NSP/004/041 - Code of Practice for the Construction of LV ABC Overhead Lines

1. Purpose

The purpose of this document is to provide a specification detailing the design and construction requirements for new low voltage ABC (Aerial Bundled Conductor) distribution systems. Additionally, this specification confirms the reference OHL6/10 as the reference to be quoted on all planning applications for new lines or on correspondence with 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/004/041	Code of Practice for the Construction of LV ABC Overhead Lines	5.2	July 2019

2. Scope

This specification covers the application policy and constructional requirements for new LV ABC three phase distribution lines supported on poles or attached to buildings. It has been designed in accordance with ENA TS 43-12, 43-13 and 43-14 utilising 4 & 5 core 120mm^2 or 4 core 70mm^2 for main lines and 2 or 4 core 35mm^2 for service lines. Additional information has been included to cover work or extensions to existing 4 core 50 and 95mm^2 sizes.

Renovation of existing open wire networks to ABC construction and additions of conductors to existing open wire networks are detailed in the supporting document NSP/004/041/001. New overhead line services and new or replacement surface wiring will be carried out in accordance with this document and NSP/004/043.

This document has been organised into 6 main parts.

a) Application policy

b) Design criteria

c) Technical Requirements

d) ABC Fittings and specific requirements for their application

e) Earthing

f) Arrangement Drawings & Material Lists

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3. Technical Specification

3.1. Application Policy

ABC shall be used for the following:

- Construction of all new LV overhead lines
- The extension or the selected refurbishment of existing LV overhead lines
- As a means of providing supplies formally achieved via surface wiring or eaves mains see NSP/004/043.
- In areas identified as high risk by NSP/004/012 "Guidance on the Risk Assessment of Overhead Lines"
- Areas identified in NSP/004/011 "Guidance on Overhead Line Clearances" as being not suitable for "non-effectively insulated conductors".

3.2. Introduction

ABC is a fully insulated, 4 wire LV overhead line distribution system. Four identical compacted stranded aluminium conductors are insulated with black XLPE and twisted into a bundled formation. The bundle is erected and secured as though it were a single overhead line conductor, supported and terminated in suspension or anchor clamps which grip the outer insulation of all four conductors.

All ABC overhead lines shall be constructed in accordance with the provisions of this document. This system is designed for use in association with Protective Multiple Earthing, however where the application of the company's earthing policy IMP/010/011 requires the installation of a separate protective conductor, this shall be provided through the use of a 5 core ABC that includes within the bundle a 25mm^2 earth protective conductor.

Note: The 5-core version does not require special fittings, the additional core is supported by the main bundle and the suspension clamps but is not incorporated in the anchor clamps.

3.3. Design Criteria

3.3.1. Weather Loadings

Lines to this specification have been designed with the following weather loadings:

- Wind Pressure = 380N/m2.
- Radial Ice = 4.75mm.
- Ice density = 913kg/m^3.

3.3.2. Conductors

This specification applies the loading conditions detailed in clause 3.3.1 and includes the following assumptions:

1. The ultimate tensile strength of the aluminium conductor is 170 N.mm2.
2. The average elastic limit of extension for the conductor material is 60 per cent of the ultimate tensile strength.

This specification uses a maximum design stress of 50 per cent of the elastic stress limit for service lines and 40 percent in the case of four core main lines. In both service and main lines, compliance with these stress levels occurs with the smallest ABC. (This effectively provides a factor of safety of at least four on the UTS of the conductor. These conditions have been selected to permit reasonable access to the cores for the application of connections.

Appendix 1 & 1A provides details of the technical data used in preparing sag/tension and pole/stay selection information.

The tension of each size of ABC under design loading conditions is used for all stay and pole selection data. These figures having been derived using actual MWT values for each conductor size in place of the common mass/tension ratios at 10 degrees Celsius used in ENA TS 43-12.

See notes:

Note 1 *- 4 x 120mm² ABC did not form part of the original ENA TS 43-13 specification. However, loading and impedance requirements necessitated the introduction of a larger size. Although 4 x 120mm² ABC is considerably stronger than a 4 x 95mm² ABC, the MWT and erection tensions have been designed to match those of a 4 x 95mm² ABC. (Any route suitable for a 4 x 95mm² ABC will also be suitable for a 4 x 120mm² ABC).*

Note 2- *The effect of adding a 25 mm² earth protective conductor to the 4 x 120mm² ABC has negligible effect on the mechanical loadings, hence no additional sag charts or stay charts have been added to this specification.*

3.3.3. Sag Tables

ABC Mains and Services shall be erected to the Sag Tables shown in Appendix 3, 4, 5, 6 and 7.

Appendix 3 - Sag Table for 35mm^2 ABC

Appendix 4 - Sag Table for 50mm^2 ABC (info purposes only)

Appendix 5 - Sag Table for 70mm^2 ABC

Appendix 6 - Sag Table for 95mm^2 ABC (info purposes only)

Appendix 7 - Sag Table for 120mm^2 ABC (with or without 25 mm^2 protective conductor)

Appendix 8 - Sag Table for Slack Spans

3.3.4. Span Lengths

<u>Span lengths of Main Lines</u>

Basic Design Span	50m *	
Maximum Span		90m
Maximum Wind Loading Span		90m

<u>Span Lengths of Service lines</u>

Basic Span	50m	between wood pole supports
Maximum Span		70m
Basic Span	20m	when attached to a building
Maximum Span		30m

** Notes - The 50m basic span has been selected on the assumption that pole positions are normally dictated by the need for service spans to properties supplied from the main line ABC. Where no service spans are required, lines shall be constructed to match the 90m spanning capability.*

3.3.5. Erection Data

Main lines shall be erected in accordance with Appendices 3 - 7.

Spans attached to buildings shall be erected at reduced tensions in accordance with Appendix 8.

Erection sag tables are based upon the requirements that: -

a) Conductor clamps shall not exceed a load beyond which damage may occur to the conductor insulation, and in any event shall not exceed 40% of the breaking load of any clamp.

b) Conductor tension shall be such that under all reasonable working conditions, the bundle may be separated for making connections.

c) Conductor tension is high enough to ensure efficient operation of anchor clamps throughout the entire range of design temperatures, whilst also ensuring the minimum sag for reasons of clearance.

d) 2 x 35mm2 single phase ABC service lines are designed so that they can be uprated to 4 x 35mm2 three phase service lines without further structural alterations.

Maximum working tensions are: -

- 11.4 kN for 4 x 95 or 4 x 120mm2 ABC – Mains (with or without 25 mm2 protective conductor)
- 9.04 kN for 4 x 70mm2 ABC - Mains
- 7.29 kN for 4 x 50mm2 ABC - Mains (historical info purposes only)
- 4.2 kN for 4 x 35mm2 ABC - Long services lines not connected directly to a building
    - kN for 2 x 35mm^2 ABC - Long service lines not connected directly to a building
- 1.3 kN for all sizes of ABC - Where a service is attached directly to a building

EDS = 20% of UTS at 5 ºC.

Erection tension = -10 ºC temperature shift.

3.3.6. Supports

The stresses created in unstayed intermediate supports are considered as bending stresses due to wind load on iced conductors and the theoretical equivalent force created by two service span attachments erected in line with the normal route of the distribution line. The loading point for the forces has been taken as 300mm below the pole top. This height has been chosen to provide a balanced transition between new and existing poles that have been previously fabricated for open wire conductors.

Poles selected within this specification have been designed to provide a minimum factor of safety of 2.5 for both strut load and bending loads.

The largest pole which has been considered within the support loading calculations is 17m, with a wind loading span of 90m. If longer poles are required then these situations shall be referred to the Policy and standards section for advice.

This Specification provides for line deviations of up to 90°. Intermediate supports are limited to a maximum line deviation of 60°.

3.3.7. Clearances

3.3.7.1. General

The minimum height of all line conductors and clearances to other objects shall be compliant with the current version of NSP/004/011. The above document supplements the basic clearance requirements as recommended by ENA TS 43-8 – "*Overhead Line Clearances*" with additional company requirements.

For the purposes of evaluating clearances, sags on main lines shall be assumed to be operating at a maximum temperature of 75°C, similarly service lines and service spans shall be assumed to be operating at 50°C.

3.3.7.2. Trees

The use of the ABC system through trees is permissible and can provide considerable benefits when compared with open wire systems. The construction shall, however, take account of the following potential dangers:

- Risks of the ABC abrading on trees.
- Sag variations and windage.
- The effect of wind and snow loading on trees or branches bearing onto the ABC.
- The danger of trees providing unauthorized climbing access.

Although there is a significant lateral reduction in the amount of tree-cutting for ABC (when compared with conventional open wire), the insulation shall not be allowed to come into contact with tree trunks, mature branches, or heavy outer growth under any circumstances, due to its susceptibility to abrasion. Boughs or branches which may exert pressure on the ABC shall be removed. A clearance window needs to be established to take account of sag variation with temperature. However, whether or not a branch or bough will bear on to the ABC system under the effects of foliage or snow can only be judged by considering the individual circumstances and estimating whether or not the particular bough or branch will deflect enough to be a danger.

The use of assessed conductor shrouding to provide limited mechanical protection for ABC passing through trees is permitted within this specification, however, its use does not remove the need for tree cutting or inspection. The ABC must still be able to move vertically without the possibility of it resting on a branch or being forced up into a branch.

Wherever ABC passes through trees, provision shall be made to protect the conductor and pole supports against the dangers of falling trees by the installation of weak links inserted between the pole hook bolt fitting and the suspension clamp. See Clause 3.5.4 for further details.

Where unauthorised access is a potential problem, consideration shall be given to the possible dangers of children climbing the trees. For example, horse chestnut trees could provide areas of high risk where an ABC system might be seen as an aid to reach inaccessible fruits. Signs of swings etc. in trees could indicate high risk areas. In such cases ABC systems shall not be placed within the reach of climbable limbs. If appropriate, branches shall be removed.

3.3.7.3. Obstructions

The use of the data in Clause 3.3.7.4 enables the line to be designed in compliance with NSP/004/011 without the need for lines surveys and profiles although line surveying is still seen as the most effective design solution.

3.3.7.4. Sag Variation Calculation Example

The conditions for the example calculation are as follows:

- 4x95mm2 ABC system with a tree or crossing obstruction 35% (or 65%) into a span of 60m.
- Temperature at time of study = 15°C.

Required clearances above and below the ABC at the position specified and at the time of study are as follows:

- Required clearance above ABC = K x (sag at 15°C minus sag at -5.6°C).
- Required clearance below ABC = K x (sag at 75°C minus sag at 15°C).

K depends only on the relative position of the obstruction within the span and is taken directly from Table 2. In this case K = 0.91.

The sag values at 15°C, -5.6°C and 75°C are taken from the appropriate design sag/tension table in appendix 3 -7. In this example for a 60m span of 4x95mm^2 ABC, the values taken from appendix 6 are: 1.25m, 0.90m and 2.02m, respectively. Using these values in the above equations gives:

- Required clearance above ABC = 0.91 x (1.25–0.90) m = 0.32m.
- Required clearance below ABC = 0.91 x (2.02–1.25) m = 0.70m.

Table 2 Values of K

Position of obstruction as a percentage of span length											
End of Span ---------- Mid Span											
%	0	5	10	15	20	25	30	35	40	45	
	100	95	90	85	80	75	70	75	70	65	50
K	0	0.19	0.36	0.51	0.65	0.75	0.84	0.91	0.96	0.99	

3.4. Technical Requirements

3.4.1. Conductors and Conductor Erection

Conductors shall be manufactured and supplied in accordance with material specification NPS/001/007 and consist of compacted, circular, stranded aluminium conductor having a black XLPE insulation. The completed cable is formed by twisting the four individual conductors together (plus the 25mm protective earth conductor where required).

Standard Conductor Sizes

ABC can be supplied in various size ranges with Northern Powergrid supporting 35mm², 70mm² and 120mm² conductors.

Identification of Cores

The individual phase cores shall be identified as indicated on Drawing No. 1000431301 by 1, 2 or 3 longitudinally continuous raised ribs.

The relationship between the number of ribs and phases is to be as follows:

1 rib	-	L1 (red phase)
2 ribs	-	L2 (yellow phase)
3 ribs	-	L3 (blue phase)

The surface of the neutral shall be lightly ribbed continuously along its length with a minimum of 16 ribs spaced evenly around the circumference of the core.

Where an additional protective earth conductor is utilised, it will be provided as a smooth surface with no ribbing.

Care must be taken when phasing in ABC networks with old historical open wire networks as the above standard phase sequence has not always been employed.

3.4.2. Conductor Erection Techniques

ABC conductor shall be erected using tension stringing techniques to ensure the conductor does not come into contact with the ground or abrasive surfaces. Prior to conductor sagging, conductors shall be pre-tensioned for 45mins with adjustment at 15 min intervals. The methods which shall be used are fully described in guidance document NSP/004/105 – *Guidance on the selection, erection and sagging of O/H line conductors*"

Note: Tension joints are not allowed in new sections of line, conductors shall be erected as complete section lengths.

3.4.3. Supports General

Supports used for ABC systems may be of wood, steel or composite material approved as suitable for overhead line construction.

ABC attached to poles shall generally be in accordance with the arrangements illustrated in Drawing Nos. 1000431202 to 1000431223.

All fittings shall provide an insulating barrier between the core insulation and the mechanical attachment. The ABC shall be attached in such a manner that it does not make direct or inadvertent contact with any metalwork or stays. When attached to steel poles, the ABC shall not be placed where it may make direct or inadvertent contact with the pole.

All fittings supporting the ABC system shall comply with the standards and specifications referenced from this specification and shall provide an insulation barrier rated at 1000V between the core insulation and the mechanical attachment.

3.4.4. Wood Poles

The default support requirement for ABC systems shall be wood poles of a minimum classification of Medium Grade as defined in BSEN 14229 and supplied in accordance with material specification NPS/001/001 – *"Technical specification for wood poles and associated products for overhead lines"*.

Wood poles shall by default be treated with creosote preservative, however in accordance with the REACH legislation where wood poles are required for use in the following locations:

- Located in or adjacent to schools or children's play area's
- Located in or adjacent to public parks and gardens
- Poles located in customers gardens
- Located in outdoor recreational and leisure facilities where there is a risk of frequent skin contact

Then the default preservative cannot be utilised and must be substituted with non-creosote-based preservative e.g., Tanalith E 3494 or alternative water-soluble preservative or composite construction poles.

Unless specified otherwise wood poles shall be supplied prefabricated with a single M22 hole located 300mm from the pole top as shown on fabrication drawing number 1091193301 sheet 4.

Note: Due to climbing difficulties associated with composite poles, they shall normally only be positioned in locations where pole top access can be provided through the use of MEWP's.

3.4.5. Tubular Steel Poles

Galvanised tubular self-supporting steel poles, minimum class 'K' manufactured in accordance with NPS/001/018 may also be utilised on unstayed angle and terminal positions where it is not possible to utilise conventional wood poles and stays. This option must only be used in special circumstances due the excessive cost and foundation requirements. Further details may be found in the renovation document NSP/004/041/001.

New tubular steel supports designed in accordance with drawing number 1091193501 sht 2 shall be erected on a concrete paving stone located 1675mm below ground level then encased with between 100-300mm of concrete depending upon the pole type. See drawing 1091193502 sht 1 for foundation details. Additional information has been provided in NSP/004/041/001 – "*Specification for the renovation of existing LV O/H Lines"*

3.4.6. Wood Poles - BT Joint Construction Agreement

Where it is desired to take advantage of the reciprocal arrangements for the attachment of wires to poles owned by British Telecom, the procedure to be adopted and the conditions which apply shall be as set out in Engineering Recommendation EB/TP3.

3.4.7. Intermediate Supports

The supports shall be configured in accordance with the following arrangement drawings

Arrangement	Drawing Number
In-Line Intermediate	1000431202
Angle support up to 30° Deviation	1000431203
Inside angle support up to 30° Deviation	1000431204
Angle support up to 60° Deviation	1000431205

In all cases the hook bolt shall be arranged to bisect the line angle. Line deviations of up to 60° may be accommodated with a single roller suspension clamp and extension rollers must be fitted during conductor erection on angles in excess of 30°.

With the exception of unstayed angle poles, all support foundations shall be installed without kicking blocks at the depths shown:

Pole Height	Pole Sinking Depth
9.0 - 10.0m	1.6m
11.0 - 14.0m	1.8m

3.4.7.1. Unstayed Angles on Intermediate Supports

Unstayed angle supports shall be avoided wherever possible, however they are permitted where justified. It is advisable to erect an unstayed angle pole half a pole diameter out of plumb away from the angle of deviation.

Without carrying out bespoke calculations using actual pole diameters, then unstayed angle supports shall have the following maximum angles of deviation:

ABC Main Line Medium grade poles without service attachment - 5°

ABC Main Line Stout grade poles without service attachment - 15°

Extended Service Span on Medium grade pole 11°

Extended Service Span on Medium grade pole 32°

ABC Main Line Stout poles with service attachment - 7°

No deviation allowed on ABC Main Line medium poles with service attachment

Tubular steel poles of minimum class 'K' may be utilised to provide unstayed angles in excess of the above limits. Their use should be limited due to the excessive cost and protracted installation requirements.

Where site specific information is available for the pole diameters at the groundline and pole top loading point, then the maximum angle of deviation for an unstayed pole can be calculated according to the following formula for pole-top load per unit pole-top deflection:

$$\delta = \frac{64h^3}{3\pi E d_1^3 d_2} \times PTL$$

where δ is the deflection (in mm)
and PTL = pole-top load (in N)
E = modulus of elasticity = 10 480 N/mm^2
h = height above ground of the point of application of the load (in mm)
d1 = diameter at groundline (mm)
d2 = diameter at point of application of load (mm)

The pole top load is calculated as twice the tension at -5.6ºC for each conductor size times the sine of half the angle of deviation applied at 300mm from the top of a 12m pole. Level ground is assumed. The maximum angle of line deviation is calculated so that the pole top deflection should not exceed half the pole top diameter.

The maximum pole height shall be limited to 12m, and the poles shall be planted at a depth of 1.8m and be fitted with 2 x ENATS 43-91 Type 2 blocks, located 500mm below ground level. Where access and ground types are suitable, augured foundations may be used as an alternative to block foundations. See drawing 1090431216 for foundation details.

3.4.7.2. Service Attachments on Unstayed Poles

A 25 or 35mm² ABC or hybrid concentric service spans to a building from a main line ABC will cause a pole top deflection of 1mm/4.1N for a medium pole and 1mm/9.4N for a stout pole. So, assuming the maximum allowed service attachment tension has been restricted to 1.3kn this will result in a pole top deflections of 317mm on a medium grade pole or 138mm on a stout grade pole.

Thus, to keep the overall maximum deflection to ≤ a pole top diameter the available unstayed angle / service attachment options are:

Pole grade	Max Unstayed Dev Angle	No Service Attachments
Medium	0°	1
Stout	7°	1
Stout	0°	2

Additional service attachments may only be connected if the resultant forces cancel each other out.

Care is also required where service attachment is connected in the resultant of an unstayed angle pole as winter loading conditions can result in unacceptably high tensions being generated in the service attachment to the property.

3.4.8. Section & Terminal Supports

Whilst section supports can be either stayed or intermediate pole arrangements, terminal supports shall always be stayed unless they are terminated with suitable self-supporting structures. By default, supports shall typically be of medium grade for all ABC conductor sizes although dependent upon the angle of deviation and or the stay spread this may result in the need for Stout grade poles. Supports shall be designed to be in accordance with clause 3.3.6 and the minimum stay spread tables detailed in Appendix 9.

Arrangement	Drawing Number
Section Support, Angles 20° to 90° Line Deviation	1000431206
Section support, including section fuses	1000431207
Section support, transition pole	1000431208
Terminal support	1000431209
Terminal support with underground cable termination	1000431210
Tee off from intermediate support	1000431211
Tee off from section support	1000431212

Transition supports between existing open wire networks and ABC networks shall be arranged as shown on drawing number 1000431208. Details on the requirements for out of balance stays between the two design systems can be found in appendix 10.

Note: Tee-off poles shall always utilise stout grade poles

3.4.9. Stays

All stays shall utilise 7/4.00mm (grade 1150) galvanised steel stay strand supplied in accordance with NPS/001/013 – *"Technical specification for galvanised steel stay wire"* providing a nominal minimum failing load of 101 kN and all stay rods shall be Type 2 (18mm dia) as detailed on drawing 1000439109.

All stays shall include a single Type 1 stay insulator in accordance with drawing no 1000439107.

Stay spreads will normally be such that an angle of 45° is provided between stay and the vertical face of the pole. 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 Appendix 9 shall be used. In all cases the minimum allowed stay angle should be 20°.

Stay blocks shall be installed at a standard installation depth of 1.8m irrespective of the stay spread. Where multiple stays are required on a support, the minimum stay block separation distance shall be 2.0m.

Stays at the edge of footpaths or in hedges cut by hedge cutting machines shall have yellow PVC, high visibility stays guards fitted to give a visual indication as to the presence of the stay wire. Similarly, guards shall also be installed on stays installed in street networks or roadside verges to try and reduce the incidence of car users inadvertently colliding with stays.

Additional guidance on the installation of stays can be found in drawing 109119 3326 and NSP/004/104 – "*Guidance on the types and installation requirements for stays"*

A balancing stay is required at transition positions between open wire and ABC constructions. See Appendix 10 for details. The stay shall be against the open wire line.

Struts, flying stays and outrigger stays may be used if necessary but should be avoided wherever possible. See drawing numbers 1091193331 & 1091193327 for additional information.

Alternative Stay Systems

Augured ground anchor stays systems and duckbill stay anchors may be used as alternative staying systems where information is available about the presence of other utility underground apparatus. See NSP/004/104 for additional guidance.

3.4.10. ABC attached to Buildings

ABC attached to buildings shall comply with the requirements of Drawing Nos. 1000431219 and 1000431220. Account must be taken of the mechanical loadings on the building due to the attachment, which should not exceed 1.3 kN (130kg) per fixing, unless special precautions are taken, and no system shall be constructed with full aerial tensions acting directly on buildings. All fixings should preferably be loaded in shear and not in tension. Angles of approach to buildings should take advantage of corners or structural features such that the angle to the building surface under load is minimised. Appendix 8 provides sag tension data, which complies with the maximum design loading.

Where 4 x 35mm^2 ABC is used as a three-phase overhead service, it may be supported on wood pole supports in accordance with the ABC main specification and then terminated at a building by means of a wall bracket. Where this occurs, the conductor tension in the last span shall be reduced as detailed in the specification.

Note: Where space for the provision of an out of balance span is not available this may result in the need for a reduced tension throughout the complete service line route.

ABC attached to the face of a building commonly described as eves main or surface wiring, shall be secured with fixing devices as specified in Drawing No. 1000431409 to provide a minimum spacing of 10 mm between the core insulation and the surface of the building. The frequency of cleating at a maximum interval of 1000 mm shall be such that the ABC when erected shall not be allowed to touch the fabric of the building or be attached in such a manner that the ABC may inadvertently contact the building, after erection. Routing of ABC shall consider potential points of hazard to the installed system.

Where ABC is required to pass in close proximity (less than 50 mm) to any metallic pipework or cables not part of the company's network, the ABC shall be secured against contact or alternatively be protected from contact by means of additional protection as detailed in clause 3.6, 'Associated Materials'.

Where ABC is adjacent to an opening in the building, such as a window, and there is a possibility of interference by persons from within the building, then additional proximity protection as detailed in clause 3.6 should be fitted. In assessing the need for this protection, account shall be taken of the window design.

If for example, the opening or fixed lights are such that they inhibit access to the ABC, additional protection will not be required. Typical areas where consideration has to be given to fitting proximity protection are shown on Drawing No. 1000431219.

Where the attachment of ABC above 2.4 metres from ground level is such that there is a potential risk of mechanical damage by the movement of vehicles, or by the placing of materials/equipment, the ABC shall be additionally protected for mechanical purposes by means of a suitable non-conducting cable guard, as detailed in Clause 3.6

ABC shall not oversail roofs unless it is unavoidable. If it is necessary to oversail a roof, the relevant spans shall not contain any in-line connections.

Under no account shall thatched roofs be oversailed and ABC shall not terminate within 0.5m of any thatched roof.

Additional guidance associated with the provision of eves main, or surface wiring can be found in NSP/004/043.

3.4.11. Service Flights

Service flights from a pole to a building shall be insulated where they are ordinarily accessible and at a “suitable height” where they are unlikely to be damaged, or where people going about their everyday activities cannot come into contact with them. A “suitable height” depends on what the service flight is crossing and on the cable type. Further guidance can be found in NSP/004/011 and NSP/004/043

3.5. ABC Fittings and Specific Requirements for their Application

3.5.1. General

All ABC fittings shall be in accordance with NPS/001/024 “Specification for Low Voltage Aerial Bundled Conductor Fittings” and as detailed in the assessed products database.

3.5.2. Anchor Clamps

The ABC is terminated by means of a bolted type of tension clamp, which grips all the insulated conductors between insulated mouldings placed either side of a central wedge. The anchor clamp is secured to the pole by means of an eyebolt. All anchor clamps shall, during assembly, be fitted in such a manner that only insulated components are in contact with the conductor insulation. Before clamping the ABC, the individual cores shall be adjusted to ensure that they enter in a uniform manner with no excess slack being exhibited by any conductor. The current range of clamps is range taking across all sizes of 4 core ABC.

An additional two anchor clamps are available for 2 core and 4 core 35mm^2 ABC to provide a smaller clamp for reduced tension service situations.

ABC bundles with a fifth core protective conductor shall be terminated using the standard 4 core anchor clamps as detailed above. To retain the protective core in its location within the main bundle, the protective core shall be tie wrapped to the main bundle prior to the bundle entering into the anchor clamp.

3.5.3. Roller / Suspension Clamps

The ABC is suspended at intermediate poles by means of a roller suspension clamp comprising a metallic clamp with a split neoprene sleeve and tightening bolt. When the suspension clamp is in the fully retracted position, the suspension clamp also acts as the conductor running out device.

All suspension clamps shall, during assembly, be fitted in such a manner that only insulated components are in contact with the conductor insulation. The maximum angle of line deviation imposed on a suspension clamp shall not exceed 60 degrees. A special extension roller assembly shall be fitted onto all suspension roller clamps where the angle of deviation exceeds 30 degrees. The extension rollers shall be removed once the conductor has been erected and terminated. Failure to use the extension rollers will result in the ABC jamming or snatching in the roller on heavy angles.

Suspension clamps can be used at straight-line uplift positions where the vertical angle of deviation is less than 30 degrees. In situations where uplift conditions can occur suspension clamps shall be inverted and bolted into a fixed position, or the pole position shall be sectioned.

The roller / suspension clamps are range taking across all sizes of ABC Bundle.

3.5.4. Weak Links

Weak links are 5kN mechanical fuses designed to be inserted between the M20 pigtail hook bolt and the in-line suspension roller clamp at intermediate support structures. They are designed to create a controlled failure of the intermediate support mechanism by releasing the ABC bundle to the ground in the event that a span of conductor if effected by fallings trees or significant branches.

As such they shall be installed at all in-line intermediate supports where the route of the line might be at risk from falling trees. Weak links shall not be used on supports associated with crossings of carriageways, railways, and navigable waterways or at any suspension angle supports.

When a weak link has operated or it is suspected that an object has fallen onto the line, whether or not weak links are included in that section of line, all supports in that line section shall be inspected.

3.5.5. Pole Fixings

Shall be supplied in accordance with material specification NPS/001/011

3.5.5.1. Eyebolt and Eye nut

An M20 eyebolt is to be used in conjunction with an eye nut at in line section positions, to secure the anchor clamps on wood poles. It is to be installed so that the collar is pulled tightly against the pole before the clamps are finally located and therefore no sag adjustment is permitted by using the eyebolt and nut. Where drilled steel poles are used, eye nuts and eyebolts shall be used in the same manner as in wood poles.

3.5.5.2. Hook Bolt & Extended Hook Bolt

M20 Open pigtail hook bolts shall be used to secure the suspension clamps to the support. Where additional standoff is required, or an ABC bundle is running through an outside angle then the standard hook bolt can be replaced with an extended version.

3.5.5.3. Outriggers Brackets

The use of outrigger brackets is permitted where minimum clearances to buildings or structures cannot be achieved, or to avoid unacceptable angles of line deviation at unstayed pole positions **and** where there is no practicable alternative.

Outrigger brackets shall be arranged as shown on drawing Y602L0106 and shall be used at intermediate positions only. The use of outriggers shall be limited to line deviations up to 30°.

3.5.6. Wall Mounts and Wall Brackets

Wall mounts shall be used to secure the cable to walls in straight-line situations and they are to be installed at intervals of 1000 mm. Using this fitting permits the cable installation to be carried out after the wall mounts have been secured.

Wall brackets shall be used in conjunction with the appropriate rubber insert where deviations are necessary due to waste and rainwater pipes etc. and also where the cable is suspended between buildings.

3.5.7. Electrical Connections

3.5.7.1. ABC Conductor Joints

Due to the difficulties associated with balancing the tension across all four cores, full tension joints shall not be utilised on new ABC lines.

Where non tension joints are required at section poles they shall be made in the jumper loop using non-tension compression joints to drawing number 1000439204 sht2. The completed joints shall be completely covered and waterproofed upon completion with an approved “non heat shrink” insulated sleeve.

3.5.7.2. Insulation Piercing Connectors (IPC's)

IPCs shall be used to provide all connections onto the ABC system. The connectors shall be applied over the insulation of the conductor and tightened using the approved 13mm insulated spanner until shearing of the torque limiting device takes place. Rubber gloves and insulated tools must be worn and used when installing and/or disconnecting insulation piercing connectors from LV systems. A cable tie shall be applied to secure the tapping conductor to the conductor being tapped.

3.5.8. ABC Main / ABC Mains Branch Connections

Double bolt insulation piercing connectors to Drawing No 1000431414, sheet 2 are to be used for all mains cable branch connections, e.g., at tee connections. They shall not be used for disconnecting a normal point of network isolation and when required section fuses shall be fitted in accordance with drawing number 1091471530 (see section 3.5.16 for additional information).

At interface with an open wire system, the ABC tails shall be connected to the open wire conductors using double bolt IPC's to Drawing No 1000431414 Sheet 3. (See arrangement drawing 1000431208).

Where existing single phase 3 wire systems are to be replaced, a four core ABC conductor shall be used. The yellow and blue phase conductors shall be connected together in parallel on the ABC tails at, or as near to, the source of supply. This may be achieved by utilising two double bolt insulation piercing connectors at each position. Care shall be taken to maintain the load balance across the phases.

Where the cut ends of an ABC bundle occur at the end of an LV network, the neutral conductor must be connected to earth. See the terminal support drawing 1000431209 for more information.

3.5.9. ABC Mains / Service Connections

New service connections shall normally be provided via concentric service cables. As such both phase and neutral connections will be made using single bolt insulation piercing connectors to Drawing No 1000431414, sheet 1 ensuring where possible that a phase balance is maintained on the main. When the neutral connection is made, a wrap of four layers of PVC tape at 50 % overlap shall be applied to the stranded neutral prior to connection.

Code of practice NSP/004/043 and drawings 1090431214 provide additional detail on service connections.

The application of electrical connections to the ABC shall not impair the environmental protection afforded by the insulation. Any connection applied following the removal of insulation shall be provided with an effective method of resealing the conductor against the effects of the environment and shall not reduce the mechanical and electrical strength of the insulation of the system. Due regard shall be taken of the possibility of insulation retraction.

Where it is necessary to remove an insulation piercing connector, the conductor insulation shall be sealed against ingress of moisture by the use of a self-amalgamating tape.

No insulation piercing connector shall be reapplied at the position of a previously removed connector.

3.5.10. ABC Mains / PL service connections

Public lighting service cables shall be attached in a similar manner as the hybrid service neutral connections detailed above with the addition that the service conductors shall be doubled back on themselves to create a much larger cable size in the connector before it is taped together with PVC insulating tape.

3.5.11. ABC Mains / Multiple Services

When the number of single-phase services at a single pole position is likely to exceed four, or three phase services exceeds two, then the service connections to the ABC main shall be obtained through the use of multi tap 2 and 4-way fittings. These fittings allow multiple phase and earth service connections (between 2 and 4) to be made of one mains IPC multi-tap.

3.5.12. ABC Conductor Ends

All cut ends of conductors will be insulated using approved cable end caps as specified in ENA TS 43-14 to provide a durable and effective means of insulation and sealing against ingress of moisture, with an insulation rating of 600/1000V.

When the cut end forms the termination of an LV network the neutral conductor must be connected to earth as shown in Drawing No 1000431209.

3.5.13. ABC Mains / Underground Cable connections

Underground cables on poles will be terminated using a heat shrink termination as in Drawing No 1000431210 and the ABC connected to it using non-tension compression joints. All connections being covered with insulation sleeve.

When terminating waveform cables the phase conductors shall be jointed using non-tension compression fittings, as detailed in the jointing Work Specification 02/364.

3.5.14. ABC Mains Transformer Poles

The LV arrangement on pole mounted transformers shall remain as shown on Drawing No 1091010130, the connection between the single core from the fuses and the ABC tails to be a bimetal compression fitting Drawing No 1091010649 which shall then be covered with an insulated sleeve.

3.5.15. Static Balancers and Regulators

Where ABC is erected at a balancer/regulator pole, it shall be connected using ABC tails for all inter connection between the auxiliary apparatus.

3.5.16. Section Fuses

LV section fuses shall be installed at 3.66m above ground level in order to allow lone working access. Where an anti-climbing device is fitted they shall be fitted at 500mm above the device. In some circumstances the minimum fixing height above ground level needs to be increased further to take account of any walls or fences that may aid access to the fuses. The highest adjacent point within 1,5m

of the pole shall be assigned the term "datum point" and as such the fuse fixing point must also be a minimum of 3m above this datum point.

Note: It is not a requirement of ESQCR to fit anti-climbing devices to LV ABC supports.

Where section fuses are deemed to be a normal network open point a dummy fuse shall be fitted into the fuse carrier to prevent inadvertent contact with the fuse unit connections. A tag should be securely attached to each fuse carrier identifying it as "NOT FUSED" when a dummy fuse is fitted. Additionally, a label shall be fitted at directly below the bottom fuse unit stating, "Normal Open Point."

3.6. Associated Materials

3.6.1. General

Clause 3.4.10 of this standard requires the use of additional non-conducting protection when contact by third parties with the ABC is possible from normal access positions, where there is a risk of mechanical damage and where in close proximity to metallic pipes or cables.

Details of positions where additional protection may be required are shown on Drawing No 431219.

3.6.2. Proximity Protection

This consists of black non-conducting split tubing with a minimum wall thickness of 1.5mm to Drawing No. 431411. It shall be used where the ABC bundle is attached above 2.4m and there is deemed to be a potential risk of mechanical damage by the movement of vehicles or the placement of materials e.g., ladders against the bundle. The tubing shall be secured by cable ties ensuring that the bundle is totally enclosed.

3.6.3. Mechanical Protection

High impact black PVC cable guards shall be used in those situations where there is a risk of mechanical damage.

Where the ABC could be damaged by abrasion against some other object, protective measures shall be taken. For example, where ABC is cleated past a stay it shall be protected with rigid UPVC tubing as shown on drawing 1000431411.

3.7. Earthing

All new and refurbished overhead lines shall be designed to comply with IMP/010/011 "Code of practise for earthing LV Networks and HV Distribution Substations".

PME connections to the neutral conductor shall be made using a single double bolted Insulation Piercing Connector as shown on drawing 1000431414 sht2. The connection to earth shall be made using 32mm^2 Hard Drawn Copper insulated with Black PVC.

The earthing conductor shall be cleated directly to the pole using polypropylene cable cleats and terminated at an earth electrode buried 600mm below ground level. See drawing 1091193339 Sht1 & 2.

Where CEW systems are required to be retained this shall be replaced with an ABC bundle that includes the additional earth protective conductor. The protective conductors shall be connected to the CEW earth conductor at each end of the Overhead section.

Note: In accordance with IMP/010/011 clause 3.8.3, when CEW networks are reviewed and retained as an open wire bare system or converted to a 5 core ABC system "additional earth electrodes and neutral earth bond connections shall be installed at those positions at which earth electrodes would have been required if the network were being converted to PME"

3.7.1. Guard wires for Over-running HV Conductors

Where ABC replaces open wire conductors and the conductors are beneath an HV line, the guard wire shall be retained in accordance with previous practice.

3.7.2. Earthing and Bonding of Steel Poles

To counter the risk of a rise in potential in steel poles used on LV networks one of the two following actions should be taken.

a) Ensure that all steel poles are effectively earthed at the base of the pole in accordance with drawing no 1091193622 or the protective conductor of a CEW system.

b) Apply MEN to the overhead network by bonding the steel pole to the neutral conductor. This does not necessitate bringing the o/h network up to PME requirements merely requiring it to fulfil the principles of MEN networks.

Note.

MEN cannot be applied to networks with CEW (Continuous Earth Wires)

To convert an overhead network to MEN, an earth electrode shall be installed at the end of the network most remote from the substation to earth the neutral conductor. Once this has been achieved, adoption of MEN by bonding a steel pole to the neutral conductor is a satisfactory alternative to earthing the pole directly to an earth electrode"

If the network is re-conductored with ABC, the neutral bar and insulators associated with the open wire network shall be removed and an electrical connection made between the pole and the neutral conductor.

Where CEW networks are encountered on steel poles, the isolated neutral arrangement shall be retained. However, the steel pole shall be bonded to the CEW wire.

3.7.3. Earthing arrangements for BT attachments

The earthing arrangements for BT attachments to company owned poles are set out in Engineering Recommendation PO5/3 "Protection of Telecommunication lines from Power Lines" and EB/TP 3 "'Engineering Recommendation for Telecommunication Providers and Distribution Network Operators Joint use of Poles."

3.8. Generator Provision

To facilitate the connection of a generator to the low voltage network, connections can be made to one side of the services fuses by means of an approved generator connection lead. The other side of the fuse terminals shall be fitted with an appropriate electrical shroud. Connecting of generators must be done in accordance with the Northern Powergrid operational procedures.

3.9. Earth Devices

When an ABC network is required to be proved dead and earthed only approved earthing devices shall be fitted. These can be fitted on the dead side of the LV section fuses or via a Litton connector to an ABC IPC fitting. Earthing of ABC networks must be done in accordance with the Northern Powergrid operational procedures.

3.10. Relationships with Other Bodies

Where lines to this standard are erected over or alongside the plant of Telecommunications Operators, Waterways Authorities or Network Rail operators, then the provisions of the relevant joint agreements shall apply. Details of the required clearances and any special provisions are available in Company Code of Practice NSP/004/011.

Additional information with respect to Telecommunication requirements can be found in EB/TP3 and PO5/3.

4. References

4.1. External Documentation

Reference	Title
43-12	Insulated Aerial Bundled Conductor Erection Requirements for LV Overhead Distribution Systems
43-13	Aerial Bundled Conductors Insulated with Cross Linked Polyethylene for low voltage overhead lines.
43-14	Conductor Fittings and Associated Apparatus for use with Low Voltage Insulated Aerial Bare Conductors.
43-30	Low Voltage Overhead Lines on Wood Poles
43-88	Treatment of Wood Poles and associated Timber for overhead Lines
43-91	Stay Strands & Stay Fittings for Overhead Lines
43-92	Stay Strands & Stay Fittings for Overhead Lines
43-95	Steelwork for Overhead Lines
43-96	Fasteners and washers for Wood Pole Overhead Lines
BS 1990	Wood Poles for Overhead Power and Telecommunications Lines part 1
EB/TP 3	'Engineering Recommendation for Telecommunication Providers and Distribution Network Operators Joint use of Poles.
PO5/3	Protection of Telecommunication lines from Power Lines
REACH legislation	The legislation referred to is EC 2006 No 1907 - Registration, Evaluation, Authorisation and Restriction of Chemicals.

4.2. Internal Documentation

Reference	Title
IMP/001/911	Code of Practice for the Economic Development of the LV System
IMP/010/011	Code of Practice for Earthing LV Networks and HV Distribution 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/001/007	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/001/016	Technical Specification for Compression and Mechanical Fittings for Overhead Lines
NPS/001/018	Technical Specification for Steel Poles
NPS/001/020	Technical Specification for Stay Ground Anchors for Overhead Lines
NPS/001/024	Technical Specification for Low Voltage Aerial Bundled Conductor Fittings
NSP/004/011	Guidance on Overhead Line Clearances
NSP/004/012	Guidance on the Risk Assessment of Overhead Lines
NSP/004/041/001	Specification for Renovation of existing LV O/H Lines
NSP/004/043	Specification for Overhead Services, Surface Wiring and Eves Wall Mains
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 notes on the selection of conductor jumpers & non-tension connections
NSP/004/109	(OHI 9) Guidance on anti-climbing devices, safety signs and labels required on overhead line supports

4.3. Amendments from Previous Version

Reference	Description
3.4.4 Wood Poles	Reference to preservative type AC500 replaced with Tanalith E 3494
3.5.11 ABC Mains / Multiple Services	Reference to service distribution box replaced with multi-tap connectors
Appendix 11 Drawings	Reference to service distribution box removed
Appendix 12 Arrangement Drawings	Drawing and material list for service distribution boxes removed

5. Definitions

Term	Definition
Aerial Bundled Conductor	The term ABC in this Specification refers to the assembly of 2 or 4 conductors to ENATS 43-13.
Anchor Clamp	A fitting, which transfers the tensile forces within the tensioned conductor, cores to the supporting structure.
CEW	Continuous Earth Wire
Design Loading Conditions	These are the augmented ice and wind loadings corresponding to ice 9.5mm diameter, wind 380N/m², as specified in EATS 43-12
EDS	Everyday Stress
I and S cable	Double Insulated & Sheathed Cable
Insulation Piercing Connectors (IPC's)	Connectors that can be applied to insulated conductors without the prior removal of the insulation
Intermediate Support	A support where the ABC system is attached by a suspension clamp. Intermediate supports may have angles of deviation up to 60°.
Main Lines	Lines of 4 core ABC with main cores of 50, 70, 95 or 120mm² conductor
MEN	Multiple Earthed Neutral
PME	Protective Multiple Earthing
Section Support	A support where adjacent spans are attached by means of anchor clamps. Section supports may have angles of deviation and may have provisions for electrically sectionalising the system. Unless there is a specific need for the conductors to be cut, the ABC shall be run unbroken and a loop, approximately 0.5m deep shall be provided.
Service Lines	Lines of 2 or 4 core ABC with core sizes of 35mm² conductor
Service Span	The span in which the service conductors are attached to a building at reduced tensions.
Suspension Clamp	A fitting that encloses and supports all ABC cores at an intermediate support.
Terminal Support	A support where the ABC is attached by an anchor clamp and does not continue into an adjacent span.

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
Joe McAndrew	Finance Co-ordinator	09/11/2023

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
Steven Salkeld	Policy and Standards Engineer	13/12/2023

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
Ged Hammel	Lead Policy and Standards Engineer	13/12/2023

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	09/01/2024

Appendix 1 - Technical Data Used as Design Basis for LV ABC

ABC Size Related Data: ABC

General

Ultimate tensile strength (UTS) of aluminium 170 N/mm of nominal csa. The elastic limit of linear extensions and recovery assumed to be 60 per cent of UTS.

Modulas of elasticity (linear) 'E' 5600 hbar.

Coefficient of linear expansion 23.00 x 10-6 per degree centigrade.

The figures in brackets for 120mm^2 ABC are the calculated tension values based on the common 2.62 Ratio of Mass/m. Since the full-strength characteristics of this conductor can never be fully utilised due to the limiting factors imposed by the pole strengths, the design loadings applicable to 4 x 95mm^2 ABC have been applied.

		Reduced Tension For Services		Full Tension					
ABC SIZES	sq mm	2 * 35	4 * 35	4 * 35	4 * 50	4 * 70	4 * 95	4 * 120	4 x 120 Plus 25
Bundle Diameter	mm	16.05	25.9	25.9	29.5	33.4	39.0	42.6	45.3*
Tension under Design Loadings	mwt			923 lb	1634 lb	2032 lb	2543 lb	2543 lb (2903 lb)	
	Kgf	87.8	132.6	418.1	743.40	922.0	1156.00	1156.00 (1317.00)	
	Kn	0.86	1.30	4.1	7.29	9.04	11.34	11.34 (12.92)	
Ratio of: UTS/Design Load		13.00	17.22	5.46	4.17	4.87	5.40	6.80 (5.97)	
Mass	Kg/m	0.26	0.52	0.52	0.70	0.96	1.30	1.60	1.70*
Ice Loaded Mass	Kg/m	0.59	1.06	1.06	1.16*	1.70	1.90 *	2.24*	2.38*
Wind Load on Iced ABC	Kg/m	0.99	1.37	1.37	1.51*	1.66	1.88 *	2.02*	2.12*
Ratio of Mass/m: Tension (10°C) x 10- (**)		13.3	13.3	4.15	2.62	2.62	2.62	(2.62)	(2.62)
Tension 10°C	Kgf	19.55	39.1	125.3	267.60	367.0	497.00	610.00	
	Kn	0.19	0.38	1.23	2.62	3.6	4.87	5.98	
Tension Limiting Device	Kn	-	-	-	4.0	4.0	4.0	4.0	

Note (**)
To extract the maximum benefits from the design sags, the common design ratio has been ignored. Instead, all conductor sags have been derived from the MWT loadings.

Appendix 2 – Extract from ENS TS 43-13 Issue 2

SCHEDULE OF TECHNICAL PARTICULARS FOR 600/1000 V AERIAL BUNDLED CONDUCTORS (ABC)

1	Nominal cross-sectional area of conductors	(mm^2)	35	35	50	70	95	120	120 + 25	
2	Number of cores		2	4	4	4	4	4	4 x 120	1 x 25
3	Nominal number of wires in conductor		7	7	19*	19*	19*	19*	19*	7
4	Diameter of conductor: Minimum Maximum	(mm) (mm)	6.6 7.5	6.6 7.5	7.7 8.5	9.3 10.2	11.0 12.0	12.0 13.2	12.0 13.2	5.6 6.5
5	Minimum average thickness of insulation	(mm)	1.3	1.3	1.5	1.5	1.7	1.8	1.8	1.3
6	Minimum thickness of insulation at any point	(mm)	1.07	1.07	1.25	1.25	1.43	1.52	1.52	1.07
7	Maximum diameter of core (excluding ribs)	(mm)	10.7	10.7	12.1	13.8	16.1	17.6	17.6	9.7
8	Calculated maximum diameter of circumscribing circle of assembled bundle	(mm)	21.9	26.2	29.6	33.4	39.3	42.6	45.2 (calc)	
9	Approximate weight of bundle	(kg/m)	0.26	0.52	0.70	0.96	1.3	1.6	1.70	
10	Maximum dc resistance of conductor in bundle at 20°C	(u/m)	868	868	641	443	320	253	253	
11	Maximum ac resistance of conductor at 75°C	(u/m)	1060	1060	783	542	392	310	310	
12	Star reactance of bundle at 50 Hz	(u/m)	86	86	83	80	80	76	76	
13	Zero sequence impedance of bundle at 50 Hz and 75°C	(u/m)	2120 +j86	4240 +j372	3130 +j348	2170 +j350	1570 +j348	1240 +j96	1240 +j96	
14	Maximum continuous current carrying capacity per phase at 75°C (25°C ambient): For erection at pole top For installation under eaves	 (A) (A)	 138 116	 117 98	 143 120	 183 154	 228 191	 300 n/a	 300 n/a	
15.	Maximum continuous conductor temperature	(°C)	75	75	75	75	75	75	75	
16	Ultimate tensile strength of conductor based on 170 N/mm_2 (calculated)	(kN)	5.6	5.6	7.6	11.0	15.3	19.3	n/a	
17	Ultimate tensile strength of bundle (calculated)	(kN)	11.3	22.4	30.4	44.0	61.2	77.2	n/a	
18	Modules of Elasticity of Conductor	(hbar)	5900	5900	5600	5600	5600	5600	n/a	
19	Coefficient of Linear Expansion	(/°C)	23 x 10^{-6}	23 x 10^{-6}	23 x 10^{-6}	23 x 10^{-6}	23 x 10^{-6}	23 x 10^{-6}	n/a	
20	Minimum bending radius of bundle Minimum bending radius of single core	(mm) (mm)	175 86	210 86	236 98	270 110	312 129	341 141	341 141	

* Subject to tolerance of 1 wire

Correction Factors for Maximum Continuous Current Ratings

AMBIENT TEMPERATURE °C	CORRECTION FACTOR
5	1.18
10	1.14
15	1.10
20	1.05

Appendix 3 – Design Sag & Tension Data for 2 or 4 Core 35mm^2 (Extended service Spans)

Conductor Code Name (if any)	35LVABC4 P2P
Covered Conductor Weight (kg/m)	0.52
Cross Sectional Area of Conductor (mm²)	140
Diameter of Covered Conductor (mm)	26.2
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm²)	6016.33
Rated Breaking Strength of Conductor (kgf)	2284.16
Basic / Recommended Span (m)	50
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	4.75
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	418
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	456.833
Temperature at EDT Limit (Degrees C)	5

Maximum Conductor Tension (MCT) (kgf)	at	-5.6°C	418.0
Maximum Conductor Weight (MCW) (kg/m)			1.073
Maximum Conductor Pressure (MCP) (kg/m)			1.383
Freezing Point Tension (FPT) (kgf)	at	0°C	132.0

DESIGN and ERECTION SAG/ TENSION TABLE

Conductor Code Name		35LVABC4 P2P	
Basic / Recommended Span (m)		50	
Temperature Shift for Creep	(Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)		0.0	at 15°C
Required Percentage Increase in Tension (%)		0	at 15°C

Temp. (Deg. C)	Tension (kgf)	DESIGN TABLE Sag (m) for Span Length (m) 10	15	20	25	30	35	40	45	50
-5.6	137.3	0.05	0.11	0.19	0.30	0.43	0.58	0.76	0.96	1.18
0	132.0	0.05	0.11	0.20	0.31	0.44	0.60	0.79	1.00	1.23
5	127.7	0.05	0.11	0.20	0.32	0.46	0.62	0.81	1.03	1.27
10	123.8	0.05	0.12	0.21	0.33	0.47	0.64	0.84	1.06	1.31
15	120.3	0.05	0.12	0.22	0.34	0.49	0.66	0.86	1.09	1.35
20	117.0	0.06	0.13	0.22	0.35	0.50	0.68	0.89	1.13	1.39
25	113.9	0.06	0.13	0.23	0.36	0.51	0.70	0.91	1.16	1.43
30	111.1	0.06	0.13	0.23	0.37	0.53	0.72	0.94	1.18	1.46
35	108.5	0.06	0.13	0.24	0.37	0.54	0.73	0.96	1.21	1.50
40	106.0	0.06	0.14	0.25	0.38	0.55	0.75	0.98	1.24	1.53
45	103.7	0.06	0.14	0.25	0.39	0.56	0.77	1.00	1.27	1.57
50	101.6	0.06	0.14	0.26	0.40	0.58	0.78	1.02	1.30	1.60
55	99.5	0.07	0.15	0.26	0.41	0.59	0.80	1.04	1.32	1.63
60	97.6	0.07	0.15	0.27	0.42	0.60	0.82	1.07	1.35	1.66
65	95.8	0.07	0.15	0.27	0.42	0.61	0.83	1.09	1.37	1.70
70	94.1	0.07	0.16	0.28	0.43	0.62	0.85	1.11	1.40	1.73
75	92.5	0.07	0.16	0.28	0.44	0.63	0.86	1.12	1.42	1.76
80	90.9	0.07	0.16	0.29	0.45	0.64	0.88	1.14	1.45	1.79

Appendix 4 – Design Sag & Tension Data for 50mm²

Conductor Code Name (if any)	50LVABC4
Covered Conductor Weight (kg/m)	0.7
Cross Sectional Area of Conductor (mm²)	200
Diameter of Covered Conductor (mm)	29.6
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm²)	5710.41
Rated Breaking Strength of Conductor (kgf)	3099.94
Basic / Recommended Span (m)	50
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	4.75
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	743.1
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	619.987
Temperature at EDT Limit (Degrees C)	5

DESIGN and ERECTION SAG/ TENSION TABLE

Conductor Code Name		50LVABC4	
Basic / Recommended Span (m)		50	
Temperature Shift for Creep	(Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)		0.0	at 15°C
Required Percentage Increase in Tension (%)		0	at 15°C

Temp. (Deg. C)	Tension (kgf)	DESIGN TABLE Sag (m) for Span Length (m)								
		10	20	30	40	50	60	70	80	90
-5.6	347.4	0.03	0.10	0.23	0.40	0.63	0.91	1.23	1.61	2.04
0	312.8	0.03	0.11	0.25	0.45	0.70	1.01	1.37	1.79	2.27
5	288.1	0.03	0.12	0.27	0.49	0.76	1.09	1.49	1.94	2.46
10	267.7	0.03	0.13	0.29	0.52	0.82	1.18	1.60	2.09	2.65
15	250.7	0.03	0.14	0.31	0.56	0.87	1.26	1.71	2.23	2.83
20	236.2	0.04	0.15	0.33	0.59	0.93	1.33	1.81	2.37	3.00
25	223.8	0.04	0.16	0.35	0.63	0.98	1.41	1.92	2.50	3.17
30	213.1	0.04	0.16	0.37	0.66	1.03	1.48	2.01	2.63	3.33
35	203.6	0.04	0.17	0.39	0.69	1.07	1.55	2.11	2.75	3.48
40	195.3	0.04	0.18	0.40	0.72	1.12	1.61	2.20	2.87	3.63
45	187.8	0.05	0.19	0.42	0.75	1.16	1.68	2.28	2.98	3.77
50	181.1	0.05	0.19	0.43	0.77	1.21	1.74	2.37	3.09	3.91
55	175.0	0.05	0.20	0.45	0.80	1.25	1.80	2.45	3.20	4.05
60	169.5	0.05	0.21	0.46	0.83	1.29	1.86	2.53	3.30	4.18
65	164.5	0.05	0.21	0.48	0.85	1.33	1.92	2.61	3.40	4.31
70	159.8	0.05	0.22	0.49	0.88	1.37	1.97	2.68	3.50	4.43
75	155.6	0.06	0.22	0.51	0.90	1.41	2.02	2.76	3.60	4.56
80	151.6	0.06	0.23	0.52	0.92	1.44	2.08	2.83	3.69	4.67

Appendix 5 – Design Sag & Tension Data for 70mm²

Conductor Code Name (if any)	70LVABC4
Covered Conductor Weight (kg/m)	0.96
Cross Sectional Area of Conductor (mm²)	280
Diameter of Covered Conductor (mm)	33.4
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm²)	5710.41
Rated Breaking Strength of Conductor (kgf)	4486.75
Basic / Recommended Span (m)	50
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	4.75
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	922
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	897.35
Temperature at EDT Limit (Degrees C)	5

Maximum Conductor Tension (MCT) (kgf) at	-5.6°C	922.0
Maximum Conductor Weight (MCW) (kg/m)		1.693
Maximum Conductor Pressure (MCP) (kg/m)		1.662
Freezing Point Tension (FPT) (kgf) at	0°C	432.7

DESIGN and ERECTION SAG/ TENSION TABLE

Conductor Code Name	70LVABC4	
Basic / Recommended Span (m)	50	
Temperature Shift for Creep (Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)	0.0	at 15°C
Required Percentage Increase in Tension (%)	0	at 15°C

Temp. (Deg. C)	Tension (kgf)	DESIGN TABLE Sag (m) for Span Length (m)								
		10	20	30	40	50	60	70	80	90
-5.6	481.4	0.02	0.10	0.22	0.40	0.62	0.90	1.22	1.60	2.02
0	432.7	0.03	0.11	0.25	0.44	0.69	1.00	1.36	1.77	2.25
5	398.0	0.03	0.12	0.27	0.48	0.75	1.09	1.48	1.93	2.44
10	369.5	0.03	0.13	0.29	0.52	0.81	1.17	1.59	2.08	2.63
15	345.7	0.03	0.14	0.31	0.56	0.87	1.25	1.70	2.22	2.81
20	325.6	0.04	0.15	0.33	0.59	0.92	1.33	1.81	2.36	2.99
25	308.3	0.04	0.16	0.35	0.62	0.97	1.40	1.91	2.49	3.15
30	293.4	0.04	0.16	0.37	0.65	1.02	1.47	2.00	2.62	3.31
35	280.2	0.04	0.17	0.39	0.69	1.07	1.54	2.10	2.74	3.47
40	268.7	0.04	0.18	0.40	0.71	1.12	1.61	2.19	2.86	3.62
45	258.3	0.05	0.19	0.42	0.74	1.16	1.67	2.28	2.97	3.76
50	249.0	0.05	0.19	0.43	0.77	1.20	1.73	2.36	3.08	3.90
55	240.7	0.05	0.20	0.45	0.80	1.25	1.80	2.44	3.19	4.04
60	233.0	0.05	0.21	0.46	0.82	1.29	1.85	2.52	3.30	4.17
65	226.1	0.05	0.21	0.48	0.85	1.33	1.91	2.60	3.40	4.30
70	219.7	0.05	0.22	0.49	0.87	1.37	1.97	2.68	3.50	4.42
75	213.8	0.06	0.22	0.51	0.90	1.40	2.02	2.75	3.59	4.55
80	208.3	0.06	0.23	0.52	0.92	1.44	2.07	2.82	3.69	4.67

Appendix 6 – Design Sag & Tension Data for 95mm^2

Conductor Code Name (if any)	95LVABC4
Covered Conductor Weight (kg/m)	1.3
Cross Sectional Area of Conductor (mm^2)	380
Diameter of Covered Conductor (mm)	39
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm^2)	5710.41
Rated Breaking Strength of Conductor (kgf)	6240.66
Basic / Recommended Span (m)	50
Wind Pressure on Conductor (N/m^2)	380
Radial Ice Thickness (mm)	4.75
Ice Density (kg/m^3)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	1156
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	1248.13
Temperature at EDT Limit (Degrees C)	5

Maximum Conductor Tension (MCT) (kgf) at	-5.6°C	1156.0
Maximum Conductor Weight (MCW) (kg/m)		2.187
Maximum Conductor Pressure (MCP) (kg/m)		1.879
Freezing Point Tension (FPT) (kgf) at	0°C	585.3

Conductor Code Name	95LVABC4	
Basic / Recommended Span (m)	50	
Temperature Shift for Creep (Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)	0.0	at 15°C
Required Percentage Increase in Tension (%)	0	at 15°C

Temp. (Deg. C)	Tension (kgf)	DESIGN TABLE Sag (m) for Span Length (m) 10	20	30	40	50	60	70	80	90
-5.6	651.0	0.02	0.10	0.22	0.40	0.62	0.90	1.22	1.60	2.02
0	585.3	0.03	0.11	0.25	0.44	0.69	1.00	1.36	1.78	2.25
5	538.4	0.03	0.12	0.27	0.48	0.75	1.09	1.48	1.93	2.44
10	499.9	0.03	0.13	0.29	0.52	0.81	1.17	1.59	2.08	2.63
15	467.7	0.03	0.14	0.31	0.56	0.87	1.25	1.70	2.22	2.81
20	440.5	0.04	0.15	0.33	0.59	0.92	1.33	1.81	2.36	2.99
25	417.2	0.04	0.16	0.35	0.62	0.97	1.40	1.91	2.49	3.16
30	397.0	0.04	0.16	0.37	0.65	1.02	1.47	2.01	2.62	3.32
35	379.2	0.04	0.17	0.39	0.69	1.07	1.54	2.10	2.74	3.47
40	363.6	0.04	0.18	0.40	0.72	1.12	1.61	2.19	2.86	3.62
45	349.6	0.05	0.19	0.42	0.74	1.16	1.67	2.28	2.97	3.76
50	337.1	0.05	0.19	0.43	0.77	1.21	1.74	2.36	3.09	3.91
55	325.7	0.05	0.20	0.45	0.80	1.25	1.80	2.44	3.19	4.04
60	315.4	0.05	0.21	0.46	0.82	1.29	1.85	2.52	3.30	4.17
65	306.0	0.05	0.21	0.48	0.85	1.33	1.91	2.60	3.40	4.30
70	297.3	0.05	0.22	0.49	0.87	1.37	1.97	2.68	3.50	4.43
75	289.4	0.06	0.22	0.51	0.90	1.40	2.02	2.75	3.59	4.55
80	282.0	0.06	0.23	0.52	0.92	1.44	2.07	2.82	3.69	4.67

Appendix 7 – Design Sag & Tension Data for 120mm^2

Conductor Code Name (if any)	120LVABC4
Covered Conductor Weight (kg/m)	1.7
Cross Sectional Area of Conductor (mm²)	380
Diameter of Covered Conductor (mm)	45.3
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm²)	5710.41
Rated Breaking Strength of Conductor (kgf)	7913
Basic / Recommended Span (m)	50
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	4.75
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	1156
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	1582.6
Temperature at EDT Limit (Degrees C)	5

Maximum Conductor Tension (MCT) (kgf)	at	-5.6°C	1156.0
Maximum Conductor Weight (MCW) (kg/m)			2.774
Maximum Conductor Pressure (MCP) (kg/m)			2.123
Freezing Point Tension (FPT) (kgf)	at	0°C	603.8

DESIGN and ERECTION SAG/ TENSION TABLE

Conductor Code Name	120LVABC4	
Basic / Recommended Span (m)	50	
Temperature Shift for Creep (Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)	0.0	at 15°C
Required Percentage Increase in Tension (%)	0	at 15°C

Temp. (Deg. C)	Tension (kgf)	DESIGN TABLE Sag (m) for Span Length (m) 10	20	30	40	50	60	70	80	90
-5.6	647.8	0.03	0.13	0.30	0.52	0.82	1.18	1.61	2.10	2.66
0	603.8	0.04	0.14	0.32	0.56	0.88	1.27	1.72	2.25	2.85
5	570.4	0.04	0.15	0.34	0.60	0.93	1.34	1.83	2.38	3.02
10	541.4	0.04	0.16	0.35	0.63	0.98	1.41	1.92	2.51	3.18
15	516.1	0.04	0.16	0.37	0.66	1.03	1.48	2.02	2.64	3.34
20	493.7	0.04	0.17	0.39	0.69	1.08	1.55	2.11	2.75	3.49
25	473.8	0.04	0.18	0.40	0.72	1.12	1.61	2.20	2.87	3.63
30	456.0	0.05	0.19	0.42	0.75	1.16	1.68	2.28	2.98	3.77
35	440.0	0.05	0.19	0.43	0.77	1.21	1.74	2.37	3.09	3.91
40	425.4	0.05	0.20	0.45	0.80	1.25	1.80	2.45	3.20	4.05
45	412.1	0.05	0.21	0.46	0.83	1.29	1.86	2.53	3.30	4.18
50	400.0	0.05	0.21	0.48	0.85	1.33	1.91	2.60	3.40	4.30
55	388.8	0.05	0.22	0.49	0.87	1.37	1.97	2.68	3.50	4.43
60	378.4	0.06	0.22	0.51	0.90	1.40	2.02	2.75	3.59	4.55
65	368.9	0.06	0.23	0.52	0.92	1.44	2.07	2.82	3.69	4.67
70	360.0	0.06	0.24	0.53	0.94	1.48	2.13	2.89	3.78	4.78
75	351.6	0.06	0.24	0.54	0.97	1.51	2.18	2.96	3.87	4.89
80	343.9	0.06	0.25	0.56	0.99	1.54	2.22	3.03	3.96	5.01

Appendix 8 – Erection Data for ABC Attached to Buildings - Slack Spans @ reduced tensions

SPAN METRES	35mm^2 - SAG (m)	50mm^2 - SAG (m)	70mm^2 - SAG (m)	95mm^2 - SAG (m)	120mm^2 - SAG (m)
10.0	0.16	0.20	0.23	0.28	0.32
12.5	0.26	0.32	0.36	0.44	0.49
15.0	0.37	0.46	0.53	0.63	0.71
17.5	0.50	0.61	0.72	0.86	0.97
20.0	0.66	0.81	0.92	1.13	1.27
22.5	0.83	1.03	1.19	1.43	1.61
25.0	1.03	1.27	1.47	1.76	1.99
27.5	1.24	1.54	1.78	2.13	2.4
30.0	1.48	1.83	2.12	2.54	2.86

NOTE: Sags are based on design conditions applied to various sizes of ABC producing a tension not exceeding 1.3 kN. The figures have been collated based on a 20m Basic Span @ 15°C

Appendix 9 – Minimum Stay Spreads for Angle Poles

50 mm^2 ABC

DEVIATION	<15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	TERM
OVERALL LENGTH	MINIMUM STAY SPREAD IN METRES										
OF POLE (METRES)											
9.0	1.1	1.3	1.5	1.7	1.8	2.1	2.2	2.5	2.6	2.8	2.3
9.5	1.2	1.4	1.6	1.8	1.9	2.2	2.4	2.6	2.8	3.0	2.2
10.0	1.3	1.4	1.7	1.9	2.2	2.3	2.5	2.8	3.0	3.1	2.5
10.5	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7	3.0
11.0	1.8	2.0	2.3	2.6	2.8	3.2	3.3	3.7	3.9	4.1	3.3
11.5	1.9	2.2	2.6	3.0	3.1	3.5	3.9	4.1	4.5	4.7	3.7
12.0	2.2	2.5	2.9	3.3	3.7	3.9	4.3	4.5	5.0	5.2	4.3
13.0	2.4	2.8	3.2	3.6	3.9	4.3	4.7	5.0	5.5	5.7	4.5

70 mm^2 ABC

DEVIATION	<15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	TERM
OVERALL LENGTH	MINIMUM STAY SPREAD IN METRES										
OF POLE (METRES)											
9.0	1.1	1.3	1.5	1.8	1.9	2.1	2.3	3.1	3.2	2.9	2.3
9.5	1.4	1.5	1.8	2.1	2.2	2.5	2.6	3.3	3.4	3.3	2.8
10.0	1.6	1.7	2.0	2.3	2.7	2.8	3.1	3.5	3.6	3.8	3.1
10.5	1.8	2.2	2.3	2.7	3.0	3.3	3.7	3.9	4.2	4.4	3.7
11.0	2.0	2.5	2.8	3.2	3.3	3.7	4.3	4.5	4.7	5.1	4.3
11.5	2.2	2.8	3.1	3.5	3.9	4.3	4.9	4.9	5.4	5.8	4.7
12.0	2.5	3.1	3.5	3.9	4.3	4.8	5.9	5.6	6.1	6.4	5.4
13.0	2.8	3.2	3.9	4.3	4.7	5.2	5.7	6.2	6.5	7.0	5.7

95/120 mm^2 ABC

DEVIATION	<15°	20°	25°	30°	35°	40°	45°	50°	55°	60°	TERM
OVERALL LENGTH	MINIMUM STAY SPREAD IN METRES										
OF POLE (METRES)											
9.0	1.5	1.8	2.2	2.5	2.8	3.1	3.5	3.8	4.2	4.5	3.8
9.5	1.6	1.9	2.4	2.6	2.8	3.3	3.8	4.1	4.4	5.0	3.4
10.0	1.9	2.2	2.5	2.8	3.1	3.6	4.0	4.4	4.7	5.3	4.0
10.5	2.2	2.5	3.0	3.3	3.7	4.1	4.4	4.8	5.2	5.6	4.6
11.0	2.5	2.8	3.3	3.7	4.3	4.7	5.1	5.5	6.0	6.2	5.3
11.5	2.8	3.3	3.7	4.3	4.7	5.2	5.8	6.3	6.5	7.0	6.1
12.0	3.1	3.7	4.3	4.8	5.4	5.9	6.4	6.9	7.4	8.0	6.6
13.0	3.4	3.9	4.5	5.2	5.7	6.5	7.0	7.5	8.1	8.7	7.3

NOTES:

1. Preferred stay spreads are 45° as shown in Chart 4 but where these are not attainable then the above table may be used.
2. These minimum stay spreads relate to medium poles and single 7/4.00 mm stay.
3. The loadings are resultant forces derived from vertical and horizontal forces, using a wind span of 90 metres.
4. Calculations are based on UTS of poles and staywire compared with design loadings x 2.5

Appendix 10 – Out of Balance Stays at In Line Junction Between Open Wire (O/W) And ABC Systems

TYPE OF JUNCTIONS AND MINIMUM STAY SPREADS (M)												
OVERALL LENGTH OF POLES	GROUP 1			GROUP 2			GROUP 3			GROUP 4		
	50/95/120mm ABC AND 4 x 32 Cu OR 4 x 50 A1 O/W			50/95/120mm ABC AND 4 x 32 Cu OR 4 x 50 A1 O/W + S/W WIRE			50/70/95/120mm ABC AND 4 x 70 Cu OR 4 x 100 Cu OR 4 x 100 A1			50/70/95/120mm ABC AND 4 x 70 Cu OR 4 x 100 Cu OR 4 x 100 A1 O/W + S/W WIRE		
	$50mm^2$	$70mm^2$	$95/120mm^2$	$50mm^2$	$70mm^2$	$95/120mm^2$	$50mm^2$	$70mm^2$	$95/120mm^2$	$50mm^2$	$70mm^2$	$95/120mm^2$
	ABC	ABC	ABC	ABC	ABC	ABC	ABC	ABC	ABC	ABC	ABC	ABC
9.0m	1 @ 3.5m	1 @ 2.8m	1 @ 2.1m	2 @4.0m	1 @ 4.7m	1 @ 3.7m	2 @ 4.3m	2 @ 4.0m	1 @ 4.3m	2 @ 3.8m*	2 @ 3.5m*	2 @ 3.1m*
9.5m	1 @ 3.8m	1 @ 3.0m	1 @ 2.2m	2 @ 4.6m	1 @ 5.0m	1 @ 3.9m	2 @ 6.0m	2 @ 4.6m	1 @ 4.6m	2 @ 4.1m*	2 @ 3.8m*	2 @ 3.3m*
10.0m	1 @ 4.0m	1 @ 3.1m	1 @ 2.3m	2 @ 5.3m	1 @ 5.3m	1 @ 4.2m	2 @ 6.8m	2 @ 5.3m	1 @ 4.9m	2 @ 4.4m*	2 @ 4.0m*	2 @ 3.5m*
10.5m	1 @ 4.2m	1 @ 3.7m	1 @ 2.7m	2 @ 6.1m	1 @ 5.6m	1 @ 4.6m	2 @ 6.8m	2 @ 6.1m	1 @ 5.2m	2 @ 4.6m*	2 @ 4.2m*	2 @ 3.7m*
11.0m	1 @ 4.9m	1 @ 4.1m	1 @ 3.0m	2 @ 6.9m	1 @ 6.2m	1 @ 5.1m	2 @ 7.7m	2 @ 6.9m	1 @ 6.0m	2 @ 4.9m*	2 @ 4.5m*	2 @ 3.9m*

NOTES:

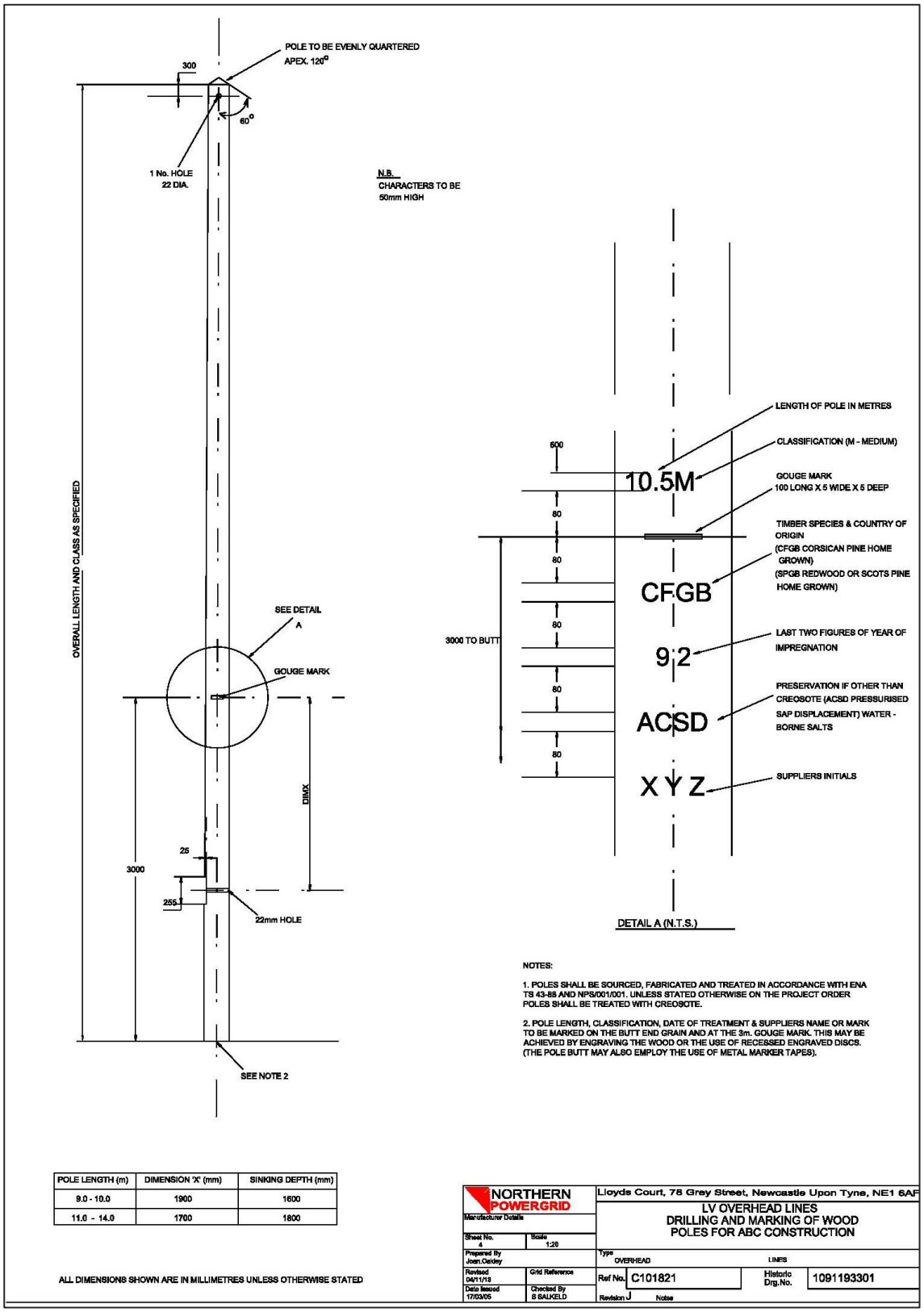
1. Preferred stay spreads are 45° as shown in Chart 4 but where these are not attainable the above table may be used.
2. These stay spreads relate to medium poles with 1 x 7/4.00 stay or 2 x 7/4.00 stay strands (grade 700) as specified. (Spreads ending in * are Stout grade poles)
3. These stays are to be installed against the open wire network.
4. Where steel poles (historic type D or present-day type K) are used with the above conductors at each end of the ABC span no stays are required.
5. For situations other than the above refer to the Policy and Standards Manager.
6. Calculations based on 45, spans.
7. Calculations are based on UTS of poles and staywire compared with design loadings x 2.5

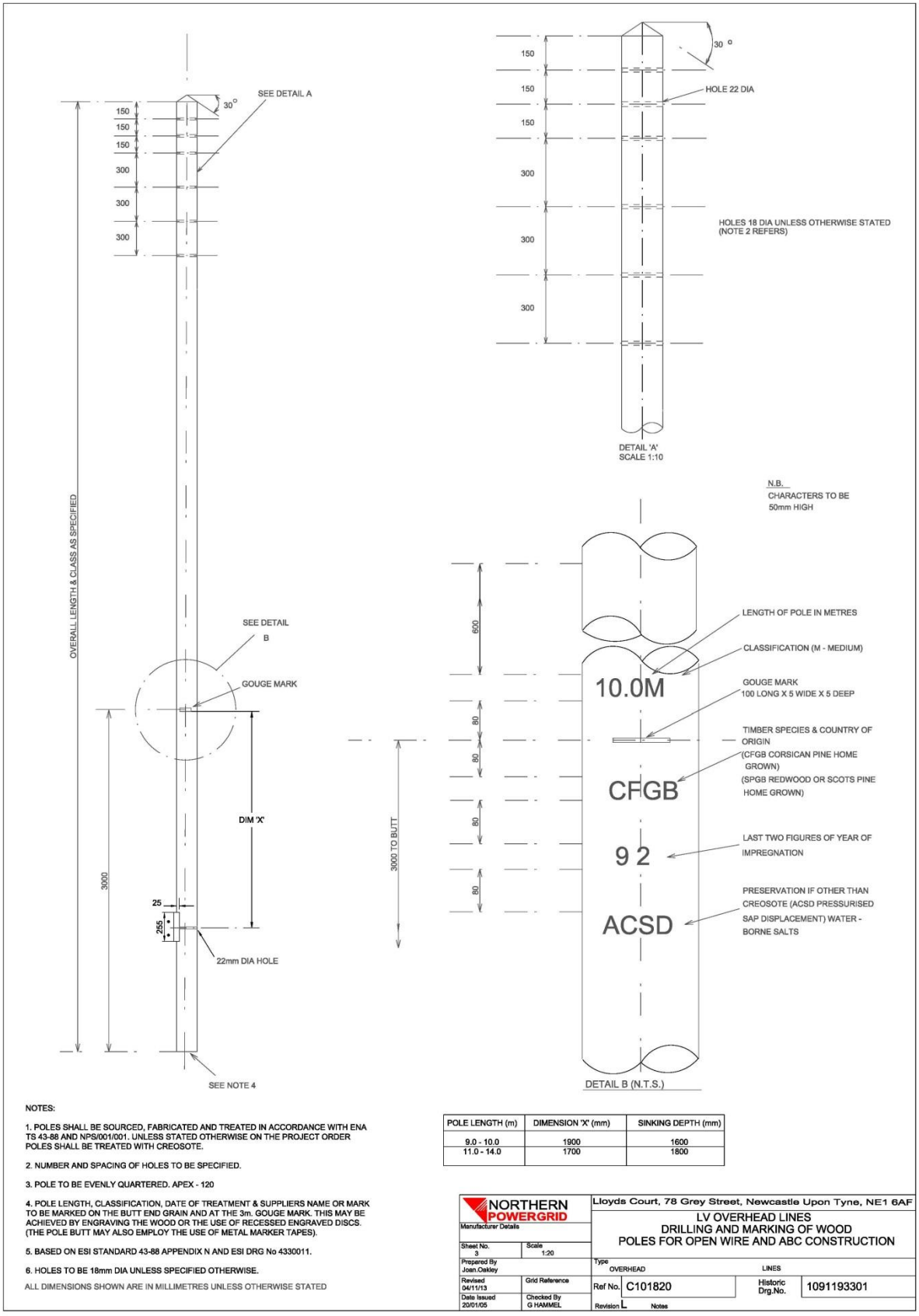
Appendix 11 – Drawings Index

The following are typical drawings.

TITLE	DRAWING NO.
Drilling and Marking of Wood Poles for LV Construction using ABC	1.09.119.3301 Sh 4
ABC Fitting - Hook Bolt - Extended	1.00.043.1401
ABC Fitting - Hook Nut	1.00.043.1401 sht 2
ABC Fitting - Hook Bolt	1.00.043.1402
ABC Fitting - Wall Mount Hook	1.00.043.1404
ABC Fitting - Weak Link	1.00.043.1405
ABC Fitting - Suspension Clamp / Roller	1.00.043.1406 sht 2
ABC Fitting - Suspension Clamp / Roller - Extension Roller	1.00.043.1406 sht 3
ABC Fitting - Wall Mount Bracket	1.00.043.1407
ABC Fitting - Wall Mount Mains Support	1.00.043.1409
ABC Fitting - Anchor Clamp	1.00.043.1410
ABC Fitting - Wall Mounting Protective Sleeve	1.00.043.1411
ABC Fitting - Conductor End Caps	1.00.043.1412
ABC Fitting - Bimetal Insulation Piercing Connectors	1.00.043.1414 sh 1,2&3
Cable Pull Stocking	1.09.145.0015
ABC Come Along Clamp	1.09.145.0016
ABC Core Separator Wedge	1.09.145.0017
Unstayed Intermediate Support	1.00.043.1202
Intermediate Support up to 30° Line Deviation	1.00.043.1203
Intermediate Inside Angle Support up to 30 ° Line Deviation	1.00.043.1204
Intermediate Inside Angle Support up to 60 ° Line Deviation	1.00.043.1205
Section Support, Angles 20° -90° Line Deviation	1.00.043.1206
Section Support with Circuit Disconnector	1.00.043.1207
Transition Support ABC. To Open Wire System	1.00.043.1208
Terminal Support	1.00.043.1209
Terminal Support, with Underground Cable	1.00.043.1210
Tee off from Intermediate Support	1.00.043.1211
Tee off Section Support	1.00.043.1212
Single Phase Service from Intermediate Support	1.00.043.1214
Multiple Service Take Off	1.00.043.1215
Intermediate Angle Support Without Strut or Stay	1.00.043.1216
Typical Attachments on and between Buildings	1.00.043.1217 Sh 1
Typical Attachments to Buildings	1.00.043.1217 Sh 2
Areas Requiring Proximity Protection	1.00.043.1219
Minimum Clearances of Aerial Systems to Buildings and Structures	1.00.043.1220
Static Balancer on Wood Pole	1.00.043.1222
Three Phase Regular on Wood Pole	1.00.043.1223
Sequence and Dimensions of Phase Identification Ribs on Cores of ABC Cable	1.00.043.1301

Appendix 12 – Arrangement Drawings and Materials Lists





NOTES:

1. POLES SHALL BE SOURCED, FABRICATED AND TREATED IN ACCORDANCE WITH ENA TS 43-88 AND NPS/001/001. UNLESS STATED OTHERWISE ON THE PROJECT ORDER POLES SHALL BE TREATED WITH CREOSOTE.
2. NUMBER AND SPACING OF HOLES TO BE SPECIFIED.
3. POLE TO BE EVENLY QUARTERED. APEX - 120
4. POLE LENGTH, CLASSIFICATION, DATE OF TREATMENT & SUPPLIERS NAME OR MARK TO BE MARKED ON THE BUTT END GRAIN AND AT THE 3m. GOUGE MARK. THIS MAY BE ACHIEVED BY ENGRAVING THE WOOD OR THE USE OF RECESSED ENGRAVED DISCS. (THE POLE BUTT MAY ALSO EMPLOY THE USE OF METAL MARKER TAPES).
5. BASED ON ESI STANDARD 43-88 APPENDIX N AND ESI DRG No 4330011.
6. HOLES TO BE 18mm DIA UNLESS SPECIFIED OTHERWISE.

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

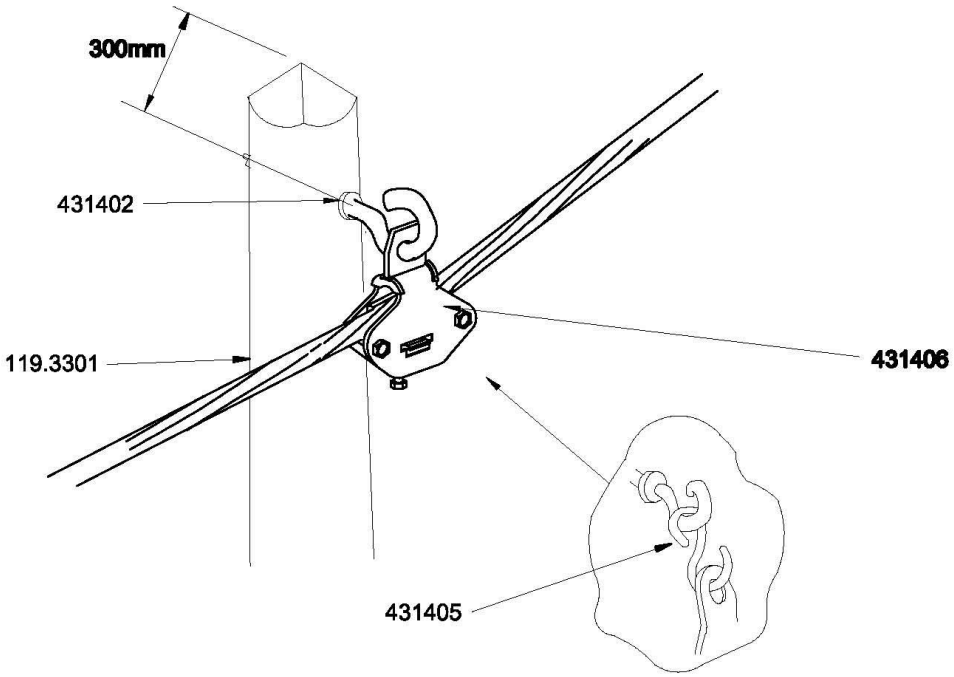
POLE LENGTH (m)	DIMENSION 'X' (mm)	SINKING DEPTH (mm)
9.0 - 10.0	1900	1600
11.0 - 14.0	1700	1800

NORTHERN POWERGRID
Manufacturer Details
Sheet No. 3 | Scale 1:20
Prepared By Joan.Oakley
Revised 04/11/13 | Grid Reference
Date Issued 20/01/05 | Checked By G HAMMEL

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

LV OVERHEAD LINES
DRILLING AND MARKING OF WOOD
POLES FOR OPEN WIRE AND ABC CONSTRUCTION

Type OVERHEAD LINES
Ref No. C101820 | Historic Drg.No. 1091193301
Revision | Notes



NOTES

1. **WEAK LINKS TO 431405 SHALL BE INSTALLED WHERE CONDUCTORS PASS THROUGH TREES.**
2. **DETAIL DRAWINGS PREFIXED 43..... REFER TO ESI BASED DRAWINGS OTHER DETAIL DRAWINGS REFER TP 1.09.119..... SERIES**

WORK SPEC 04/470

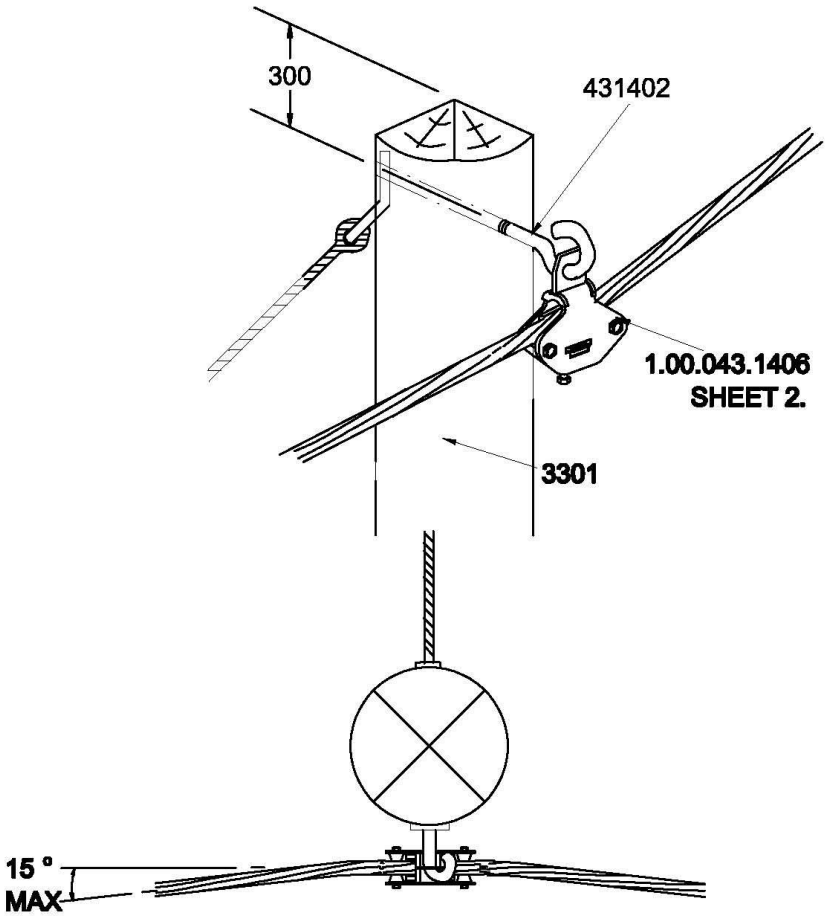
NORTHERN POWERGRID	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Manufacturer Details	UNSTAYED INTERMEDIATE SUPPORT	
Sheet No. 1 / Scale N.T.S.		
Prepared By Pauline.Moore	Type ESI	ESI
Revised 13/12/11 / Grid Reference	Ref No. C316559	Historic Drg.No. 1000431202
Date Issued 23/09/05 / Checked By G.HAMMEL	Revision C Notes	

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220 mm	431402	1	265596
Washer, Square/Curved	434605	1	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
When Specified:			
Mechanical Weak Link	431405	1	262032

Arrangement of Typical ABC Unstayed Intermediate Support

Drawing Number 1000431202



NOTES:-
1. FOR ANGLES OF DEVIATION GREATER THAN 30°
2. DETAIL DRAWINGS PREFIXED 43..... REFER TO ESI BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO DRG 1.09.119..... SERIES

ISSUED BY JLW

WORK SPEC No 04/471

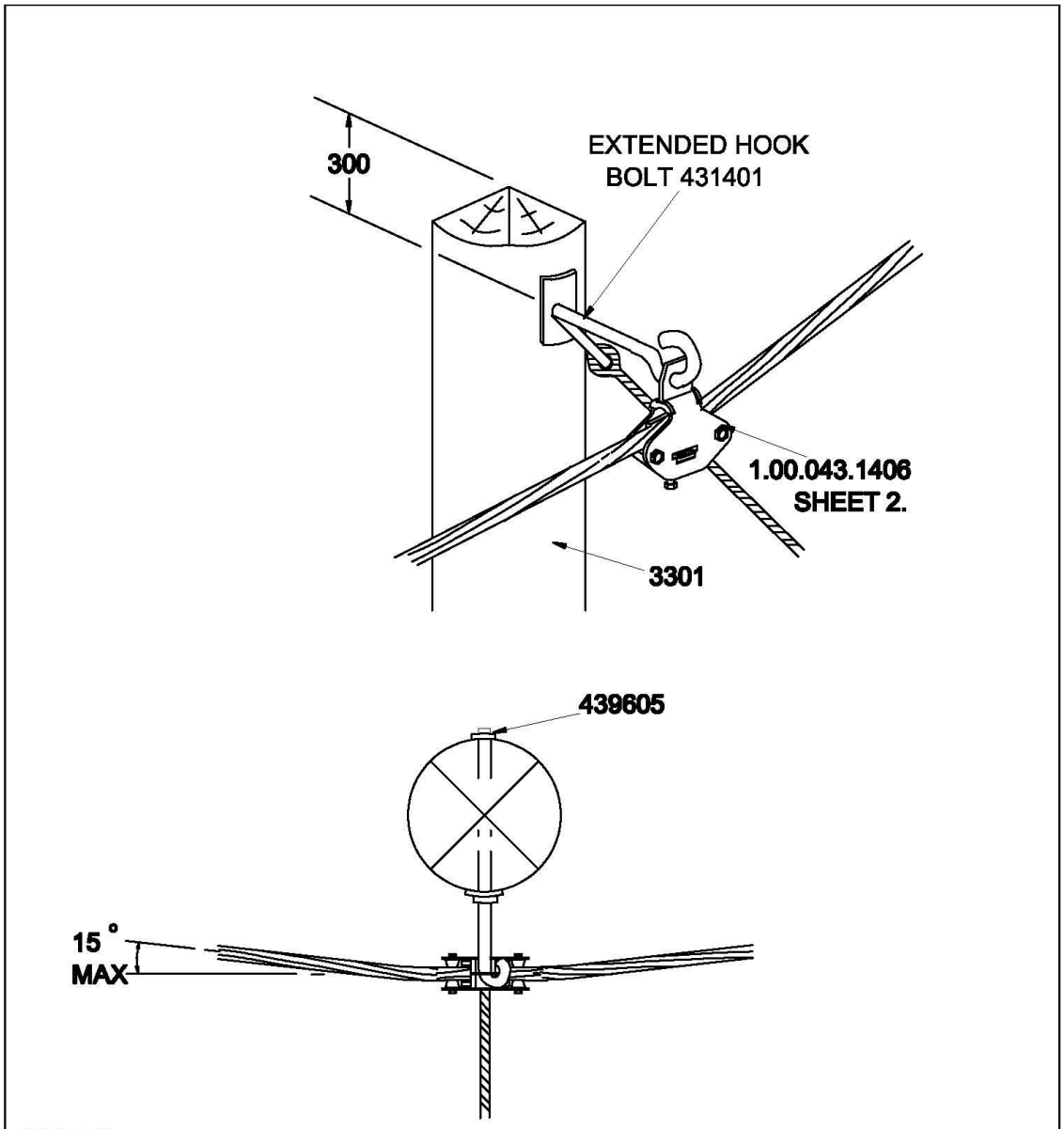
NORTHERN POWERGRID Manufacturer Details	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF ARRANGEMENT OF TYPICAL ABC ANGLE SUPPORT UP TO 30* LINE DEVIATION
Sheet No. 1 / Scale N.T.S.	
Prepared By Pauline.Moore	Type ESI ESI
Revised 13/12/11 / Grid Reference	Ref No. C147597 Historic Drg.No. 1000431203
Date Issued 23/09/05 / Checked By G HAMMEL	Revision E Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220 mm	431402	1	265596
Washer, Square/Curved	434605	1	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components (Were Required)			
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124
When Specified:			
Mechanical Weak Link	431405	1	262032

Arrangement of Typical ABC Angle support Up to 30° Deviation

Drawing Number 1000431203



NOTES:-

1. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I.BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO 1.09.119.....SERIES.

ISSUED BY JLW

WORK SPEC.No. 04/472

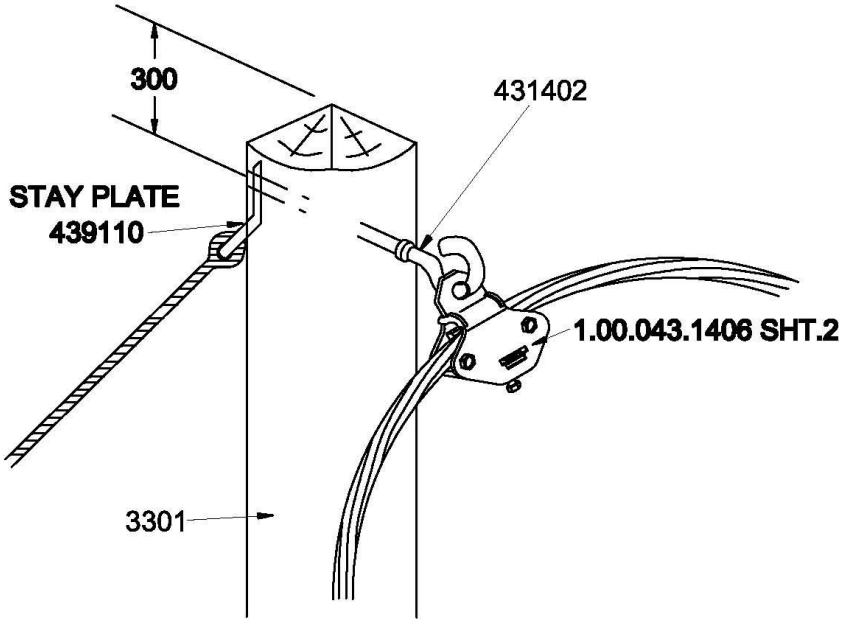
NORTHERN POWERGRID	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Manufacturer Details	ARRANGEMENT FOR TYPICAL ABC INSIDE ANGLE SUPPORT UP TO 30* LINE DEVIATION	
Sheet No. 1 / Scale N.T.S.		
Prepared By Pauline.Moore	Type ESI	ESI
Revised 13/12/11 / Grid Reference	Ref No. C147598	Historic Drg.No. 1000431204
Date Issued 23/09/05 / Checked By G HAMMEL	Revision F Notes	

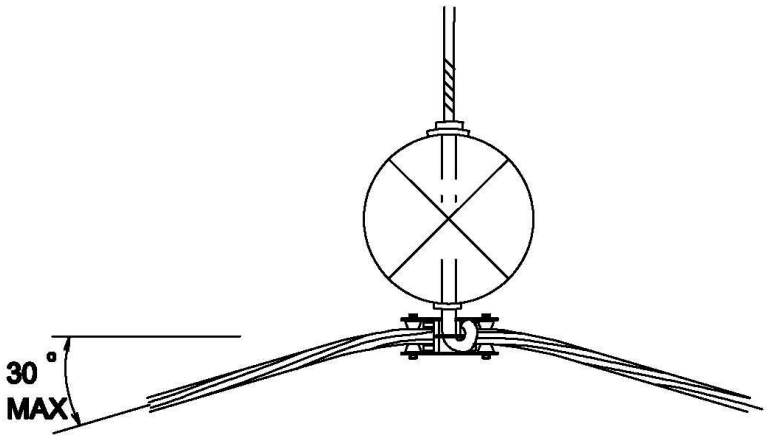
MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, Extended M20, 240 mm	431401	1	265613
Washer, Square/Curved	434605	1	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components (Were Required)			
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124
When Specified:			
Mechanical Weak Link	431405	1	262032

Arrangement of Typical ABC Inside Angle support Up to 30° Deviation

Drawing Number 1000431204





NOTES:-

1. FOR ANGLES OF DEVIATION GREATER THAN 60 ° THE CONDUCTORS MUST **BE SECTIONED SEE DRG.1.00.043.1206**
2. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I.BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO 1.09.119.....SERIES.

ISSUED BY BG **WORK SPEC.No. 04/473**

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF		
		ARRANGEMENT FOR TYPICAL ABC IINTERMEDIATE SUPPORT UP TO 60 DEGREES LINE DEVIATION		
Sheet No. 1	Scale			
Prepared By Carolyn.Palmer		Type ESI		
Revised 08/10/13	Grid Reference	Ref No. C406251	Historic Drg.No.	1000431205

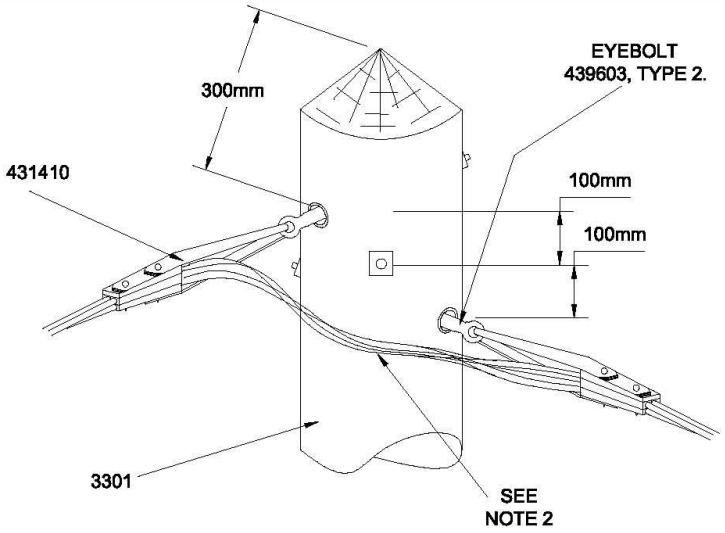
MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 240 mm	431402	1	265596
Washer, Square/Curved	434605	1	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components (Were Required)			
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124
When Specified:			
Mechanical Weak Link	431405	1	262032

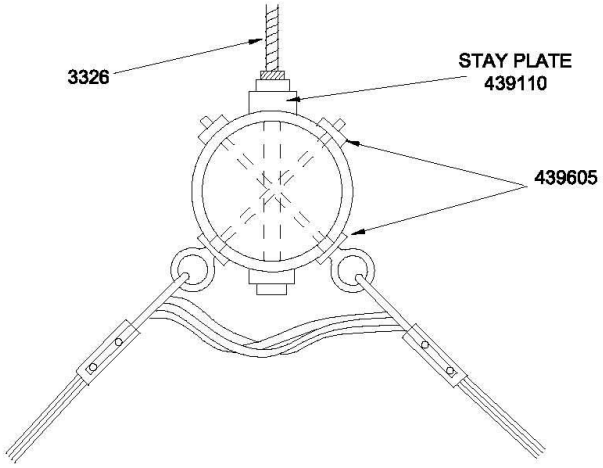
Arrangement of Typical ABC Angle support Up to 60° Deviation

Drawing Number 1000431205

Note
Where angles of deviation exceed 30° the combined angle roller suspension clamp must be supplemented with extension rollers during the conductor running out stage. See drawing 1.00.043.1406 sheet 3 for details on the additional rollers.



SEPARATION OF CROSS DRILLING TO BE A MINIMUM DISTANCE OF 100mm BETWEEN CENTRES



NOTES
1. DETAIL DRAWINGS PREFIXED 43..... REFER TO ESI BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO 1.09.119 SERIES
2. WHERE THE BUNDLE IS CUT AT THIS POINT NON TENSION CONNECTORS TO DRG No 43.9204 SHALL BE USED COVERED WITH AN INSULATING SLEEVE (CAT No 262210)
3. WHERE THE ANGLE OF DEVIATION IS LESS THAN 20* USE THE ARRANGEMENT SHOWN ON DRAWING No 43.1207

ISSUED BY: JLW

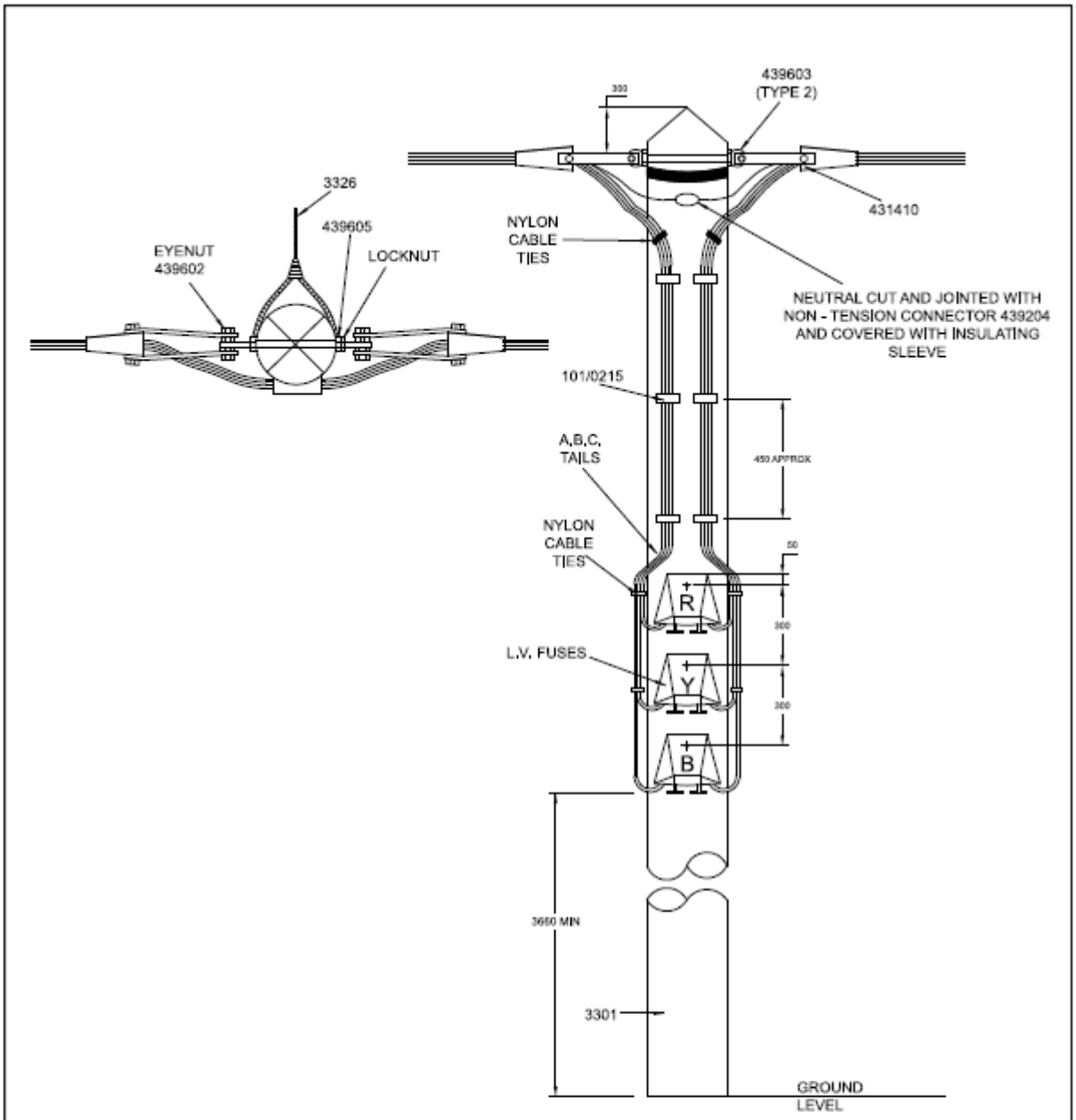
NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF ARRANGEMENT FOR TYPICAL ABC SECTION SUPPORT ANGLE 20* - 90* LINE DEVIATION
Sheet No. 1	Scale	
Prepared By Pauline.Moore		Type ESI
Revised 14/12/11	Grid Reference	Ref No. C147599 — Historic Drg.No. 1000431206
Date Issued 23/09/05	Checked By G HAMMEL	Revision F — Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Eye Bolts, M20, Type 2	439603	2	368059
Washer, Square/Curved	434605	4	368078
Anchor Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431410	1	242359
Anchor Clamp 2 x 35mm^2	431410	1	221085
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Section Angle support 20° to 90° Deviation

Drawing Number 1000431206



NOTES

1. WHERE POLE IS ERECTED ALONGSIDE A ROAD THEN FUSES SHOULD BE MOUNTED ON FOOTPATH SIDE OF ROAD IF POSSIBLE
2. CONNECTIONS TO L.V. FUSES TO BE MADE USING A LUG TO DRG 1,09,119,3157
3. WHERE THE ANGLE OF DEVIATION EXCEEDS 20° USE POLE TOP ARRANGEMENT AS SHOWN ON 431206
4. WHERE THIS ARRANGEMENT IS PROVIDED AS AN OPEN POINT ON THE LV NETWORK WITH NO FUSES INSTALLED, THEN THE FUSE TERMINALS SHALL BE SHROUDED OR A DUMMY FUSE UNIT INSTALLED TO PREVENT ACCESS TO THE BARE TERMINALS.

WORK SPEC
04/410
04/475

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

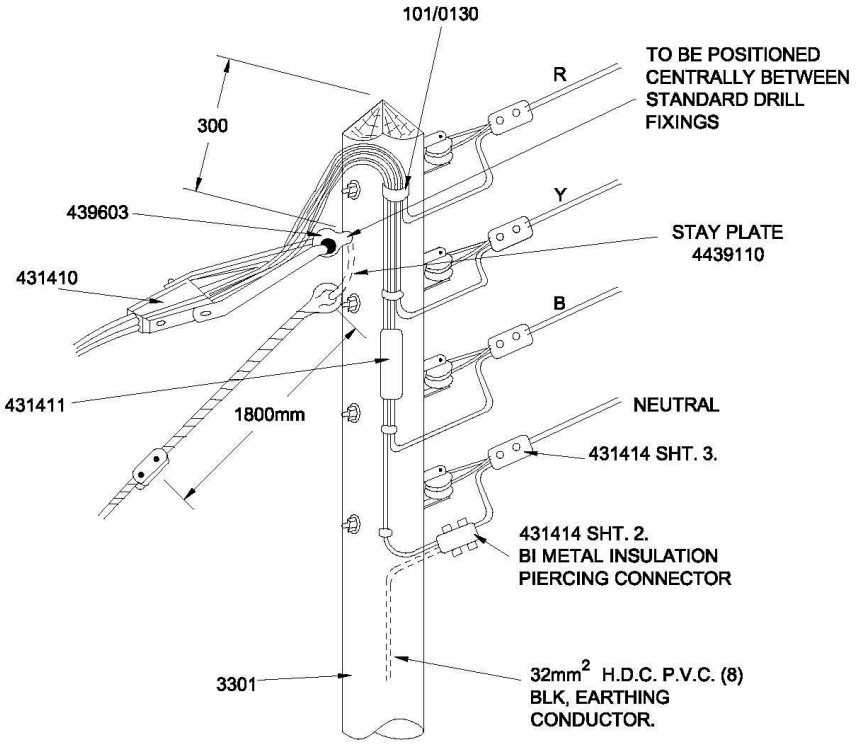
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ARRANGEMENT FOR TYPICAL ABC SECTION
SUPPORT FOR ANGLES OF DEVIATION UPTO 20°
COMPLETE WITH LV FUSES
Ref No. C147600
1000431207

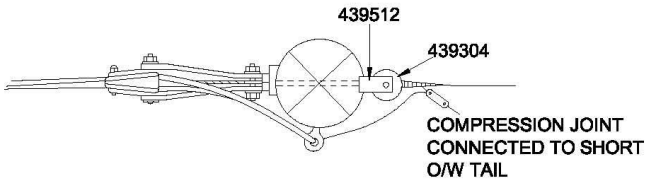
MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Eye Bolts, M20, Type 2	439603	1	368059
Eye Nut, M20	439602	1	368025
Locknut M20	-	1	378915
Washer, Square/Curved	434605	2	368078
Anchor Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431410	1	242359
Requirements for LV Section Fuses (where req)			
Non-Tension Joint Ucan 1.2	439204	1	268433
Insulated Sleeve	-	1	262210
Cable Cleats 4 x 35 mm^2 ABC	101/0215	10	244763 or
Cable Cleats 4 x 70 mm^2 ABC	101/0215	10	244778 or
Cable Cleats 4 x 120mm^2 ABC	101/0215	10	244797
Nylon Cable Ties	-	6	354111
Screw Nails, No 10 x 50 mm	-	20	371738
Lucy PC Fuse Units (Plastic)		3	184115
Cartridge Fuses (State Size)		3	To Suit
Tape, PVC, Self-Adhesive	-	-	350483
Tape, Identification, 12 mm			
Red	-	-	350642
Yellow	-	-	352686
Blue	-	-	350835
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Section Angle support Up to 20° Deviation Complete with Section Fuses

Drawing Number 1000431207





NOTES.
1. DETAIL DRAWINGS PREFIXED 43..... REFER TO ESI BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO 1.09.119 SERIES UNLESS INDICATED OTHERWISE

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

WORK SPEC 04/476

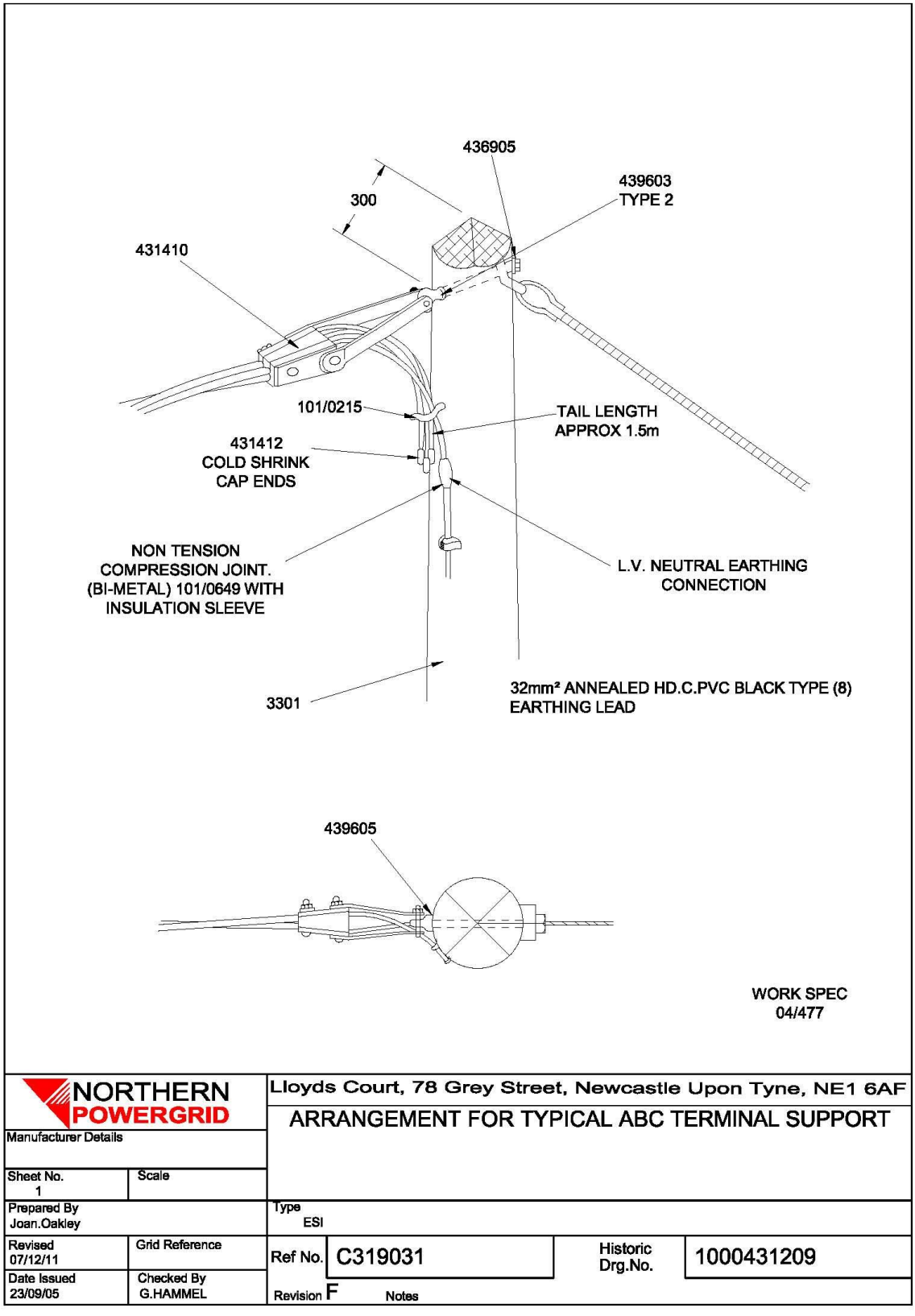
NORTHERN POWERGRID		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF		
Manufacturer Details		TRANSITION SUPPORT ABC TO OPEN WIRE SYSTEM		
Sheet No. 1	Scale			
Prepared By Joan.Oakley		Type ESI		
Revised 07/12/11	Grid Reference	Ref No. C318809	Historic Drg.No.	1000431208
Date Issued 23/09/05	Checked By G.HAMMEL	Revision F Notes		

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
See drawing 1091193304 for details of Open Wire side of Pole			
Eye Bolts, M20, Type 2	439603	1	368059
Washer, Square/Curved	434605	2	368078
Anchor Clamp (Range taking) 4 x 35mm² / 4 x 120mm² & 2 x 35mm²	431410	1	242359
Insulation Piercing Connectors	431414 sht 3	4	242024
PVC Protective Sleeving	431411	1	265774
Cable Cleats 4 x 35 mm² ABC	101/0215	3	244763 or
Cable Cleats 4 x 70 mm² ABC	101/0215	3	244778 or
Cable Cleats 4 x 120mm² ABC	101/0215	3	244797
Nylon Cable Ties	-	6	354111
Screw Nails, No 10 x 50 mm	-	20	371738
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
For PME earthing if required			
Insulation Piercing Connector	431414 sht 2	1	240090
32 mm² HDC Black PVC Insulated (6)		10m	224755
Single Core Cable Cleats		10	248815
Nails, Screw, No 10 x 2 in		10	371738
Earth Lead Casing		1	235548
Earth Electrode		1	354249
Earth Clamp		1	354338
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical Transition support between Open Wire and ABC

Drawing Number 1000431208

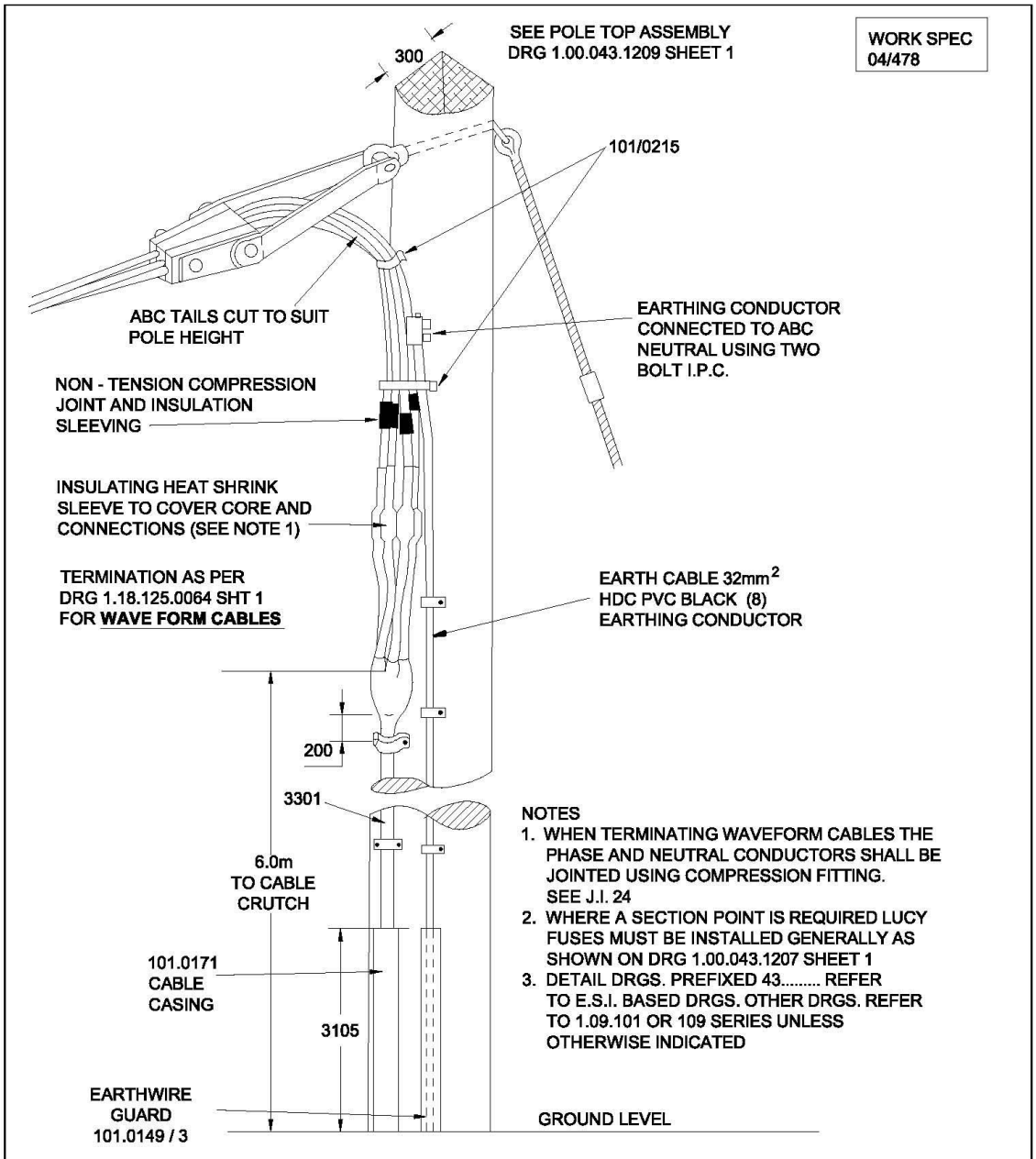

436905
439603
TYPE 2
300
431410
101/0215
TAIL LENGTH
APPROX 1.5m
431412
COLD SHRINK
CAP ENDS
NON TENSION
COMPRESSION JOINT.
(BI-METAL) 101/0649 WITH
INSULATION SLEEVE
L.V. NEUTRAL EARTHING
CONNECTION
3301
32mm² ANNEALED HD.C.PVC BLACK TYPE (8)
EARTHING LEAD
439605
WORK SPEC
04/477
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ARRANGEMENT FOR TYPICAL ABC TERMINAL SUPPORT
Sheet No. 1
Scale
Prepared By Joan.Oakley
Type ESI
Revised 07/12/11
Grid Reference
Ref No. C319031
Historic Drg.No. 1000431209
Date Issued 23/09/05
Checked By G.HAMMEL
Revision F
Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
See drawing 1091193304 for details of Open Wire side of Pole			
Eye Bolts, M20, Type 2	439603	1	368059
Washer, Square/Curved	434605	2	368078
Anchor Clamp (Range taking) 4 x 35mm² / 4 x 120mm² & 2 x 35mm²	431410	1	242359
Cable Cleats 4 x 35 mm² ABC	101/0215	2	244763 or
Cable Cleats 4 x 70 mm² ABC	101/0215	2	244778 or
Cable Cleats 4 x 120mm² ABC	101/0215	2	244797
Nylon Cable Ties	-	6	354111
Screw Nails, No 10 x 50 mm	-	20	371738
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
For PME earthing if required			
Non-Tension Joint	101/0649	1	246932
Cable Joint Insulating Sleeve	-	1	262210
32 mm² HDC Black PVC Insulated (6)		10m	224755
Single Core Cable Cleats		10	248815
Nails, Screw, No 10 x 2 in		10	371738
Earth Lead Casing		1	235548
Earth Electrode		1	354249
Earth Clamp		1	354338
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Terminal Support

Drawing Number 1000431209



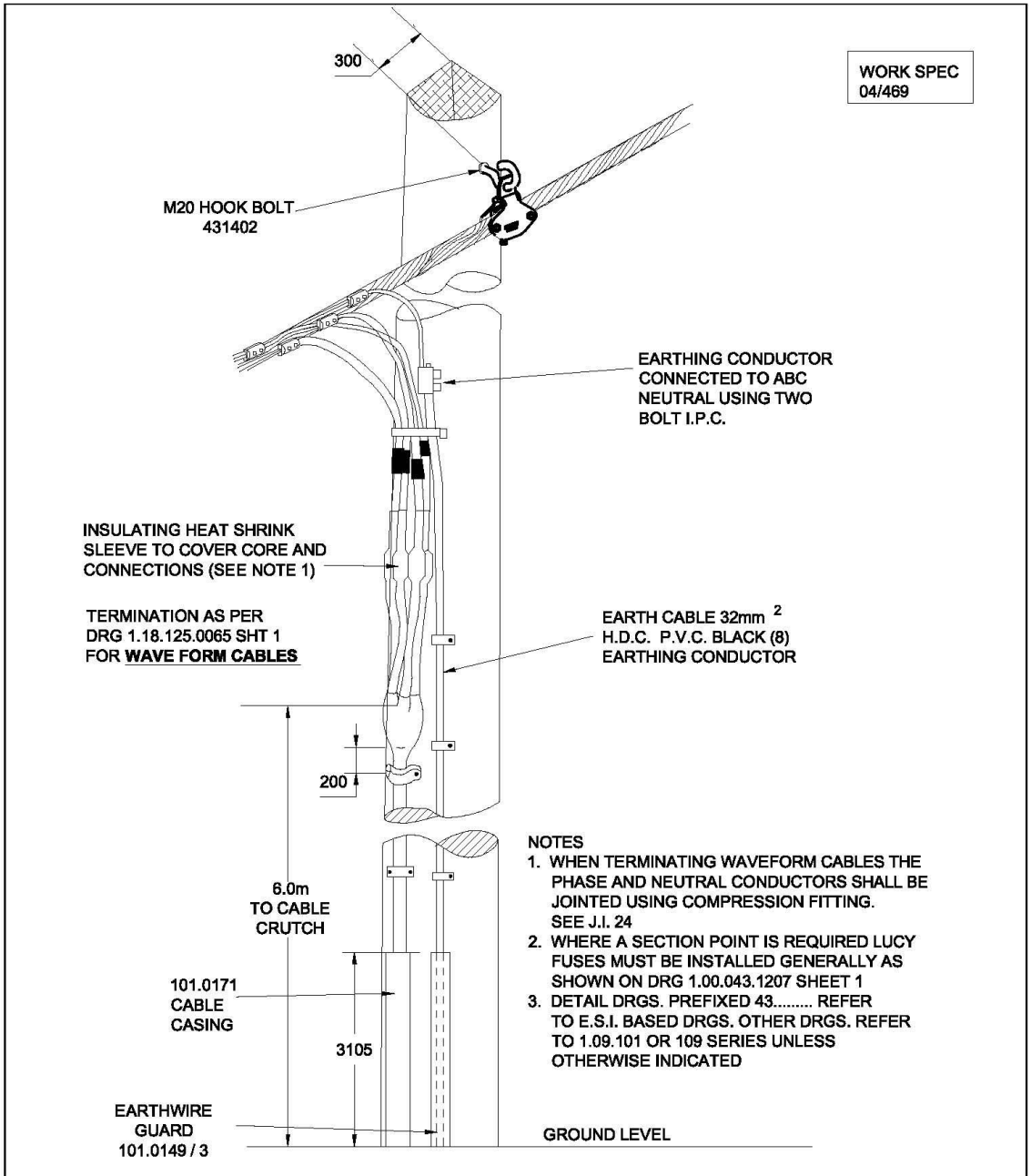
NORTHERN POWERGRID	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details	ARRANGEMENT FOR TYPICAL ABC TERMINAL SUPPORT WITH HEAT SHRINK CABLE TERMINATION
Sheet No. 1 / Scale	
Prepared By Joan.Oakley	Type ESI
Revised 15/12/11 / Grid Reference	Ref No. C147603 — Historic Drg.No. 1000431210
Date Issued 23/09/05 / Checked By G HAMMEL	Revision / Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Eye Bolts, M20, Type 2	439603	1	368059
Washer, Square/Curved	434605	2	368078
Anchor Clamp (Range taking) 4 x 35mm² / 4 x 120mm² & 2 x 35mm²	431410	1	242359
Cable Cleats 4 x 35 mm² ABC	101/0215	5	244763 or
Cable Cleats 4 x 70 mm² ABC	101/0215	5	244778 or
Cable Cleats 4 x 120mm² ABC	101/0215	5	244797
Cable Joint Insulating Sleeve	-	1	262210
Cable Guard - Fibre Glass	101/0171	1	To Suit
Screw Nails, No 10 x 50 mm	-	10	371738
Waveform Cable Termination Kit - 70 - 95mm	1.18.125.0064	1	086645
Waveform Cable Termination Kit - 120 - 300mm	1.18.125.0064	1	086660
Compression connectors to suit cable combination	-	-	To Suit
Insulation Piercing Connector	431414 sht 2	1	262070
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
For PME earthing if required			
Non-Tension Joint	101/0649	1	246932
Cable Joint Insulating Sleeve	-	1	262210
32 mm² HDC Black PVC Insulated (6)		10m	224755
Single Core Cable Cleats		10	248815
Nails, Screw, No 10 x 2 in		10	371738
Earth Lead Casing		1	235548
Earth Electrode		1	354249
Earth Clamp		1	354338
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Terminal Support with Heat Shrink Cable Termination

Drawing Number 1000431210 sht1



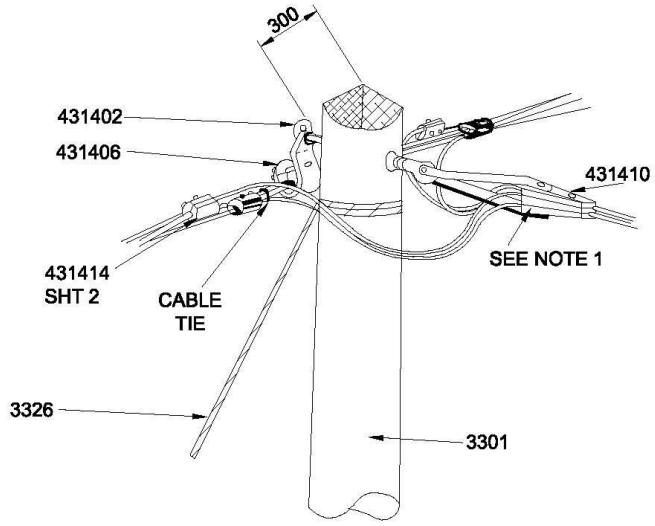
NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
		ARRANGEMENT FOR TYPICAL ABC TEE - OFF FROM INTERMEDIATE SUPPORT WITH HEAT SHRINK CABLE TERMINATION
Sheet No. 2	Scale	
Prepared By Joan.Oakley		Type ESI
Revised 15/12/11	Grid Reference	Ref No. C147605 — Historic Drg.No. 1000431210
Date Issued 23/09/05	Checked By G HAMMEL	Revision E Notes

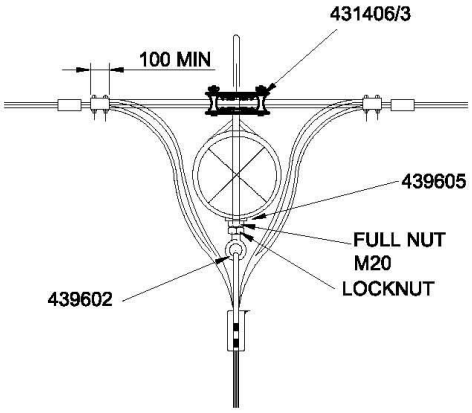
MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220mm	431402	1	265596
Washer, Square/Curved	434605	2	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Cable Cleats 4 x 35 mm^2 ABC	101/0215	5	244763 or
Cable Cleats 4 x 70 mm^2 ABC	101/0215	5	244778 or
Cable Cleats 4 x 120mm^2 ABC	101/0215	5	244797
Cable Joint Insulating Sleeve	-	1	262210
Cable Guard - Fibre Glass	101/0171	1	To Suit
Screw Nails, No 10 x 50 mm	-	10	371738
Waveform Cable Termination Kit - 70 - 95mm	1.18.125.0064	1	086645
Waveform Cable Termination Kit - 120 - 300mm	1.18.125.0064	1	086660
Compression connectors to suit cable combination	-	-	To Suit
Insulation Piercing Connector	431414 sht 2	1	262070
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
For PME earthing if required			
Non-Tension Joint	101/0649	1	246932
Cable Joint Insulating Sleeve	-	1	262210
32 mm^2 HDC Black PVC Insulated (6)		10m	224755
Single Core Cable Cleats		10	248815
Nails, Screw, No 10 x 2 in		10	371738
Earth Lead Casing		1	235548
Earth Electrode		1	354249
Earth Clamp		1	354338
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Intermediate Support with Heat Shrink Cable Termination

Drawing Number 1000431210 sht2





NOTES:
1. WHERE A SECTION POINT IS REQUIRED, LUCY FUSES MUST BE INSTALLED GENERALLY AS SHOWN ON DRG No 1.00.043.1207
2. DETAIL DRAWINGS PREFIXED 43..... REFER TO E.S.I. BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO 1.09.119 SERIES

WORK SPEC
04/479

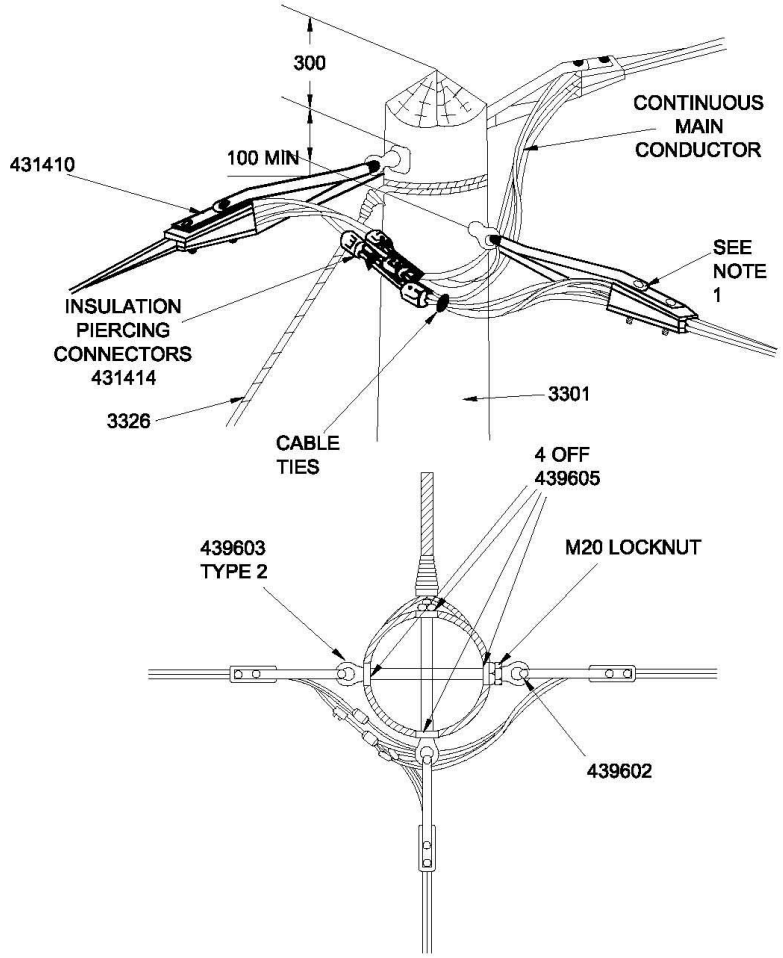
NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF ARRANGEMENT FOR TYPICAL ABC TEE - OFF FROM INTERMEDIATE SUPPORT
Sheet No. 1	Scale	
Prepared By Joan.Oakley		Type ESI
Revised 07/12/11	Grid Reference	Ref No. C147606 — Historic Drg.No. 1000431211
Date Issued 01/09/05	Checked By G HAMMEL	Revision D Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220mm	431402	1	265596
Locknut M20	-	1	378915
Eyenut M20	439602	1	368025
Washer, Square/Curved	434605	2	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Insulation Piercing Connector	431414 sht 2	4	241996
Nylon Cable Ties	-	4	354094
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Tee-Off from Intermediate Support

Drawing Number 1000431211 sht1



NOTES
1, WHERE A SECTION POINT IS REQUIRED. LUCY FUSES MUST BE INSTALLED GENERALLY AS SHOWN ON DRAWING No 1.00.043.1207
2. DETAIL DRAWINGS PREFIXED 43..... REFER TO E.S.I. BASED DRAWINGS, AND OTHER DETAILED DRAWINGS REFER TO 1.09.119. SERIES

WORK SPEC 04/480

ISSUED BY JLW/BG

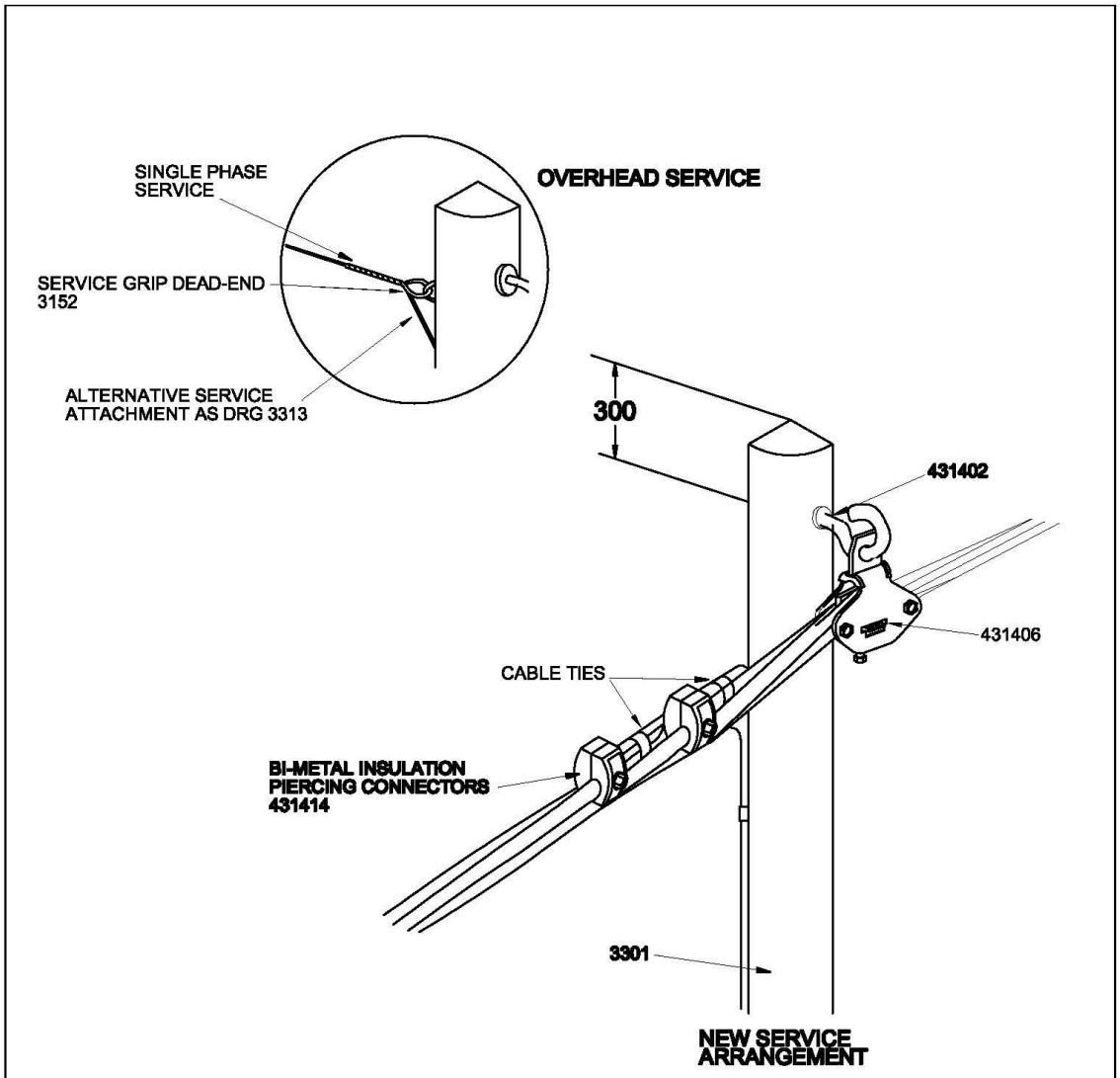
NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF ARRANGEMENT FOR TYPICAL ABC TEE - OFF FROM SECTION SUPPORT
Sheet No. 1	Scale	
Prepared By Pauline.Moore		Type ESI
Revised 15/12/11	Grid Reference	Ref No. C319030 / Historic Drg.No. 1000431212
Date Issued 03/03/05	Checked By G.HAMMEL	Revision D Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Eye Bolts, M20, Type 2	439603	1	368059
Locknut M20	-	1	378915
Eyenut M20	439602	1	368025
Washer, Square/Curved	434605	2	368078
Anchor Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431410	1	242359
Insulation Piercing Connector	431414 sht 2	4	241996
Nylon Cable Ties	-	4	354094
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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
Stay Components			
Bolt M20 x 220mm	-	1	378756
Washer, Square/Curved	434605	2	368078
Stay dead end	0541 item 1	3	255217
Pole Top dead end	0541 item 2	1	250209
Stay Thimble	9109	1	244922
Stay Plate	9110	1	237124
Stay Wire - 7/4.00mm Grade 1150		To suit	229609
Stay Insulator (type 1)	9107	1	248232
Stay Rod	9101		231477
Stay Block	9103 sht 2		235124

Arrangement of Typical ABC Tee-Off Section Support

Drawing Number 1000431212 sht1



NOTES:-
1. NEUTRAL CONNECTOR TO BE ATTACHED ADJACEMENT TO PHASE CONNECTOR.
2. DETAIL DRGS. REFIXED 43.... REFER TO ESI BASED DRGS.
   AND OTHER DETAIL DRGS. REFER TO 1 09 119 SERIES.

ISSUED BY JLW 23/09/05

WORK SPEC 04/482

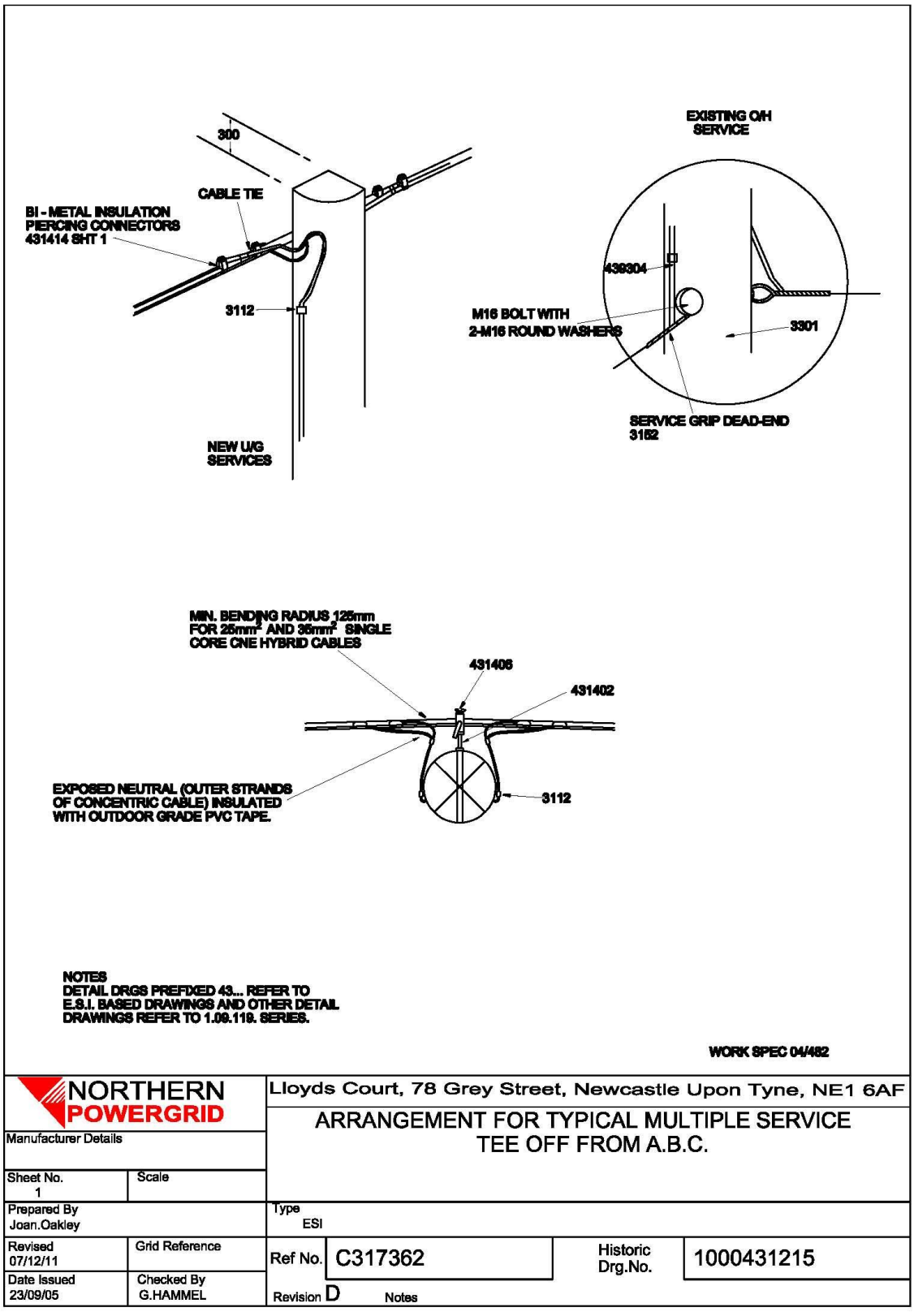
NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF ARRANGEMENT FOR TYPICAL SINGLE PHASE SERVICE FROM ABC SUPPORT
Sheet No. 1	Scale N.T.S.	
Prepared By Pauline.Moore		Type ESI
Revised 15/12/11	Grid Reference	Ref No. C147611 — Historic Drg.No. 1000431214
Date Issued 23/09/05	Checked By G HAMMEL	Revision F — Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220mm	431402	1	265596
Washer, Square/Curved	434605	2	368078
Suspension Roller Clamp (Range taking) 4 x 35mm² / 4 x 120mm² & 2 x 35mm²	431406	1	242217
Insulation Piercing Connector	431414 sht 1	2	242132
Nylon Cable Ties	-	2	354094
Coachscrew Service Insulator	9305	1	253868
Single Cable Cleat	3112	1	248815
Service Grip Dead Ends	3152	As Req	To Suit
Or			
Anchor Clamp 2 x 35mm ABC - Reduced Tension 1.4kN	-	1	221077
Anchor Clamp 4 x 35mm ABC - Reduced Tension 1.4kN	-	*2*	221069
Eye Bolts, M20, Type 2	439603	1	368059
Washer, Square/Curved	439605	1	368075
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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

Arrangement of Typical Single Service Phase Service from ABC Intermediate Support

Drawing Number 1000431214 sht1

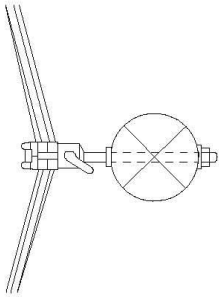

300
CABLE TIE
BI - METAL INSULATION PIERCING CONNECTORS 431414 SHT 1
3112
NEW U/G SERVICES
EXISTING O/H SERVICE
430304
M16 BOLT WITH 2-M16 ROUND WASHERS
3301
SERVICE GRIP DEAD-END 3102
MIN. BENDING RADIUS 125mm FOR 25mm² AND 35mm² SINGLE CORE CNE HYBRID CABLES
431406
431402
EXPOSED NEUTRAL (OUTER STRANDS OF CONCENTRIC CABLE) INSULATED WITH OUTDOOR GRADE PVC TAPE.
3112
NOTES
DETAIL DRGS PREFIXED 43... REFER TO E.S.I. BASED DRAWINGS AND OTHER DETAIL DRAWINGS REFER TO 1.09.119. SERIES.
WORK SPEC 04/482
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ARRANGEMENT FOR TYPICAL MULTIPLE SERVICE TEE OFF FROM A.B.C.
Sheet No. 1
Scale
Prepared By Joan.Oakley
Type ESI
Revised 07/12/11
Grid Reference
Ref No. C317362
Historic Drg.No. 1000431215
Date Issued 23/09/05
Checked By G.HAMMEL
Revision D
Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220mm	431402	1	265596
Washer, Square/Curved	434605	2	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Insulation Piercing Connector	431414 sht 1	As req	242132
Nylon Cable Ties	-	As req	354094
Coachscrew Service Insulator	9305	As req	253868
Single Cable Cleat	3112	As req	248815
Service Grip Dead Ends	3152	As Req	To Suit
Or			
Anchor Clamp 2 x 35mm ABC - Reduced Tension 1.4kN	-	*2*	221077
Anchor Clamp 4 x 35mm ABC - Reduced Tension 1.4kN	-	*2*	221069
Eye Bolts, M20, Type 2	439603	2	368059
Washer, Square/Curved	439605	2	368075
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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

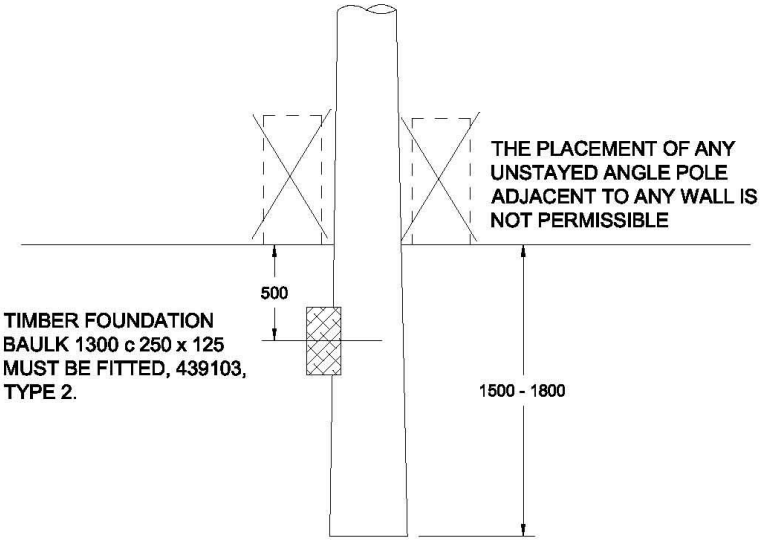
Arrangement of Typical Multiple Service Take off from ABC Intermediate Support

Drawing Number 1000431215 sht1



POLE HEAD ARRANGEMENT
AS 431203

ANGLE OF DEVIATION
NOT TO BE GREATER
THAN VALUES GIVEN
IN CHARTS 1, 2, 3 & 4



ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

ISSUED BY JLW 18/07/05

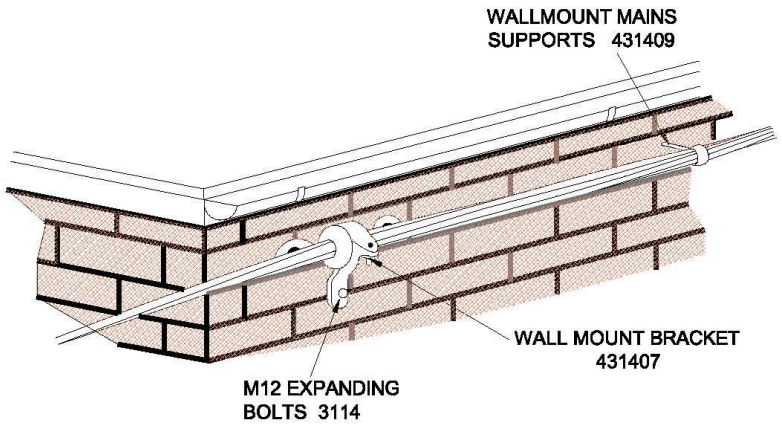
NORTHERN POWERGRID		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details		INTERMEDIATE SMALL ANGLE SUPPORT WITHOUT STRUT OR STAY
Sheet No. 1	Scale N.T.S.	
Prepared By Pauline.Moore		Type PLANNING SYSTEM
Revised 15/12/11	Grid Reference	Ref No. C1004465 Historic Drg.No. 1000431216
Date Issued 15/12/11	Checked By G HAMMEL	Revision C Notes

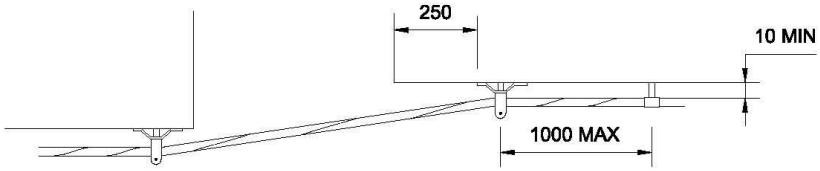
MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220mm	431402	1	265596
Washer, Square/Curved	434605	2	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Foundation Block	439103 sht2	*1*	235124
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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

Arrangement of Typical Multiple Service Take off from ABC Intermediate Support

Drawing Number 1000431216 sht1

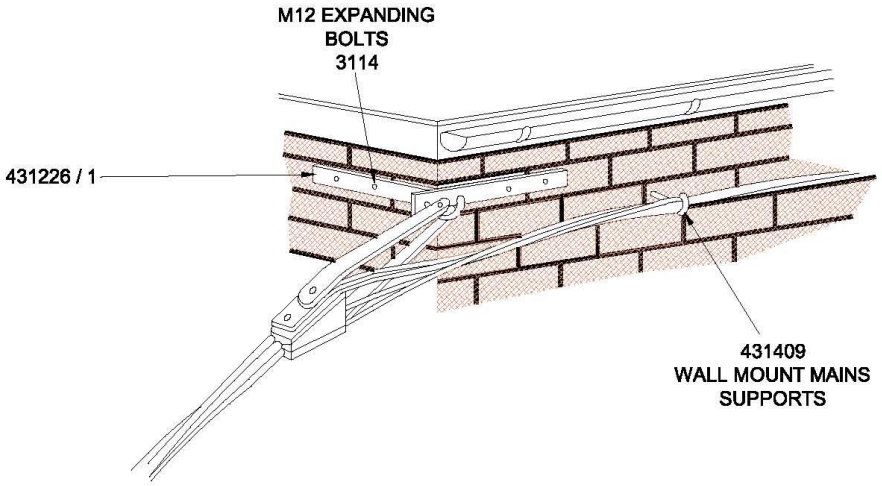


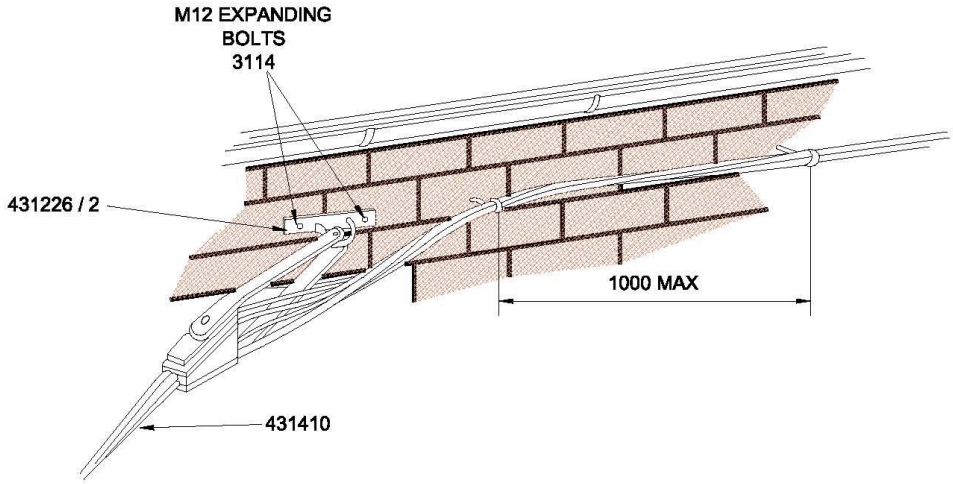


NOTES:
DETAIL DRAWINGS PREFIXED 43 ..... REFER TO ESI BASED DRAWINGS AND OTHER DETAILED DRAWINGS REFER TO 1.09.119 ..... SERIES

ISSUED BY BG

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF TYPICAL ATTACHMENT FOR ABC ON AND BETWEEN BUILDINGS
Sheet No. 1	Scale	
Prepared By Pauline.Moore		Type ESI
Revised 15/12/11	Grid Reference	Ref No. C316865 Historic Drg.No. 1000431217
Date Issued 01/08/05	Checked By G.HAMMEL	Revision C Notes





NOTES:
1. DETAIL DRAWINGS PREFIXED 43..... REFER TO E.S.I. BASED DRAWINGS
   OTHER DETAILED DRAWINGS REFER TO 1.09.119..... SERIES
2. ERECTION TENSION LIMITED BY FIXING MEDIUM STRUCTURE STRENGTH
   SEE O.H.I. 5 FOR DETAILS

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

NORTHERN POWERGRID		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details		ARRANGEMENT OF TYPICAL ATTACHMENTS TO BUILDING
Sheet No. 2	Scale	
Prepared By Joan.Oakley		Type ESI
Revised 07/12/11	Grid Reference	Ref No. C316867 / Historic Drg.No. 1000431217
Date Issued 01/08/05	Checked By G.HAMMEL	Revision E Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
House service bracket	439510	1	241341or
House service bracket	439514	1	242236
Support Wall mains 100mm stand off	431409	1	262051
Wall Mount bracket	431407	1	To Suit
Fixings used with above brackets			
Bolts, M12 Expanding	-	2	371121

Typical Attachment for ABC on and between buildings

Drawing Number 1000431217 sht1 & 2

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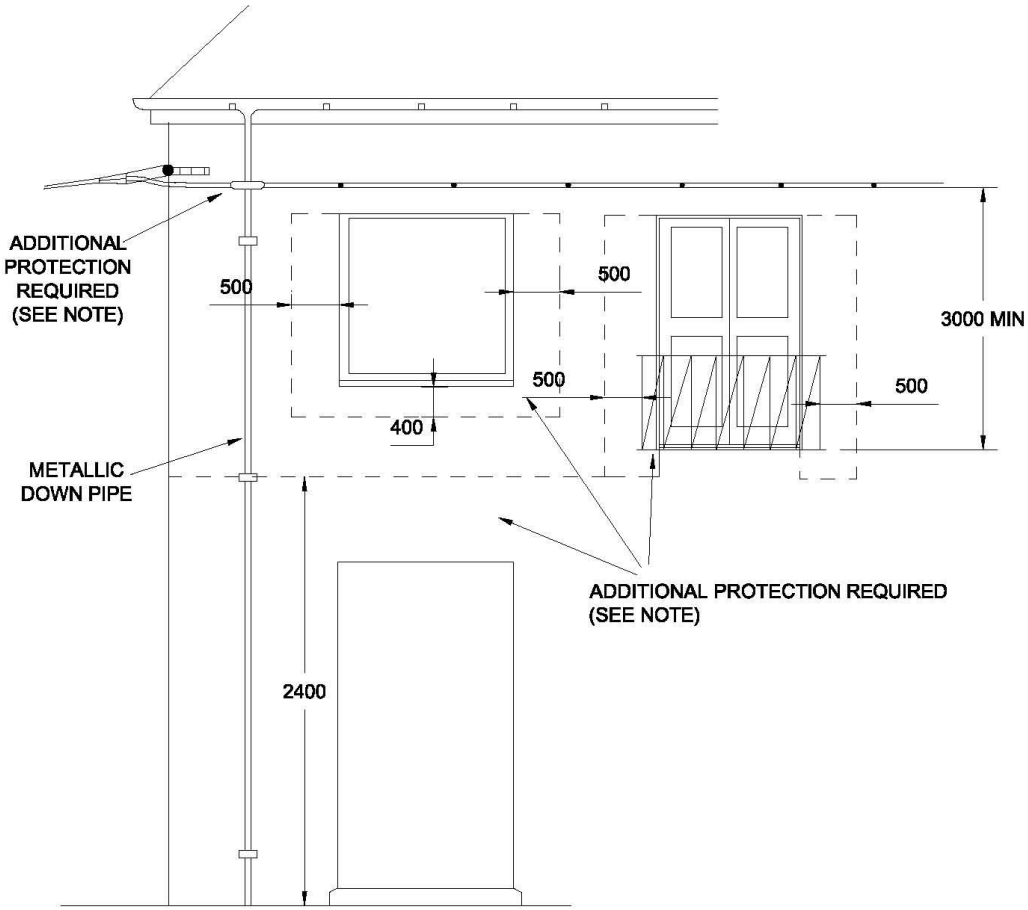
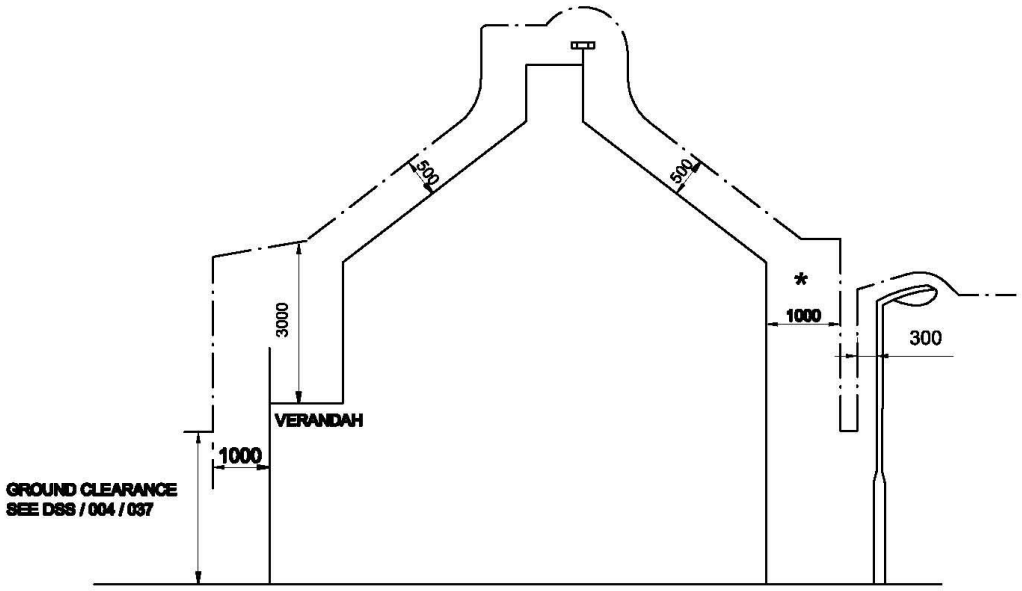


NOTES
1. WHERE ADDITIONAL PROTECTION IS REQUIRED AROUND WINDOWS AND METALLIC PIPEWORK ETC., THEN THIS SHALL BE PROVIDED BY MEANS OF A FLEXIBLE PVC SLEEVING AS SHOWN ON DRG No 1.00.043.1411

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF AREAS REQUIRING PROXIMITY PROTECTION
Sheet No. 1	Scale	
Prepared By Caralyn.Palmer		Type ESI
Revised 04/10/13	Grid Reference	Ref No. C319026 — Historic Drg.No. 1000431219
Date Issued 23/09/05	Checked By G.HAMMEL	Revision F — Notes



NO ABC WITHIN THIS LINE

* THIS CLEARANCE MAY BE REDUCED TO 500 IN THE CASE OF BLANK WALLS.

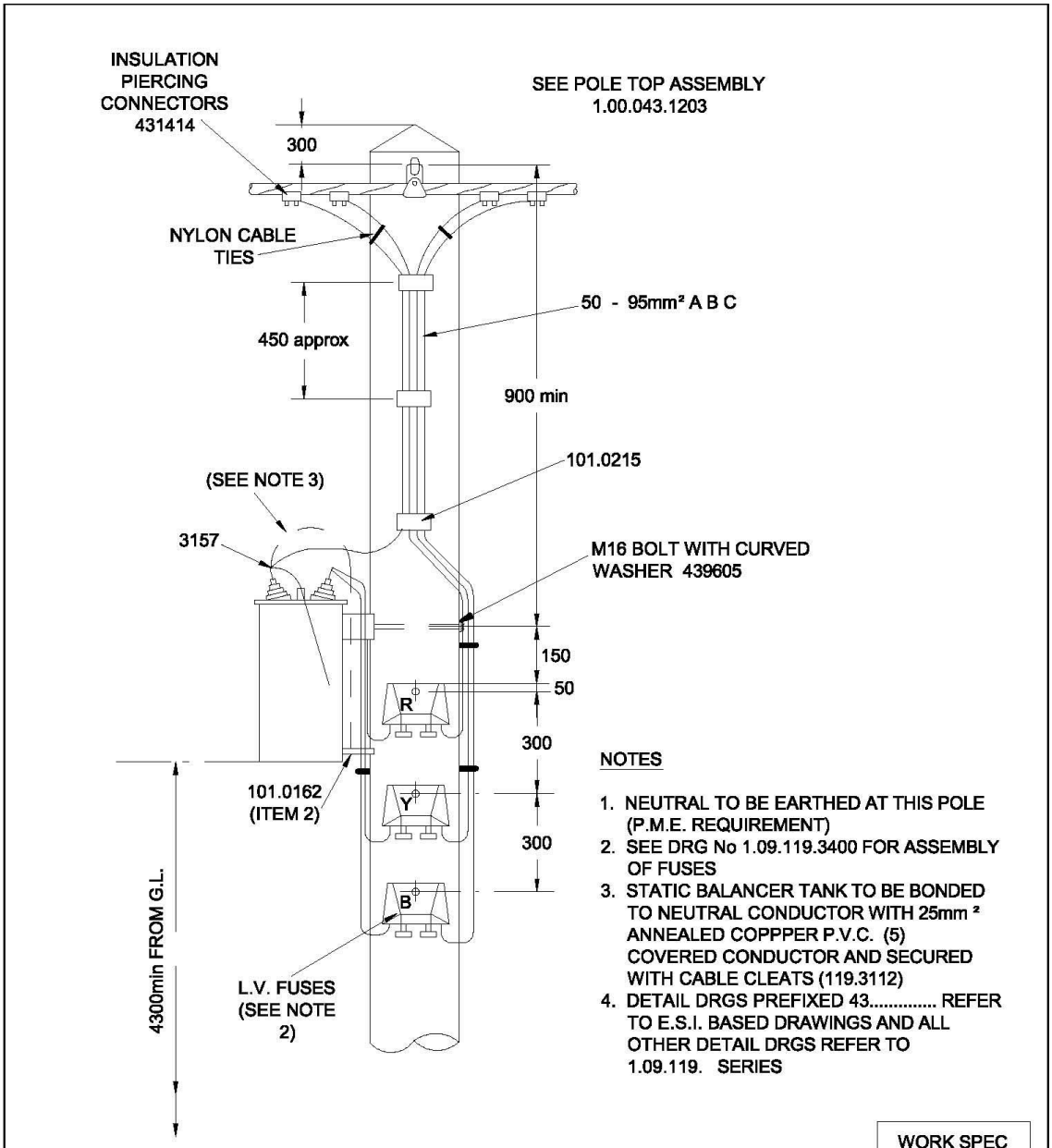
NOTE

THE MIN.CLEARANCES SPECIFIED ABOVE WHEN THE ABC IS OPERATING AT 75° CENTIGRADE AND SWUNG OUT AT AN ANGULAR DEFLECTION OF 45 °

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

ISSUED BY JLW/BG ON 23/09/05

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF MINIMUM CLEARANCE OF AERIAL SYSTEMS ON POLES FROM BUILDINGS AND STRUCTURES
Sheet No. 1	Scale	
Prepared By Pauline.Moore		Type ESI
Revised 15/12/11	Grid Reference	Ref No. C147617 — Historic Drg.No. 1000431220
Date Issued 23/09/05	Checked By G HAMMEL	Revision F — Notes

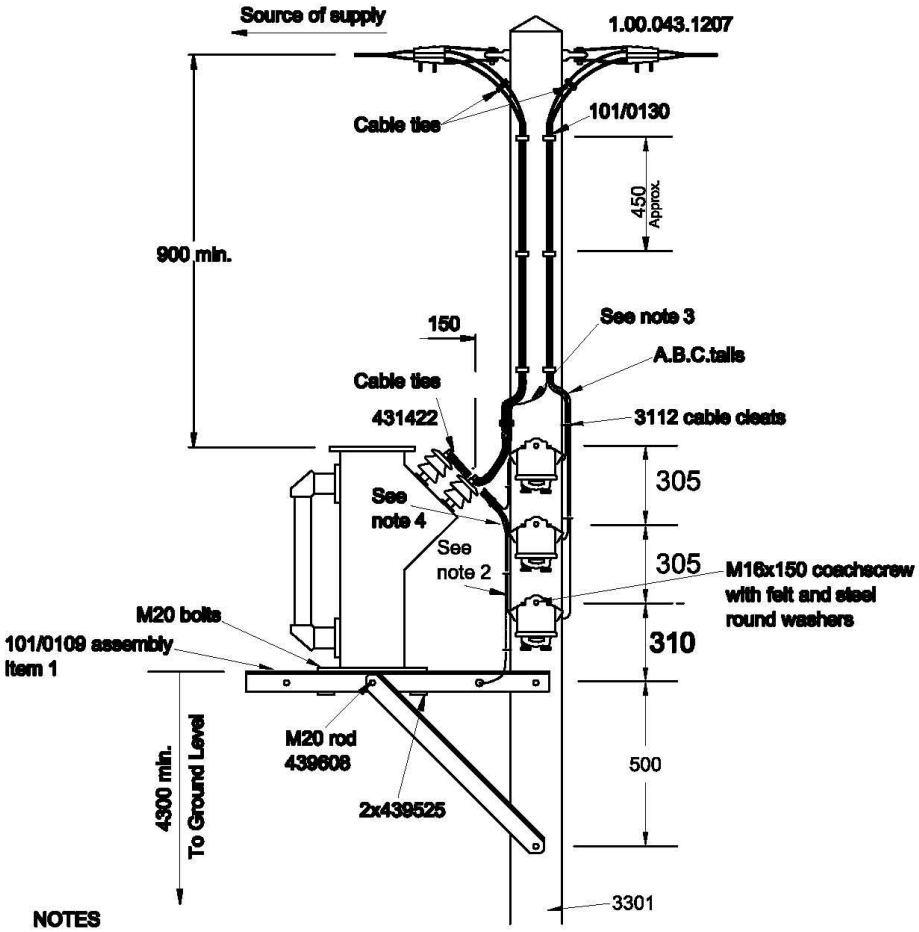

INSULATION PIERCING CONNECTORS 431414
SEE POLE TOP ASSEMBLY 1.00.043.1203
300
NYLON CABLE TIES
50 - 95mm² A B C
450 approx
900 min
101.0215
(SEE NOTE 3)
3157
M16 BOLT WITH CURVED WASHER 439605
150
50
R
300
Y
300
B
101.0162 (ITEM 2)
4300min FROM G.L.
L.V. FUSES (SEE NOTE 2)
NOTES
1. NEUTRAL TO BE EARTHED AT THIS POLE (P.M.E. REQUIREMENT)
2. SEE DRG No 1.09.119.3400 FOR ASSEMBLY OF FUSES
3. STATIC BALANCER TANK TO BE BONDED TO NEUTRAL CONDUCTOR WITH 25mm ² ANNEALED COPPPER P.V.C. (5) COVERED CONDUCTOR AND SECURED WITH CABLE CLEATS (119.3112)
4. DETAIL DRGS PREFIXED 43..... REFER TO E.S.I. BASED DRAWINGS AND ALL OTHER DETAIL DRGS REFER TO 1.09.119. SERIES
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
WORK SPEC 04 / 484
ISSUED BY JLW/BS
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ARRANGEMENT OF STATIC BALANCER ON WOOD POLE
Manufacturer Details
Sheet No. 1
Scale
Prepared By Pauline.Moore
Type ESI
Revised 15/12/11
Grid Reference
Ref No. C316866
Historic Drg.No. 1000431222
Date Issued 01/08/05
Checked By G.HAMMEL
Revision D
Notes

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Hook Bolt, M20, 220mm	431402	1	265596
Washer, Square/Curved	434605	2	368078
Suspension Roller Clamp (Range taking) 4 x 35mm^2 / 4 x 120mm^2 & 2 x 35mm^2	431406	1	242217
Bolt Galv M20 x 300	-	1	378794
Washer Galv, Round	-	1	375616
Washer, Square/Curved	434605	1	368078
Bolt, earthing	101/0162	1	370491
Insulation Piercing Connector	431414 sht 2	4	241996
Nylon Cable Ties	-	8	354094
Lugs, Compression BL5	101/0237	4	To Suit
Lugs Compression, VPCL 1.1	101/0237	2	268838
4 x 70mm ABC		6m	226031
4 x 120mm ABC		6m	226021
Cable Cleats 4 x 70 mm^2 ABC	101/0215	6	244778 or
Cable Cleats 4 x 120mm^2 ABC	101/0215	6	244797
Single Way, Cable Cleats	3112	8	248815
Nails, Screw No 10 x 2 in		20	371738
For PME earthing if required			
Insulation Piercing Connector	431414 sht 2	1	240090
32 mm^2 HDC Black PVC Insulated (6)		10m	224755
Single Core Cable Cleats		10	248815
Nails, Screw, No 10 x 2 in		10	371738
Earth Lead Casing		1	235548
Earth Electrode		1	354249
Earth Clamp		1	354338
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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

Arrangement of ABC Supplying a Static Balancer

Drawing Number 1000431222 sht1



NOTES

1. Neutral may be earthed at this pole if P.M.E. is applied to the network
2. Steelwork to be bonded to neutral conductor by means of 32mm^2 annealed copper p.v.c. and secured using cable cleats
3. Neutral of A.B.C. taken to a common neutral connection
4. 70-120mm A.B.C. used to connect regulator to fuses
5. Detail drgs prefixed 43... refer to ESI based drgs and

ISSUED BY JLW/BS

NORTHERN POWERGRID		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF		
Manufacturer Details		ARRANGEMENT OF PLATFORM MOUNTED 3 PHASE REGULATOR ON WOOD POLE		
Sheet No. 1	Scale			
Prepared By Pauline.Moore		Type ESI		
Revised 15/12/11	Grid Reference	Ref No. C147619	Historic Drg.No.	1000431223
Date Issued 23/09/05	Checked By G HAMMEL	Revision D Notes		

MATERIALS LIST

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Eye Bolts, M20, Type 2	439603	1	368059
Eye Nut, M20	439602	1	368025
Locknut M20	-	1	378915
Washer, Square/Curved	434605	2	368078
Anchor Clamp (Range taking) 4 x 35mm² / 4 x 120mm² & 2 x 35mm²	431410	1	242359
Lucy PC Fuse Units (Plastic)		3	184115
Cartridge Fuses (State Size)		3	To Suit
Support Platform Kit	101/0612 sht 8	2	245306
Bolt Galv M20 x 300	-	1	378794
Rod, Tie M20, 330	439608 item 4	1	375828
Bolts M20 x 140mm	-	4	378101
Washer Galv, Round	-	8	375616
Washer, Square/Curved	434605	1	368078
Bolt, earthing	101/0162	1	370491
Lugs, Compression BL5	101/0237	8	To Suit
Lugs Compression, VPCL 1.1	101/0237	2	268838
4 x 70mm ABC		6m	226031
4 x 120mm ABC		6m	226021
Cable Cleats 4 x 70 mm² ABC	101/0215	6	244778 or
Cable Cleats 4 x 120mm² ABC	101/0215	6	244797
Single Way, Cable Cleats	3112	8	248815
Nails, Screw No 10 x 2 in		20	371738
For PME earthing			
Insulation Piercing Connector	431414 sht 2	1	240090
32 mm² HDC Black PVC Insulated (6)		10m	224755
Single Core Cable Cleats		10	248815
Nails, Screw, No 10 x 2 in		10	371738
Earth Lead Casing		1	235548
Earth Electrode		1	354249
Earth Clamp		1	354338
Signs & Notices			
Number Plate (select cat numbers to suit)	0228 sht3	To Suit	To Suit
Base Plate	0228 sht3	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

Arrangement of Platform Mounted 3 Phase Regulator on Wood pole

Drawing Number 100043123 sht1