*	***Due to Cond. Insulation Issues***	*Conductor Insulation Condition (Q82) = 4*

Additional Work on existing structures

Stay Work Required (Rods, Insulator, Wire)	*Wire condition for stay (Q43_1) = 3 or 4* *Insulator condition for stay (Q43_2) = 2,3 or 4* *Rod condition for stay (Q43_3) = 3 or 4*	***Cross arm Replacement***	*Condition of crossarm (Q44_1) = 4*
Tree issues	*Proximity of trees to pole/span (Q51) = 3 or 4* *Proximity of climbable trees by pole/span (Q52) = 2,3 or 4*	***Pole Leaning***	*Pole leaning (Q23) = 4*
Earthing Issues	*Earth – condition of earth (Q40) = 3 or 4* *HV earth/OP handle separation (Q41) = 4* *Neutral/HV earth separation (Q42) = 4*	***Cable & cable terminations***	*Cable condition (Q37) = 4* *Cable guard condition (Q38) = 4* *Cable Box Condition (Q39) = 3 or 4*
Conductor Fittings and Binders	*Condition of fittings (Q46) = 4* *Condition of binders (Q50) = 2 or 4*	***ACD's & Signs***	*ACD Ineffective (Q28) = 4* *DOD Condition (Q30) = 3 or 4* *Property Plate condition (Q32) = 4* *Double Circuit (Q34) = 3 or 4* *Equipment Name Plate (Q35) = 3 or 4*

Insulator Work Required	*Condition of Insulators (Q48) = 2,3 or 4* *Insulator type (Q47) = 4*	***Pole Mounted Equipment***	*Transformer (Q61) = 3 or 4* *Transformer (2) (Q62) = 3 or 4* *Isolator/switch (Q63) = 2 or 4* *Auto recloser (Q64) = 3 or 4)* *Static balancer/regulator (Q65) = 2, 3 or 4* *HV Fuses (Q66) = 4* *LV Fuses (Q67) = 3 or 4* *Triggered Spark Gap (Q71) = 3 or 4* *Fault Flow Indicator (Q72) = 4* *Surge Diverter (Q73) = 4* *Sealing End (Q74) = 3 or 4*

Notes:-

1) This table shall be used as a template to summarise the condition of a section of line being considered for refurbishment.

2) The condition point question numbers relate to the table in Appendix 45 of this document.

3) To complete the table the pole or span numbers identified from the data shall be entered into the table replacing the questions in italics. As shown in the example cell below It is recommended that the table includes the pole or span affected by the reported issue, together with the condition point question ref and the reported CR code applicable to the component groups in the table. Where necessary these shall be supplemented with appropriate comments.

P1 (Q21) 4, P6 (Q21) 3,

4) For each condition point I have entered the level of condition rating or “CR” that is of sufficient severity to require our attention when the line is being considered for refurbishment.

5) The content of the form will be used by the re-survey staff to confirm the condition of the initial line report and form the work content included in the subsequent refurbishment scheme. If the resurvey team disagree with the original condition rating the original entry shall be amended and marked with an asterisk to provide an audit trail of the proposed change.