NSP/004/104 (OHI 4) - Guidance on the Types and Installation Requirements for Stays

1. Purpose

The purpose of this document is to provide guidance on the types and installation requirements for stays on all wood pole constructions used on the Northern Powergrid distribution system.

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

Document Reference	Document Title	Version	Published Date
NSP/004/104	Guidance on the Types and Installation Requirements for Stays	5.1	July 2019

2. Scope

This document provides guidance on the types, rating and installation requirements for stay assemblies and their individual components. This guidance relates to all voltages up to and including 132kV. The network product specifications relating to this guidance document are:

- NPS/001/005 - Technical Specification for Overhead Line Steelwork, Conductor Fittings, Insulator Fittings and Stay Fittings
- NPS/001/006 - Technical Specification for Insulators for Overhead Lines up to and including 132kV
- NPS/001/013 - Technical Specification for Galvanised Steel Stay Wire
- NPS/001/020 - Technical Specification for Stay Ground Anchors for Overhead Lines

The following appendices are included within this document:

- Appendix 1 - LV Stay Arrangement
- Appendix 2 - 11kV to 33kV Typical Arrangement
- Appendix 3 - 11kV to 33kV Alternative Stay Arrangement (LV Only)
- Appendix 4 - Typical CE/OM/DC1 Stay Arrangement
- Appendix 5 - Typical CE/C/37 Stay Arrangement
- Appendix 6 - 66kV/132kV Typical Arrangement
- Appendix 7 - Stay Make offs
- Appendix 8 - Platipus Utility System
- Appendix 9 - Installation Instructions for Augured Ground Anchor Systems

2.1. Table of Contents

3. Technical Specification

3.1. Background

Stays are fitted to poles to counteract conductor tension forces and restrain deflection of the pole top into the conductor span, thereby maintaining poles plumb, at angle and terminal positions. To allow for this, new poles should be erected leaning slightly towards the stays when initially made off with the threaded shank of the stay rod inserted not less than 40 mm into the stay barrel.

The optimum angle between the pole and the stay should be 45°, but in practice this is not always possible. Design specifications must be reviewed to confirm that stays are allowed at lesser angles. In all cases the minimum stay angle shall be 30° between stay and pole. A range of stay charts have been produced for different line specifications detailing permissible stay angles below 45°. See clause 3.13 for further details.

3.2. Stay Arrangements

The general arrangement of stays for the different types of construction shall be as follows:

Construction (Related Specifications)	Arrangement Drawing
LV Construction (NSP/004/041)	1091193326
HV Construction (NSP/004/042)	1000439108
Legacy 33/66kV Construction CE/C/37 & CE/OM/DC1 (DSS/004/040)	Y204L0501 or Y205L0501
33/66/132kV Construction OHL 4 / OHL 9 (NSP/004/045) (Arrangement drawing 1091231192 requires the use of 439113 stay straps)	1091231166

3.2.1. Strut Poles

Under exceptional circumstances where no other traditional stayed support can be utilised due to wayleave or access problems, a strut pole arrangement as shown on the following drawings may be utilised.

The use of this arrangement is limited to low voltage lines and high voltage lines with a maximum conductor CSA of 50mm AAAC or copper equivalent.

Voltage	Conductor CSA	Max Angle of Deviation	Drawing Arrangement
11 - 20kV	50mm AAAC	30°	1000434001 sht 2
LV	All conductor Sizes	30°	1091193331

3.3. Stay Wire

The stay wire used shall be in accordance with Northern Powergrid network product specification NPS/001/013.

- Manufactured from 7 strands of 4.00mm diameter grade 1150 galvanised wire (7/4.00mm), made up with a right hand lay. The stay wire shall have a minimum failing load of 101 kN.
- This grade matches the tensile rating used in the manufacture of helical stay fittings.
- Steel of this design is very hard, making it very difficult to cut and impossible to hand splice. For this reason all stays are made off using helical stay fittings which are suitable for wrapping onto right hand lay stay wire.

3.4. Stay Blocks & Rods

All stay shall be installed utilising 439103 types 2 stay blocks installed to a depth to the bottom of the block, as per the table below;

Voltage	Stay at 45° to pole	Stay at 30° to pole
LV	1.6m	1.8m
HV & EHV	1.8m	2.0m

In all cases the block must be installed into undisturbed ground to provide maximum resistance to uplift. A slot must be cut into the side of the stay hole so that the stay rod is in line with the stay wire. See NSP/004/101 – Guidance on Pole and Stay Holes for further details.

A common design of adjustable stay rod rated at 110kN shall be used for all voltages. See drawing number 1000439101 sheet 2 for details of commodity code 231477.

Note - see also clause 3.13, the use of alternative stay anchoring systems

In ground with a high acid content, such as peat or refuse tip sites, it is necessary to wrap the rod with two layers of grease impregnated Denso tape (commodity code 062661), applied at 50% overlap, in order to protect the stay rod against corrosion.

3.5. Stay Rod Terminations

Stays shall be terminated onto the stay rods using helical guy grip dead ends to drawing no 1091010541. The stay wire shall be cut so that there is no protrusion of the wire through the stay perform loop that could cause injury to animals rubbing against the stay.

3.6. Pole Top Terminations

The following methods of pole top stay termination may be used:

- Pole top dead end to drawing no 1000439108 sheet 6
- Pole top stay make off for use on LV lines only
- Stay Plates complete with Stay Wire Thimbles
- Stay Straps (OHL 4 Construction) or Stay Bracket (CE/C/37)

3.6.1. Pole Top Stay Dead End

- A pole top stay dead end is a galvanised steel helical fitting used to terminate a length of 7/4.00mm stay strand. The other end of the stay strand shall then be terminated directly into a guy grip dead end containing the required insulator type. (See notes on positioning of stay insulators).
- The stay wire shall be bonded to the pole top crossarm by cutting the outer strands of the offered stay strand in such a way that it leaves sufficient length of “king-wire” to reach onto the structure earthing point.

3.6.2. Pole Top Stay Make Off

- Pole top stay make offs are restricted to use on LV lines only
- A pole top stay make off is a galvanised steel helical fitting that when applied at the pole top, the completed tail ends form into a 1.8m length of 7/4.00mm stay strand.
- The newly formed stay strand tail shall be terminated directly into a guy grip dead end containing the required insulator type. (see notes on positioning of stay insulators)
- Where it is necessary to locate a stay insulator at a height lower than 1.8m from the pole top, this shall be achieved by extending the tail from the pole top stay make off with a “stay wire splice” and a short length of 7/4.00mm stay strand. The extended length stay may then be terminated onto a stay insulator in a similar way to the pole top dead end described above. A medium tensile quality single bond wire is incorporated into this fitting for bonding purposes

3.6.3. Stay Wire Splice

- A stay wire splice is a 1.4m long galvanised steel helical fitting that can be utilised to joint/extend 7/4.00mm stay strand.

3.6.4. Stay Plates (complete with stay thimbles to 439109)

Drawing for Stay Plate/Straps	Cat Number	Stay Wire Suitability
1000439110 (125kN MFL) - Single	237134	Single 7/4.00mm grade 700 or 1150 stay strand
1091010207 (240kN MFL) - Double	242005	Single or double 7/4.00mm grade 700 or 1150 stay strand
Stay Bracket – Y204L0503 (CE/C/37 Lines)	220343	Single 7/4.00mm grade 1150 stay strand
1000439113 (190kN MFL) – OHL 4 Lines	252647	Single 7/4.00mm grade 1150 stay strand or Twin 7/4.00mm grade 1150 stay strand
1091010675 sheet 46 - 10° cranked stay strap for use on OHL9/10 lines Angle Supports	346503	Single 7/4.00mm grade 1150 stay strand per strap
1091010675 sheet 47 - 45° cranked stay strap for use on OHL9/10 lines Terminal Supports	346504	Single 7/4.00mm grade 1150 stay strand per strap, (Typically 4 straps applied on terminal H to provide staying for 4 7/4.00mm grade 1150 stays)
1091010675 sheet 16 – stay yoke leg assembly – for use on OHL9/10 angle supports - See also 1091010675 sheet 24 as this shows it used to provide 3 stays	346483	Single 7/4.00mm grade 1150 stay strand per yoke assembly but can be used in conjunction with 10° cranked stay strap to attach three 7/4.00mm grade 1150 stay strand provide

- Single and double stay plates to 1000439110 and 1091010207 are suitable for use on HV and LV lines.
- Where an angle pole requires a single stay (grade 1150) the 1091010207 stay plate shall be fitted as shown on drawing no 1000439108 sheet 4 fig1.
- Where two grade 1150 stays are required at an angle pole the 1091010207 stay plates shall be fitted as shown on drawing no 1000439108 sheet 4 fig. 2.
- Stay plates may be used to terminate single grade 1150 stays per structure leg. See drawing 1000439108 sheet 5 fig1, for details. Where two stays per leg are required, they shall be terminated in accordance with clauses 3.6.1 or 3.6.2 of this document.

Note: In all cases where a stay plate is used, the M20 bolt should be fitted such that the bolt head is retaining the stay plate with the square curved washer and full nut on the opposite side of the pole. In all cases the stay wire shall be bonded to the pole top steelwork.

3.7. Stay Insulator Terminations

Single insulators in a stay shall be terminated using helical guy grip dead ends as shown on drawing 1000439107 sheet 2.

Twin insulators in a stay shall be terminated using helical stay link assemblies as shown on drawing 1000439107 sheet 3.

3.8. Stay Insulators

Every stay shall be:-

a) Fitted with an approved type of insulator(s) positioned as specified on the general arrangement drawing.

b) Bonded at the top, to the line crossarm.

Note – Stay Insulator Positioning

In situations where a broken jumper or a broken stay may result in a stay becoming 'live' the insulator shall be placed below any likely point of contact with live metal, but NOT below a position which would maintain a minimum of 3.0m above the ground when the stay swings vertical if broken. The most common circumstances

for this situation is on poles carrying auxiliary apparatus and the stay insulator(s) should be repositioned from the standard 1.8m for LV or 3m for HV from the pole top to ensure that this hazard will not occur.

Approved insulators are shown below;

Voltage	No. Req.	Insulator Type or Drawing No.	Insulator arrangement drawing
LV poles	1	1000439107 Sheet 1 Type 1	1091193326 Sheet 1
All earthed poles	1		1000439108 Sheet 1
11kV unearthed poles * see below	1		
20kV unearthed poles	2		
33kV unearthed poles	2	1000439107 Sheet 1 Type 2	
33kV unearthed poles OHL9/10	2		1000439107 Sheet 5 ** see below
66kV unearthed poles OHL9/10	1	1091010372 Sheet 2 item 2	1091231166 Sheet 2 ** see below
132kV unearthed poles OHL9/10	1	1091010372 Sheet 2 item 1	

* Except in the Northern Powergrid (Northern) Limited licence area where 2 type 1 stay insulators shall be used with the link assembly. This policy may also be applied in other areas where evidence is found of lightening flashover on the stay insulators.

(Double stay insulator and stay link assembly is normally designed to be used with triggered spark gaps to encourage flashover at the triggered spark gaps and thus reducing source circuit breaker or pole mounted auto reclose circuit breaker operations.

Stay insulators manufactured with glass fibre rod type previously by Mosdorfer CCL Systems or laminated wood type from Permalli should be replaced during any refurbishment works. Care should be taken when installing insulators in previously un-insulated stays as they were prone to corrosion of the stay rod due to circulating leakage currents. The stay rod should be inspected below ground level before stay wire replacement or insulator insertion.

** see further guidance with respect to the use of arc gaps on stay insulators for 33/66 or 132kV lines designed to OHL9/10 in NSP/004/045 clause 3.6.4.1

3.9. Stay Fencing

Stay fencing shall be fitted as shown on drawing no 1091010099 as determined by the stay location, use of the land and as agreed with the landowner or wayleave officer.

3.10. Stay Wire Guards

Stays at the edge of footpaths or in hedges cut by hedge cutting machines shall have yellow PVC, high visibility stay 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 and the public inadvertently colliding with stays.

3.11. Stay Setting Out and Stay Positions

- Stay positions at angle poles shall be set out on site in accordance with NSP/004/101.
- On lay terminal tee-off arrangements with expulsion fuse switches on the main line pole, the stay positions should be set out to achieve the maximum stay angle whilst still ensuring that the stay to jumper clearances specified in NSP/004/107 are not infringed.

3.12. Temporary Stays

To facilitate conductor running and pre-stressing of conductors over a number of line sections it is necessary to install temporary stays at section positions.

When installing temporary backstays all blocks, rods and fittings shall be installed in accordance with this document to the same standards as permanent installations. Temporary backstays shall be fitted to all points where conductors are attached with a minimum of 3 stays fitted.

Minimum stay spreads must be achieved as detailed in Section 3.14.

Application of Helical Fittings (as detailed in NSP/004/106 and the manufacturers installation instructions)

- Always ensure the correct fitting is used and applied in line with the manufacturer's instructions.
- All helical fittings are supplied with a weatherproof tag to identify the conductor and insulator range suitable for application.
- Additionally, all fittings are colour coded in line with ENA TS 43-91 (section 9.5) identifying the application.
- Dead-end stay fittings shall have the same direction of lay of the stay wire.
- Dead-end fittings shall not be used as tools e.g. come- along clamps or pulling grips.
- When applying preformed fittings, the starting point of application the fitting is easily determined by paint markings applied at the beginning of the helix. However, the fitting should be applied before the minimum starting point where possible.
- Helical fitting must be fitted in their entirety before any tension is released onto the fitting. Failing to do so will result in the minimum failing load of the fitting being severely reduced.
- Helical fittings shall only be fitted a maximum of 3 times before they should be scrapped. As a key aspect of the fitting's performance grit is glued internally to the strands with any loss of this reducing the minimum failing load of the fitting.

3.13. Alternative Stay Anchoring Systems

Duckbill (Platipus) Stay Anchors

The duckbill stay anchor system provides an alternative ground anchor to the traditional wood block and stay rod. The system utilises portable compressors to drive specially shaped anchors into the ground. Once installed the attached stay tendon is pulled back out of the ground using the accompanying load lock jack. This process turns the anchor head around through 90° resulting in the anchor becoming fixed in the ground. The usual above ground stay components can then be attached to the fully proof tested ground anchor.

The main advantages of utilising the duckbill system is if an excavator is not available, access is restricted or where stays are required in sensitive hedge lines and excavations may damage the existing fauna.

Each installed anchor must be proof tested with the load lock jack to the criteria below and the stay installed in accordance with the minimum requirements stay chart requirements. The minimum separation distance between any two duckbill stay anchors will be one metre between tendons. Drawing no 1091010024 sheet 1 and 2 provides details on the installation equipment. Full installation instruction can be found in Appendix 8

The effectiveness of this ground anchor system is dependent upon the ground type where it is installed.

If the required proof load cannot be achieved, the installation of the anchor system shall be replaced with the traditional rod and block system.

Situation	Min Proof Load Requirement
All LV overhead lines with a minimum proof load	25kN
Three phase & single phase HV overhead lines with conductor CSA up to 100mm diameter.	30kN
Three phase & single phase HV overhead lines with conductor CSA up to 175mm diameter.	35kN
For use on Out of balance Stays – any conductor size	30kN

Augured Stay Anchors

The AB Chance screw anchor system provides an alternative ground anchor to the traditional wood block and stay rod system. This system utilises a JCB or other all-terrain vehicles to mount a hydraulically driven Auger motor. The Auger motor provides a rotational drive system to power the helix screw anchors into the ground.

A documented relationship exists between the torque required to drive the anchor into the ground and its resultant ground holding capability.

The installed anchor can then be terminated to the stay wire in the usual way using helical preformed fittings. Detailed instructions are included in Appendix 8 of this document.

3.14. Stay Charts

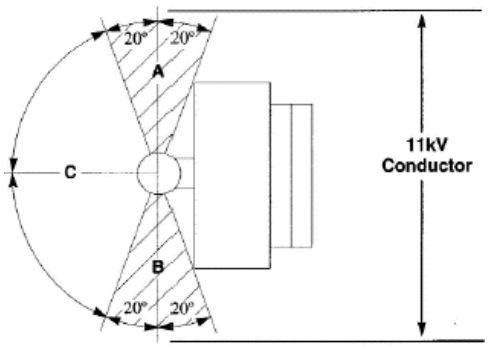
The following documents provide sag charts detailing the minimum allowed stay angles or stay spreads for different design specifications.

Specification	CDS doc ref	Appendix Number
Specification for LV ABC Lines	NSP/004/041	Appendix 9 and 10
Renovation of existing LV overhead lines	NSP/004/041/001	Appendix 10
Specification for HV lines up to 33kV	NSP/004/042	Appendix 2 – 11 (or 25 – 43 for renovation work)
Specification for covered conductor HV lines up to 33kV	NSP/004/044	Appendix 2 – 6
EHV Wood Pole Lines operating up to 132kV with span lengths up to 220m	NSP/005/045	Clause 3.2.4.2 Angle & Terminal Structures – Max Deviations & Staying requirements

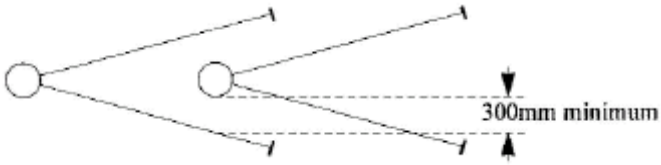
3.15. Clearances

Where a low voltage line is attached to a pole at the same level as or above a transformer on the pole:

- Conductors in tension and backstays are only permitted in the shaded area (A & B), shown on the diagram below.
- Low voltage slack spans may be located anywhere in the shaded or un-shaded sectors (A & B or C), provided that a minimum clearance of 300mm is maintained from any staywire.



- When a low voltage overhead line is attached to a pole below the level of the transformer on that pole, no restriction to the direction of slack spans, tension spans or stays applies.
- Where 'H' supports are used at angle positions it is necessary to make sure that 300mm clearance exists between stay and pole surface, at the point where the stay wire attached to the inner limb passes the outer limb, as shown in the diagram below.



4. References

All standards or specifications referenced within this document refer to the latest version.

4.1. External Documentation

Reference	Title
None	

4.2. Internal Documentation

Reference	Title
NPS/001/005	Technical Specification for Overhead Line Steelwork, Conductor Fittings, Insulator Fittings and Stay Fittings
NPS/001/006	Technical Specification for Insulators for Overhead Lines up to and including 132kV
NPS/001/013	Technical Specification for Galvanised Steel Stay Wire
NPS/001/020	Technical Specification for Stay Ground Anchors for Overhead Lines
NSP/004/041	Code of Practice for the Construction of LV ABC Overhead Lines
NSP/004/041/001	Specification for the renovation of existing LV O/H Lines
NSP/004/042	Specification for HV Wood Pole Lines up to and including 33kV
NSP/004/044	Specification for HV Wood Pole Lines of Compact Covered Construction up to and including 33kV
NSP/004/045	Code of Practice for EHV Wood Pole Lines operating up to 132kV with span lengths up to 220m
NSP/004/101	Guidance on Pole and Stay Holes
NSP/004/106	Guidance on the Selection and Application of Conductor Joints, Terminations and Binders
NSP/004/107	(OHI 7) Guidance on the selection of conductor jumpers and non-tension connections

4.3. Amendments from Previous Version

Reference	Amendments
3 - Technical Specification	Reference to legacy work instructions removed.
3.12 - Temporary Stays	Additional detail added ensuring temporary installations are to the minimum standards as permanent installations.
Appendix 6 – 66kV/132kV Typical Angle Pole Arrangement	Drawing and material list added.

5. Definitions

Term	Definition
None	

6. Authority for Issue

6.1. CDS Assurance

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

		Date
Liz Beat	Governance Administrator	30/06/2022

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
Steve Salkeld	Policy and Standards Engineer	30/06/2022

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.

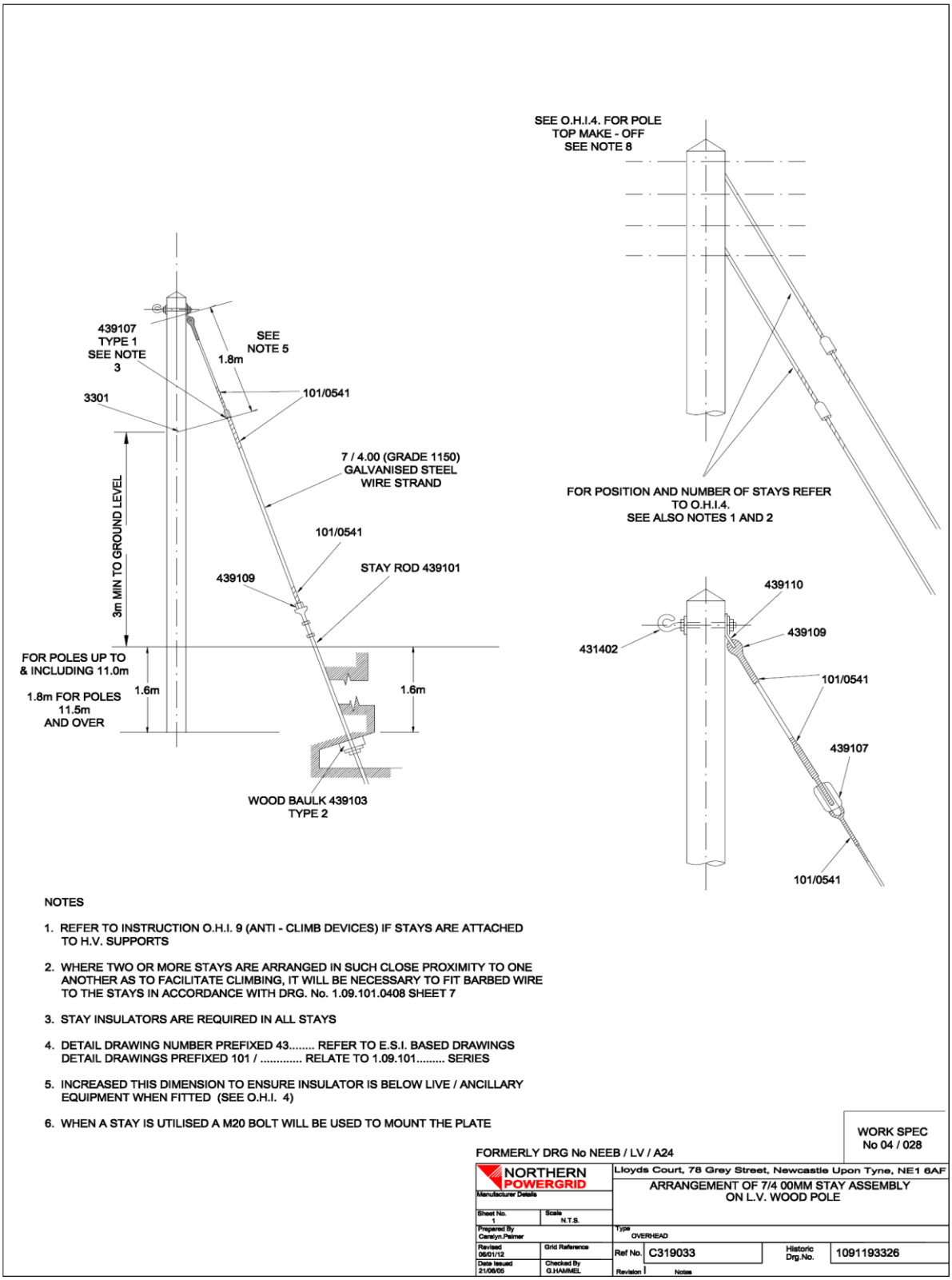
		Date
Ged Hammel	Senior Policy and Standards Engineer	03/07/2022
Joseph Helm	Policy and Standards Manager	12/07/2022

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	System Engineering Manager	02/08/2022

Appendix 1 – LV Stay Arrangement



NOTES

1. REFER TO INSTRUCTION O.H.I. 9 (ANTI - CLIMB DEVICES) IF STAYS ARE ATTACHED TO H.V. SUPPORTS
2. WHERE TWO OR MORE STAYS ARE ARRANGED IN SUCH CLOSE PROXIMITY TO ONE ANOTHER AS TO FACILITATE CLIMBING, IT WILL BE NECESSARY TO FIT BARBED WIRE TO THE STAYS IN ACCORDANCE WITH DRG. No. 1.09.101.0408 SHEET 7
3. STAY INSULATORS ARE REQUIRED IN ALL STAYS
4. DETAIL DRAWING NUMBER PREFIXED 43..... REFER TO E.S.I. BASED DRAWINGS DETAIL DRAWINGS PREFIXED 101 / ..... RELATE TO 1.09.101..... SERIES
5. INCREASED THIS DIMENSION TO ENSURE INSULATOR IS BELOW LIVE / ANCILLARY EQUIPMENT WHEN FITTED (SEE O.H.I. 4)
6. WHEN A STAY IS UTILISED A M20 BOLT WILL BE USED TO MOUNT THE PLATE

WORK SPEC No 04 / 028

FORMERLY DRG No NEEB / LV / A24

NORTHERN POWERGRID
Manufacturer Details

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

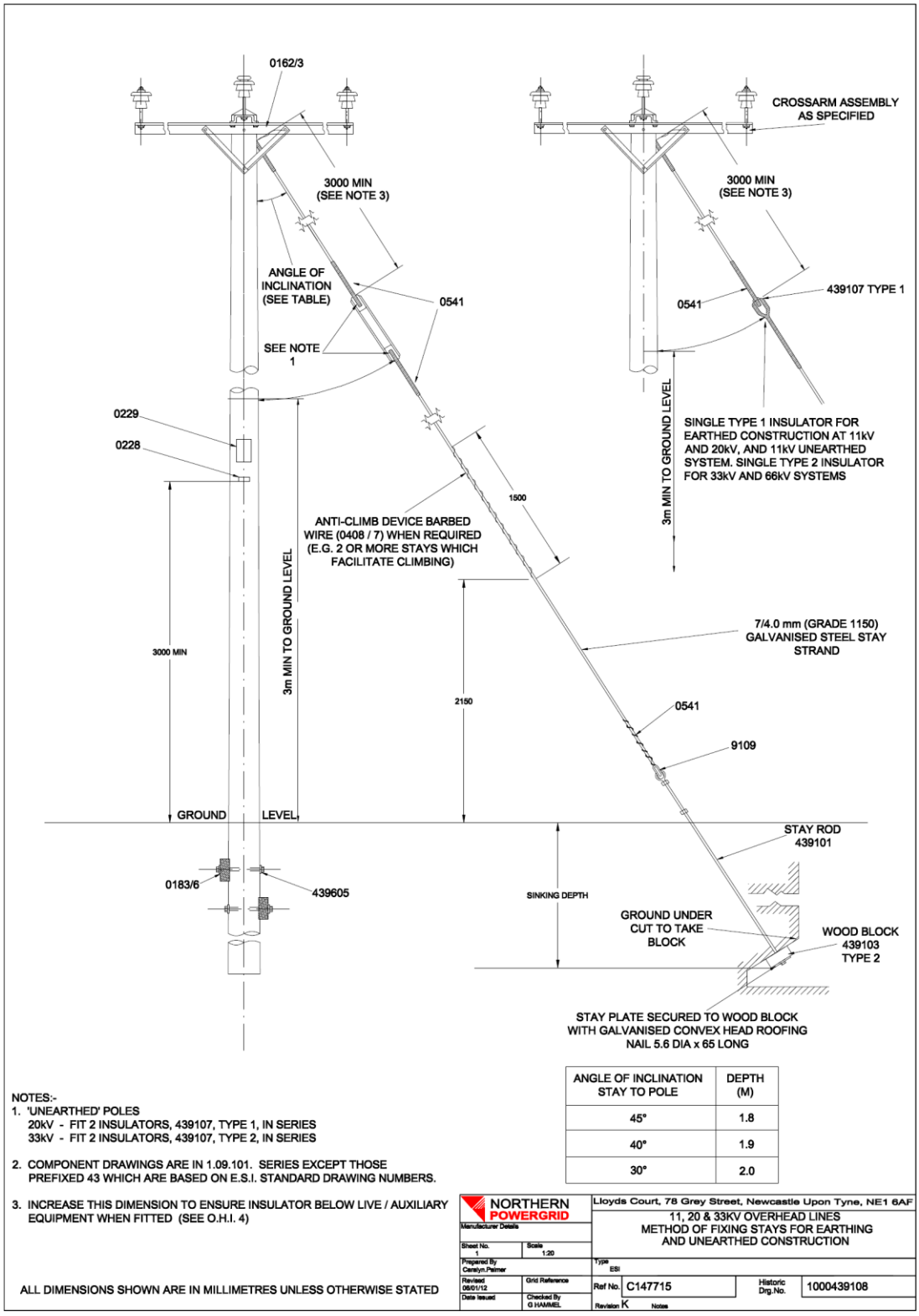
ARRANGEMENT OF 7/4 00MM STAY ASSEMBLY ON L.V. WOOD POLE

Sheet No. 1	Scale N.T.S.	Type OVERHEAD	
Prepared By Carolyn.Palmer			
Revised 06/01/12	Grid Reference	Ref No. C319033	Historic Drg.No. 1091193326
Date Issued 21/06/05	Checked By G.HAMMEL	Revision	Notes

Materials for 1000439108 sheet 1

Item	No	Cat	Description	Drawing
16	1	235124	Kicking /Stay Block (Type2)	1000439103
100	1	231477	Stay Rod (Type 2)	1000439101
101		229583	Stay Wire (7/4.00mm) Grade 1150	N/A
63	1	248232	Stay Insulator (Type 1)	1000439107
-	1	237134	Stay Plate	1000439110
102	4	255217	Stay Grip Dead End	1091010541

Appendix 2 - 11kV to 33kV Typical Stay Arrangement



ANGLE OF INCLINATION STAY TO POLE	DEPTH (M)
45°	1.8
40°	1.9
30°	2.0

NOTES:-
1. 'UNEARTHED' POLES
   20kV - FIT 2 INSULATORS, 439107, TYPE 1, IN SERIES
   33kV - FIT 2 INSULATORS, 439107, TYPE 2, IN SERIES
2. COMPONENT DRAWINGS ARE IN 1.09.101. SERIES EXCEPT THOSE PREFIXED 43 WHICH ARE BASED ON E.S.I. STANDARD DRAWING NUMBERS.
3. INCREASE THIS DIMENSION TO ENSURE INSULATOR BELOW LIVE / AUXILIARY EQUIPMENT WHEN FITTED (SEE O.H.I. 4)

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
11, 20 & 33KV OVERHEAD LINES
METHOD OF FIXING STAYS FOR EARTHING AND UNEARTHED CONSTRUCTION
Ref No. C147715
Historic Drg.No. 1000439108
Revision K

Materials for 1000439108 sheet 1

Item	No	Cat	Description	Drawing
16	1	235124	Kicking /Stay Block (Type2)	1000439103
100	1	231477	Stay Rod (Type 2)	1000439101
101		229583	Stay Wire (7/4.00mm) Grade 1150	
102	3	255217	Stay Grip	1091010541
-	3	244922	Stay Thimble	1000439109
Pole Top Terminations				
105	1	225342	Pole top make off	
104	1	254089	Stay Wire Splice	
101		229583	Stay Wire (7/4.00mm) Grade 1150	
Or				
-	1	250209	Pole top dead end	1000439108 sht6
101		229583	Stay Wire (7/4.00mm) Grade 1150	
Or				
102	3	255217	Stay Grip	1091010541
-	1	237134	Stay Plate	1000439110

Insulator requirements for:-

11, 20, 33, 66 or 132kV unearthed arrangements

63	1	248232	Stay Insulator (Type 1)	1000439107

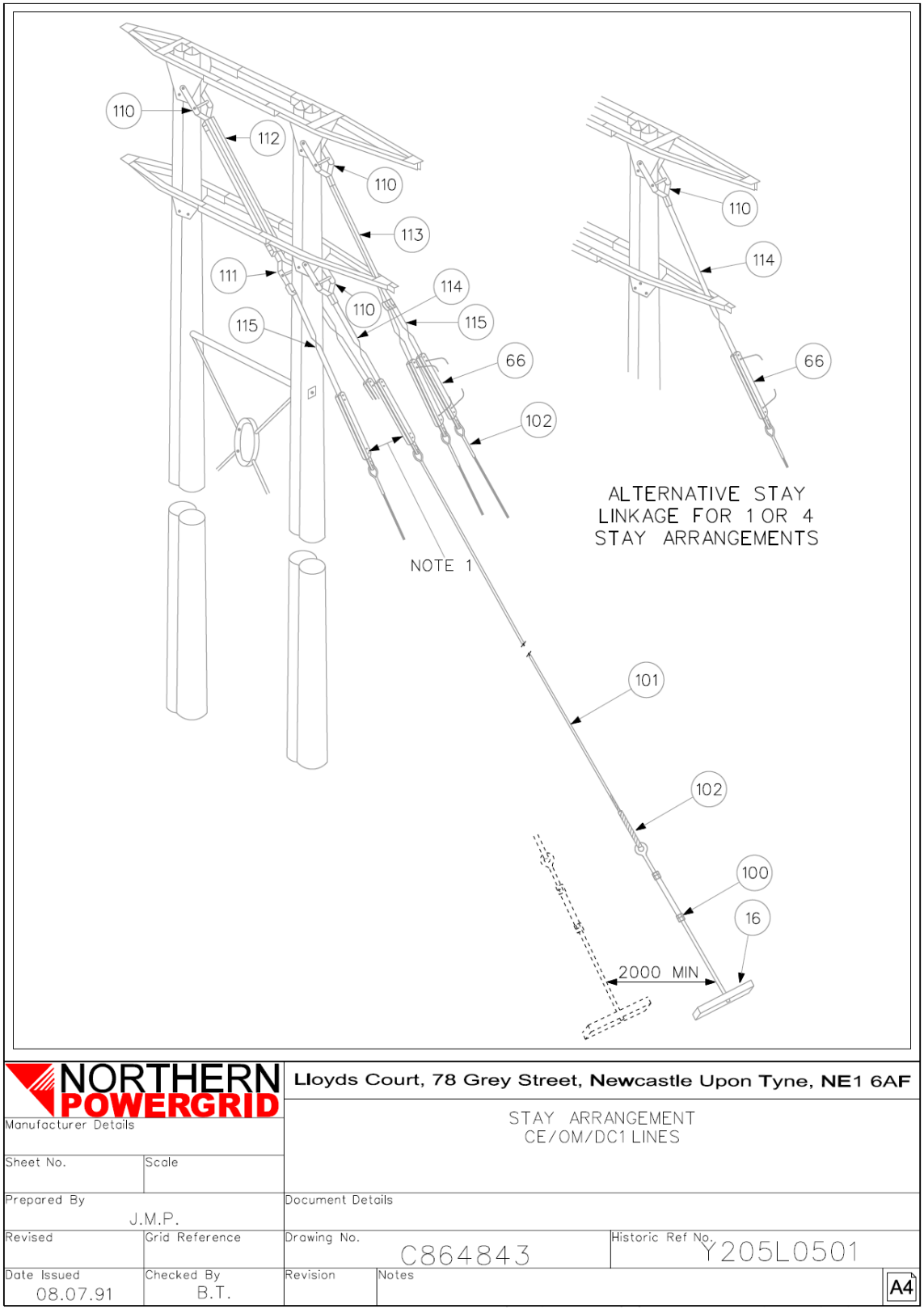
20kV Unearthed Arrangement

63	2	248232	Stay Insulator (Type 1)	1000439107
103	1	260183	Stay Link Assembly	1000439107 sht3

33kV Unearthed Arrangement

63	2	253743	Stay Insulator (Type 2)	1000439107
103	1	260183	Stay Link Assembly	1000439107 sht3

Appendix 3 - Typical CE/OM/DC1 Stay Arrangement



Materials for Y205L0501

Item	No	Cat	Description	Drawing
16	1	235124	Kicking /Stay Block (Type2)	1000439103
66	1	346596	Beam Insulator	109.101.0372 sht2
100	1	231477	Stay Rod (Type 2)	1000439101
101		229583	Stay Wire (7/4.00mm) Grade 1150	
102	3	255217	Stay Grip	1091010541

Stay Linkage – Top Crossarm, Outer Limb, Single Stay

110	1		Stay Link (type A)	
114	1		Stay Strap (Type 2) long	

Stay Linkage – Top Crossarm, Outer Limb, Double Stay

110	1		Stay Link (type A)	Y003X3213
113	1		Stay Strap (Type 1)	Y003X3212
115	2		Stay Strap (Type 3)	Y003X3212

Stay Linkage – Bottom Crossarm, Outer Limb, Single Stay

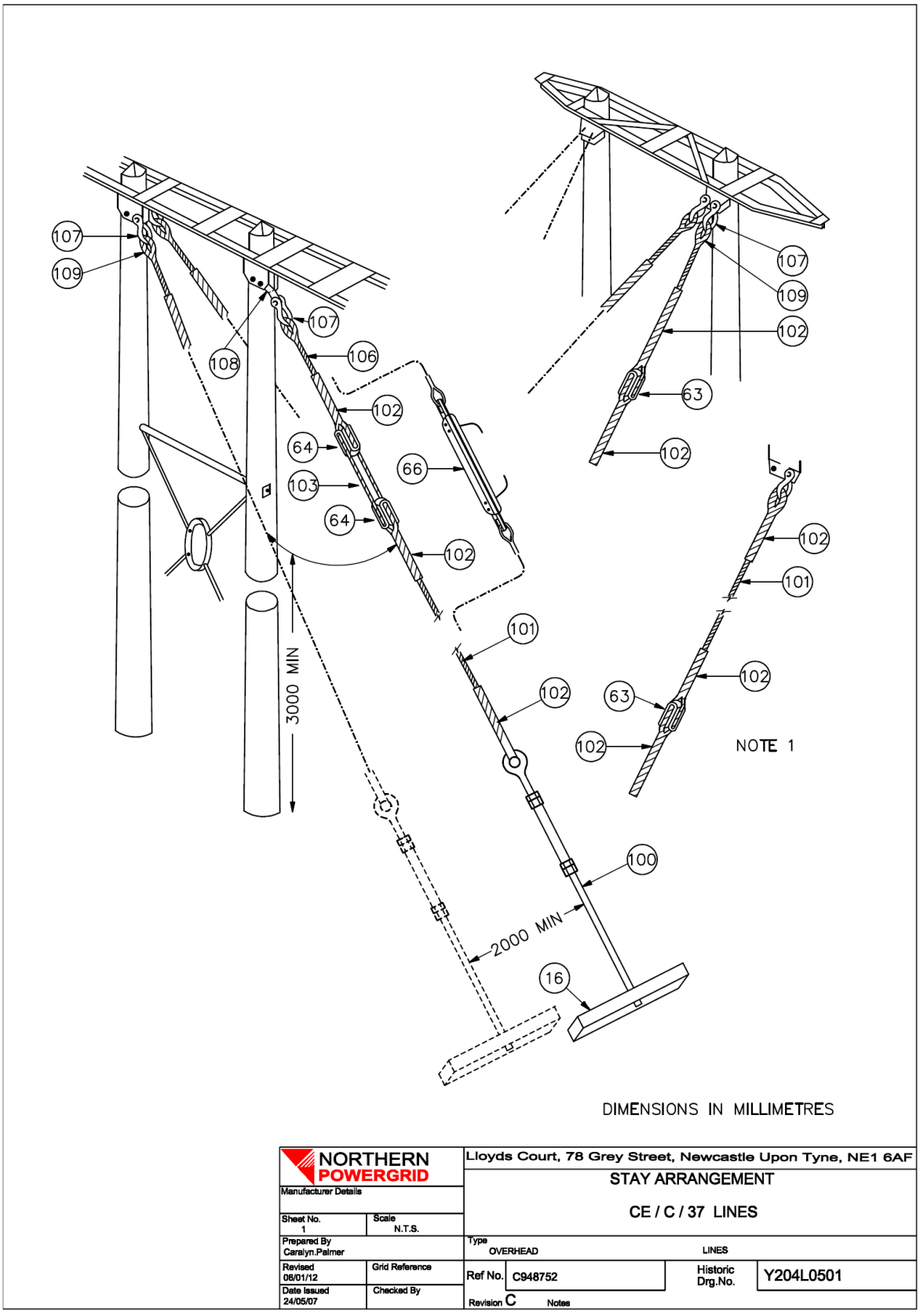
110	1		Stay Link (type A)	Y003X3213
114	1		Stay Strap (Type 2) Short	Y003X3212

Stay Linkage – Bottom Crossarm, Outer Limb, Single Stay

110	1		Stay Link (type A)	Y003X3213
111	1		Stay Link (type B)	Y003X3213
112	1		Stay Insulating Insert	Y003X3211
115	2		Stay Strap (Type 3) Long	Y003X3212

Arcing horns not required on lower stays

Appendix 4 – Typical CE/C/37 Stay Arrangement



Materials for Y204L0501

Item	No	Cat	Description	Drawing
16	1	235124	Kicking /Stay Block (Type2)	1000439103
100	1	231477	Stay Rod (Type 2)	1000439101
101		229583	Stay Wire (7/4.00mm) Grade 1150	
102	3	255217	Stay Grip	1091010541
106	1	225367	Shackle Stay make Off	Y003X3205
107	1	226365	Shackle	Y003X3205
108	1	220343	Stay Bracket	Y003X3214
109	1	244922	Stay Thimble Type 1	1000439109

Stay Insulator Components – unearthed 33kV

64	2	253743	Stay Insulator (Type 2)	1000439107
103	1	260183	Stay Link	1000439107 sht3

Stay Insulator Components – unearthed 66kV

66	1	346596	Beam Insulator	109.101.0372 sht2

Stay Insulator Components – earthed 33kV & 66kV

63	1	248232	Stay Insulator (Type 1)	1000439107

Extended stay tops – for use on structures with auxiliary equipment

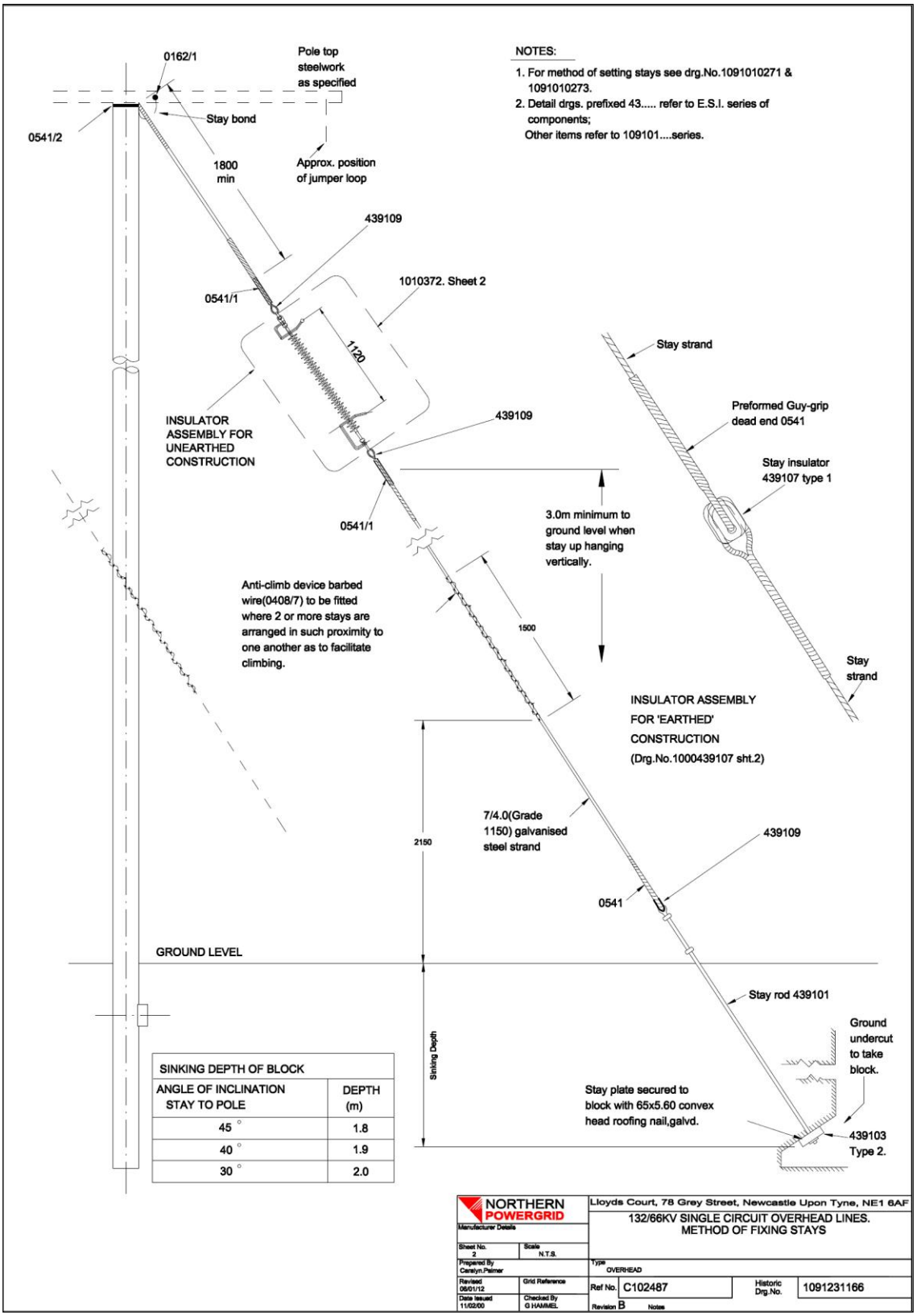
Additional materials

101		216606	Stay Wire (7/4.00mm) Grade 1150	
102	1	255217	Stay Grip	1091010541

Stay Positions:-

On 1 or 2 stay installations the stays are fixed to the outer limb of the structure
On 3 stay installations 1 stay is fixed to the outer limb and 2 stays to the inner limb.

Appendix 5 – 66kV/132kV Typical Arrangement



Materials for 1091231166 sht2

Item	No	Cat	Description	Drawing
16	1	235124	Kicking /Stay Block (Type2)	1000439103
100	1	231477	Stay Rod (Type 2)	1000439101
101		229583	Stay Wire (7/4.00mm) Grade 1150	
102	3	255217	Stay Grip	1091010541
-	3	244922	Stay Thimble	1000439109
Pole Top Terminations				
105	1	225342	Pole top make off	
104	1	226738	Stay Splice	
101		229583	Stay Wire (7/4.00mm) Grade 1150	
Or				
-	1	250209	Pole top dead end	1000439108 sht6
101		229583	Stay Wire (7/4.00mm) Grade 1150	

Insulator requirements for:-

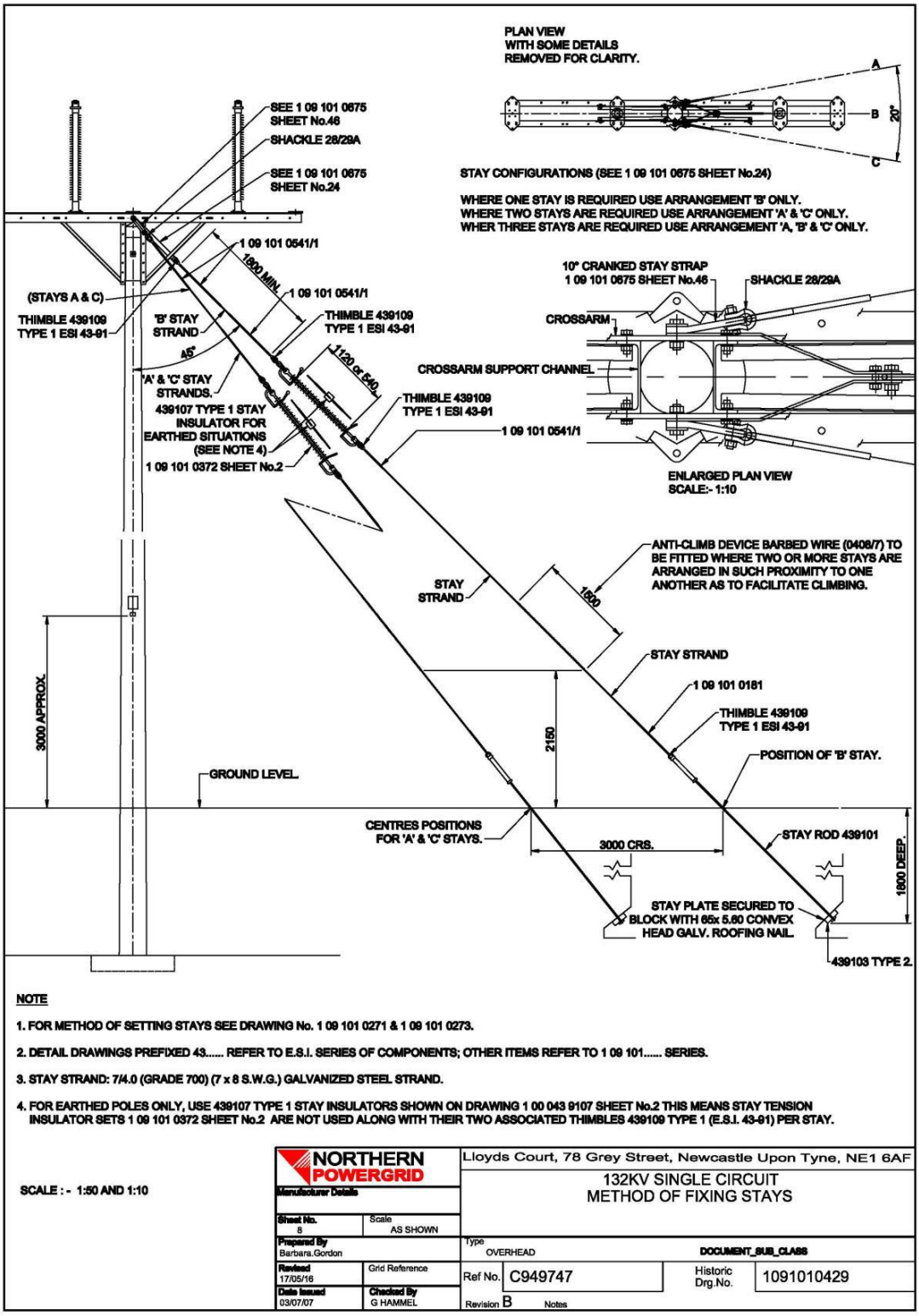
66 or 132kV earthed arrangements

63	1	248232	Stay Insulator (Type 1)	1000439107

66 or 132kV unearthed arrangements

	1	346596	Stay Insulator	109.101.0372 sht2
			Stay Insulator Arcing Horns	1091010490 item 9

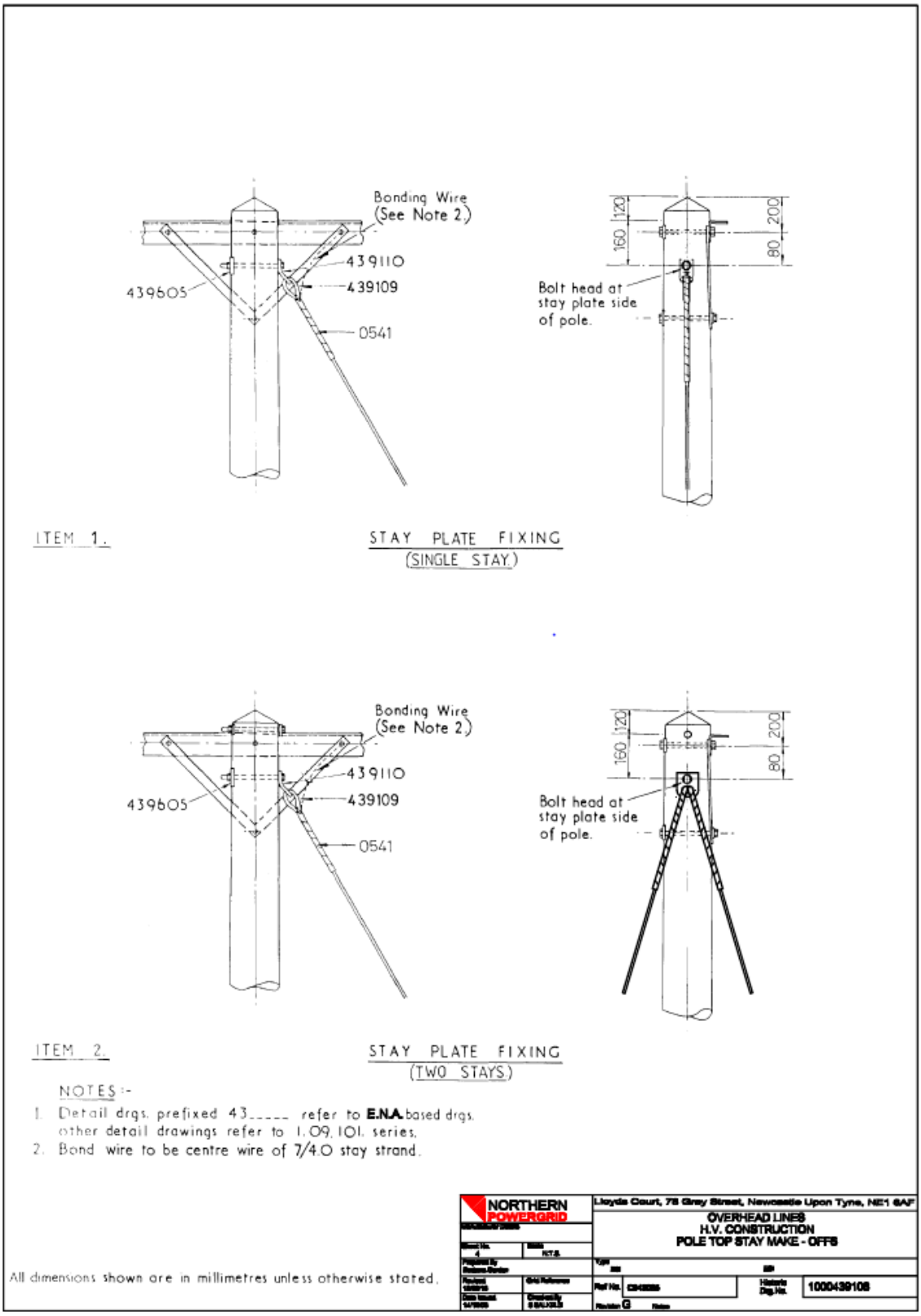
Appendix 6 – 66kV/132kV Typical Angle Pole Arrangement



Materials for 1091010429 sheet 8

IF ONE STAY IS USED THE FOLLOWING ITEMS ARE REQUIRED: -				
Qty	Cat	Description		Drawing
1	248232	Single Stay Insulator Type 1	Earthed Poles	1 00 043 9107 Sht1 item1 **Or**
1	251547	Stay Insulator Assembly	132kV Unearthed Poles	1 09 123 0372 Sht2 item 1 Or
1	346596	Stay Insulator Assembly	66kV Unearthed Poles	1 09 123 0372 Sht2 item 2 Or
2	253743	Stay Insulator	33kV Unearthed Poles	1 00 043 9107 Sht1 item 2 and
1	260183	Stay Insulator	33kV Unearthed Poles	1 00 043 9107 sht 3
4	244922	Stay Thimble	-	1000439109 Type 1
4	255217	Helical Stay Dead End	-	1091010541
1	231477	Stay Rod	-	1000439101 Type 2 Item 3
3	337632	Bolt Ms Hex Galv M24 X 80 Long c/w full nut	-	-
3	229195	Plain Washer Galv M24	-	-
1	378703	Bolts MS Hex Galv M20 x 60 long	-	-
1	375616	Washers, M20, round Galv	-	-
IF TWO STAYS ARE USED THE FOLLOWING ITEMS ARE REQUIRED: -				
2	346503	10˚ Cranked Stay Strap	-	1091010675 Sht46
2	226365	Shackle BS3288 28/29a	-	1091010461 sht1
2	248232	Single Stay Insulator Type 1	Earthed Poles	1 00 043 9107 Sht1 item1 Or
2	251547	Stay Insulator Assembly	132kV Unearthed Poles	1 09 123 0372 Sht2 item1 Or
2	346596	Stay Insulator Assembly	66kV Unearthed Poles	1 09 123 0372 Sht2 Item 2 Or
4	253743	Stay Insulator	33kV Unearthed Poles	1 00 043 9107 Sht1 item 2 and
2	260183	Stay Link Assembly	33kV Unearthed Poles	1 00 043 9107 sht 3
8	244922	Thimble	-	1000439109 Type 1
8	255217	Helical Stay Dead End	-	1000439109 Type 1
2	231477	Stay Rod	-	1000439109 Type 1
2	337632	Bolt Ms Hex Galv M24 X 80 Long c/w full nut	-	-
2	229195	Plain Washer Galv M24	-	-
1	235124	Stay Block 439103 type 2	-	1000439103 type 2
IF THREE STAYS ARE USED THE FOLLOWING ITEMS ARE REQUIRED: -				
3	248232	Single Stay Insulator Type 1	Earthed Poles	1 00 043 9107 Sht1 item1 Or
3	251547	Stay Insulator Assembly 132kV	132kV Unearthed Poles	1 09 123 0372 Sht2 item 1 Or
3	346596	Stay Insulator Assembly 66kV	66kV Unearthed Poles	1 09 123 0372 Sht2 item 2 Or
6	253743	Stay Insulator 33kV	33kV Unearthed Poles	1 00 043 9107 Sht1 Item 2 and
3	253743	Stay Link Assembly	33kV Unearthed poles Only	1 00 043 9107 sht 3
2	346503	10˚ Cranked Stay Strap	-	1091010675 Sht46
2	226363	Shackle BS3288 28/29a	-	1091010461 sht1
2	346483	Stay Yoke leg	-	1091010675 sht 16
12	244922	Stay Thimble	-	1000439109 Type 1
12	255217	Helical Stay Dead End	-	1091010541
3	231477	Stay Rod	-	1000439101 Type 2 Item 3
3	337632	Bolt Ms Hex Galv M24 X 80 Long c/w full nut	-	-
3	229195	Plain Washer Galv M24	-	-
1	378703	Bolts MS Hex Galv M20 x 60 long	-	-
1	375616	Washers, M20, round Galv	-	-
1	235124	Stay Block 439103 type 2	-	1000439103 type 2

Appendix 7 – Stay Make Offs



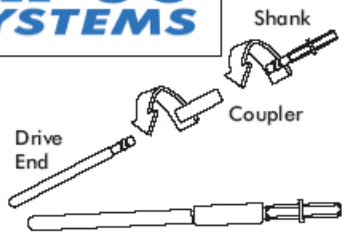
Appendix 8 - Platipus Utility System

PLATIPUS UTILITY SYSTEMS

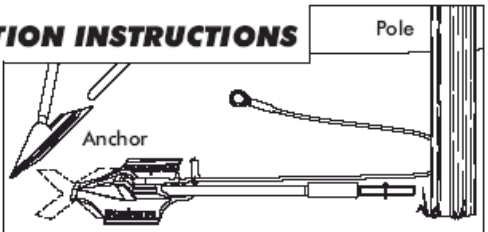
INSTALLATION INSTRUCTIONS

CAUTION!
All underground services must be located prior to installation of an anchor. Use two people to lift the hydraulic hammer.

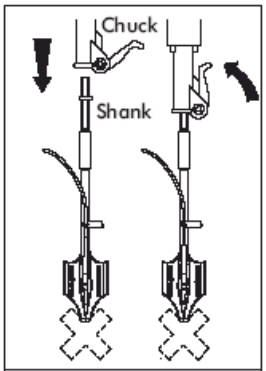
SAFETY!
Wear safety clothing, especially ear defenders when using the hydraulic hammer.



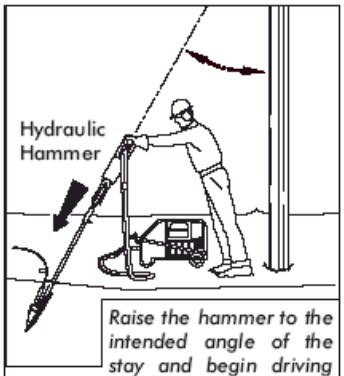
Connect the shank and drive end using the coupler. NOTE: Drive rods, couplers and shank are left hand thread.



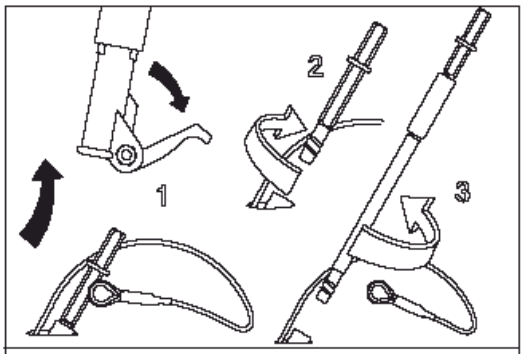
Insert the round tip of the drive end into the anchor and position the anchor at the point of entry into the ground facing away from the pole.



Insert the shank into the hammer chuck and lock in place.



Raise the hammer to the intended angle of the stay and begin driving the anchor into the ground at this angle until the top of the coupler just reaches ground level.

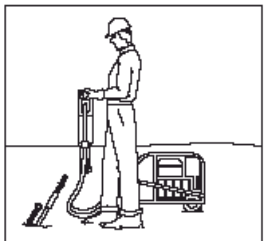


Lift the hammer from the shank. DO NOT PULL THE DRIVE ROD UP OUT OF THE ANCHOR. RELOCATION MAY BE IMPOSSIBLE. Attach another drive rod and coupler between the original drive end and shank.

Replace the hammer on the shank and continue driving the anchor until the protective sleeving just reaches ground level.
CAUTION! DRIVING THE ANCHOR PAST THIS POINT CAN MAKE LOADLOCKING DIFFICULT.

NOTE: In reasonable ground the above process should not take more than 6-8 minutes. In very hard ground up to 20 minutes may be needed. In hard soil conditions a MINIMUM depth of 1.5 drive rod lengths must be reached.

Once driving has been completed the drive rods are removed by an upward pull of the hammer. If the rods do not break free immediately then pulling up on the hammer while pressing the trigger will creep the rods up and out of the anchor.

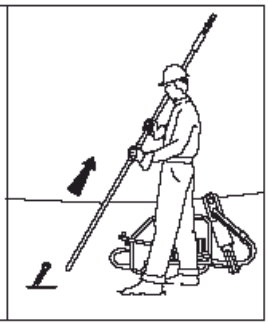


Remove the hammer from the shank.

Pull the drive rods out of the ground.

CAUTION! RODS AND COUPLERS MAY BE VERY HOT.

When the rods have been removed the anchor must be 'loadlocked' into its working position.



The PLATIPUS anchor must be LOADLOCKED and proof loaded before attaching the backstay.
LOADLOCKING INSTRUCTIONS ARE OVERLEAF.

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210803 CRF281

Appendix 9 – Installation Instructions for Augured Ground Anchor Systems

Choice of Anchor

Different types of soil affect the holding capability of the screw anchor and this should be considered prior to installation. As a guide the ground type can usually be determined when inspecting the backfill material from newly excavated adjacent pole holes or from local experience. The standard Northern Powergrid stock items are listed below but additional specialist anchors are available for non-standard ground conditions.

224881	10" Single Helix Assembly
224899	12" Single Helix Assembly
217448	Barrel Turnbuckle c/w Eye, Thimble & Locknut
226175	Rod 2012mm (7 ft.)
222414	Rod Coupling
226183	Rod 1050mm (4ft)

Generally the larger the disc diameter and number of discs the stronger the holding strength of the stay assembly. In areas where the ground type is peat or fine sand twin helical discs are available. Alternately the holding strength can be increased by adding a 1050mm extension to the standard 2012mm rod.

Installing the Auger Stay Anchor

Before commencing work ensure that utilities are identified and safe dig practices are implemented.

Note – In view of the height of the machinery when installing the screw anchor extreme care should be taken when working in the proximity of live overhead line conductors.

- Mark out the position of the stays as detailed in the line schedule.
- Insert the helical assembly into the hydraulic drive attachment and ensure it is locked into place with the holding bolts.
- The aim is to install the anchor in a smooth progressive manor ensuring that it remains aligned thus reducing the ground disturbance and increasing strength.
- During the anchor installation the driver operator must monitor the applied torque on the gauge attached to the machinery. If the value exceeds 7000Nm the body of the rod twists and the anchor could be damaged.
- Drill the first 0.3m of the anchor into the ground in the vertical position.
- Set the anchor to the required angle and continue to install until the appropriate depth is achieved. The minimum size rod installed shall be 2012mm with no more than 300mm protruding out of the ground.
- In the final stages of installation the reading of the torque gauge should be noted by the operator.
- When the installation is completed withdraw the drive attachment from the ground after firstly ensuring that the bolts holding the anchor in place are removed.

Determining the Holding Capacity

The operator shall look to achieve a final installation torque of between 2000Nm and 7000Nm.

The strength can be increased by changing the rod length, disc diameter or number of discs.

If the final torque achieved is less than 2000Nm it is likely that insufficient holding strength has been achieved. If this cannot be increased by changing the assembly type a standard rod and block system should be installed. Anchors can be unscrewed if they fail to meet the required torque. Install any new anchor a minimum of three helix diameters away from the original to ensure that it is installed in undisturbed ground.

Completing the installation

When the installation is completed and the drive attachment removed the barrel turnbuckle can be attached as a future means of adjustment. Any disturbed ground shall be consolidated.