NSP/004/045 – Code of Practice for EHV Wood Pole Lines operating up to 132kV with span lengths up to 220m

1. Purpose

The purpose of this document is to provide a code of practice detailing the requirements for new single circuit EHV overhead lines with span lengths up to 220m designed for operation up to and including 132kV. This code of practice has been prepared to satisfy the requirements of ESQCR 2002. In essence the regulations require distribution plant to be fit for purpose and in the context of overhead lines this has been interpreted as requiring lines to be designed, constructed, used and maintained to adequately withstand all likely weather conditions.

Additionally this code of practice confirms the reference OHL 10/16 as the reference to be quoted to the DECC (Department for Energy & Climate Change) for all new lines.

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

Document Reference	Document Title	Version	Published Date
NSP/004/045	Code of Practice for EHV Wood Pole Lines operating up to 132kV with span lengths up to 220m	2.1	July 2019

2. Scope

This code of practice covers the design and constructional requirements for 3-phase overhead lines designed to operate at voltages up to and including 132 kV. Its prime purpose is to provide small footprint, wayleave friendly single support design arrangements suitable for the replacement of Woodhouse Mast structures or for the modification, renovation and extension of existing 33-66kV wood pole and mast lines. This code of practice has been designed to accommodate a maximum conductor size of 200mm AAAC (Poplar).

This code of practice also contains guidance on the renovation / refurbishment of existing 33 and 66kV lines containing a range of legacy conductor types and where in certain circumstances it may be preferable to retain the use of Portal H suspension intermediate structures rather than refurbishing or rebuilding the line.

This code of practice has been merged with the content of a former code of practice NPS/004/046 “Code of practice *for 33-132kV Single Circuit Wood Pole Lines with span lengths up to 150m*” to create a single design code of practice.

Although this code of practice is capable of operating at up to 132kV, the insulators and fittings shall be selected to match the operating voltage applicable to the line at the time of its construction.

Whilst this code of practice is primarily based on wood supports, it additionally provides details on a range of self-supporting steel structures for special design scenarios e.g. the provision of FCD structures at support locations where it has not been possible to obtain wayleaves for stays.

Notes:-

Where existing 33kV woodhouse mast or portal construction lines are being considered for replacement in their entirety, especially where route alterations are being considered and a review of the span lengths show that the lines do not warrant this long span design code of practice then consideration shall be given to the use of NSP/004/042 as a more cost effective alternative.

2.1. Contents

3. Design Criteria

This code of practice has been designed in accordance with the requirements of BS EN 50341-1:2012 "*Overhead Electrical Lines Exceeding AC 1kV"*. The structures in Appendix A have been designed to accommodate 200 mm² bare aluminium alloy (AAAC) conductors using the "Empirical" design approach as detailed in BS EN 50341-2-9:2015 "*Overhead Electrical lines exceeding AC 1kV. National Normative Aspects (NNA) for Great Britain and Northern Ireland (based on EN 50341-1:2012*).

This code of practice was originally designed as a replacement for a range of legacy overhead line specifications known as Woodhouse Mast lines which operated at 33 and 66kV. The Woodhouse mast lines typically consisted of single small footprint steel supports with stays installed at all section and angle supports to provide spanning of up to 220m but with very limited failure containment capability. As a result the replacement line design was biased towards providing a range of wood supports that could match the spanning capability of the legacy woodhouse masts with similar footprints, an increased level of failure containment, an option to carry larger conductors, an option to operate at voltages up to and including 132kV but without exceeding the height of the tallest support in the existing line by more than 10%. This capability was achieved within the new design by exploiting the strengths of special Rutter Poles with 132kV composite post insulators and AAAC conductors operating at increased design tensions.

This new long span design was born out of a need for the replacement of the existing woodhouse mast lines with minimal wayleave and planning consents issues rather than that which would ideally be chosen for a new or diverted overhead line route. Thus to supplement this design and provide a more cost effective design for new lines or where long spans were not required to facilitate the replacement of woodhouse mast lines, this code of practice has been merged with a NSP/004/046 *"Specification for EHV 66/132kV Single Circuit Overhead Lines on Single Wood Poles for span lengths up to 150m*".

The merger of the two previous codes of practice has now resulted in a new code of practice with a common range of section structures, thus all capable of operating at the higher design tensions but which instead default to a lower design tension only utilising the high tensions where line design conditions require their use but with an increased range of intermediate supports to accommodate the varying spanning requirements of both new and refurbished line routes whilst still maintaining the core object of creating a small footprint design.

However this revised code of practice also recognises the difficulty in the application of this range of support types into legacy overhead line designs in particular that of the EHV portal suspension structures. Post insulator type supports cannot be easily utilised for the replacement of individual portal suspension supports resulting in the need to replace complete line sections or the need for unnecessary section structures. Thus to provide a more versatile code of practice for the refurbishment or replacement of existing portal lines this code of practice has been supplemented with an additional range of portal structures utilising composite suspension insulators which again utilise the same common range of section structures and design tensions detailed earlier.

Whilst this code of practice does not allow the mix of post type structures adjacent to portal suspension structures in the same mechanical section of line it does allow a simple transition between support types providing they transition through one of the common section supports. Thus were an existing portal line is refurbished and already utilises a wide footprint 'H type support then it shall be replaced with a similar type of support. This flexibility provides for the much simpler replacement of individual structures rather than necessitating that complete line sections be replaced without any lengthy wayleave negotiations.

Finally this code of practice also includes access to a range of self-supporting steel structures that may be used to supplement this design, where stayed structures cannot be accommodated.

3.1. Spanning Design Criteria

This COP has been designed to accommodate the following span/ load cases

Spanning Details for New Lines or Complete rebuilds of Existing Lines using supports with Post Insulators		
Normal Spanning		Load Cases
Lines located <300 MASL (Metres Above Sea Level)		
Design Span Max clashing span	150m 190m	Based on a conductor loaded condition of 23.5kN MWT with 9.5mm radial Ice & 380 n/m^2 wind @ -5.6°C and an EDT limit of 20% of UTS @ 5ºC
Lines located >300 MASL		
Design Span Max clashing span	150m 180m	Based on a 23.5kN MWT with 12.5mm Ice & 570 n/m2 wind and an EDT limit of 20% of UTS @ 5ºC
Extended Spanning		Load Cases
Lines located <300 MASL		
Design Span Max clashing span	200m 220m	Based on a 35.3kN MWT with 9.5mm Ice & 380 n/m^2 wind and a vibration limit of 20% of UTS @ 15ºC
Lines located >300 MASL		
Design Span Max clashing span	200m 210m	Based on a 35.3kN MWT with 12.5mm Ice & 570 n/m2 wind and a vibration limit of 20% of UTS @ 15ºC. It would be preferable to construct these sections of line using Portal H structures where wayleaves are achievable.
The actual spanning capability of individual structure types can be seen in tables 3.2.3.1 & 3.2.3.2		
Guidance – The design/equivalent span for a wood pole line shall normally be calculated for the route as a whole averaging out the large spans with the short spans. Designers shall aim to construct new lines based on a 150m basic/normal design span ensuring that the calculated equivalent span falls within +/- 15% of the Normal basic design span. Ie 128m - 172m, this does not preclude an occasional span reaching up to the stated max clashing span. *However where due to wayleave or terrain issues the line requires multiple spans in excess of the normal design span, then the section of line or the complete line shall be constructed to the extended design taking advantage of the higher tensions to reduce the sags and improve the clashing performance. Where discrete extended sections are installed in a route designed to a normal design these sections must include out of balance stays.*		
Spanning Details for Partial/Full Rebuild of existing Lines using Portal H Suspension Structures		
Normal Spanning		Load Cases
Lines located <300 MASL		
Design Span Max clashing span	150m 215m	Based on a conductor loaded condition of 23.5kN MWT with 9.5mm radial Ice & 380 n/m^2 wind @ -5.6°C and an EDT limit of 20% of UTS @ 5ºC
Lines located >300 MASL		
Design Span Max clashing span	150m 180m	Based on a 23.5kN MWT with 12.5mm Ice & 570 n/m2 wind and an EDT limit of 20% of UTS @ 5ºC

Notes

- *Whilst the overall design may be capable of the basic or max spanning clashing spanning listed above, note must be taken of any structure based limitations created by windspan limits or reduced clashing limits created by angle structures.*
- *Insulator configuration differences on single pole intermediate structures and twin Rutter poles intermediate structures have been normalised within the spanning arrangements offered above.*
- *The assumed weight of ice of used in this design is 9 kN/m³*

3.2. Supports

3.2.1. Type and Range of Supports

Supports are divided into two functional groupings

a) Wood Pole Intermediate supports - limited by the Pole strength/foundation capability referred to as the windspan limit or the clashing limit of the structure whichever is the lesser. For details on the windspan limits of intermediate poles see clause 3.2.3.1

b) Wood Pole Section supports - limited by the strut loading capability of the support, the supporting guys or the clashing limit of the structure whichever is the lesser. For more details on the use of section supports see clause 3.6 and the limitations of section supports see clause 3.2.3.2

To maximise the flexibility of this code of practice it has been designed to support both post type intermediate and portal type suspension intermediate supports terminated by a common range of wood pole section supports further supplemented by an option for the use of a of self-supporting steel pole structures removing the requirement for stays in difficult wayleaving situations. The steel poles have been designed to comply with EN 50341-3-9:2015.

3.2.2. Support / Line Type Selection Criteria

Line Design Type	Support Types
New build or Replacement of 33/66kV Woodhouse mast lines or Riley & Neate Mast lines where the basic span of the replacement line is > 130m	Single pole construction with composite post insulators supplemented by Rutter or Portal H Post Structures were span limitations require their use
New build or complete rebuild of any existing 33kV line e.g., Woodhouse Mast, C/CE/36, C/CE/37 or OHL4 where the basic span of the replacement line < 130m	The line shall be constructed using single pole supports with pin insulators in accordance with OHL5 construction as detailed in NSP/004/042
New build single circuit 132 kV construction	Single pole construction with composite post insulators supplemented by Rutter or Portal H Post Structures were span limitations require their use
Partial or complete replacement of supports in existing CE/C/37 or OHL4 Portal lines	Portal H suspension structures with 2.74m Phase Centres

3.2.3. Support Installation Requirements

All new supports shall be installed in accordance with NSP/004/102 *"Guidance on Erecting Single or 'H' Poles" using* Pole and stay holes as detailed in NSP/004/101 "Guidance on Pole and Stay Holes". Further information on foundation types and installation depths can be found in clauses 3.2.4.1 and 3.7 of this code of practice.

3.2.4. Timber Supports

Poles shall be fabricated and supplied in accordance with ENATS 43-88 issue 6, the Northern Powergrid product specification NPS/001/001 and the fabrication drawings detailed within this code of practice.

The strength of timber supports used in this code of practice have been derived from the formulae contained in BSEN 14429 in respect of Pinus Sylvestris based on the following parameters:

Mean ultimate extreme fibre stress (bending stress)	53.3 N/mm2
Mean modulus of elasticity	10054 N/mm2

These parameters are based on a Pinus Sylvestris population whose southern border occurs at 60° latitude. Where other wood species and / or pole populations are being considered then it will be necessary to recalculate the capabilities of the poles detailed in this code of practice.

The Northern Powergrid preference for will always be for Pinus Sylvestris (Scots Pine) however we accept that suppliers may occasionally not be able to offer this species to satisfy the taller pole requirement in a timescale

acceptable to many projects. As such the company is prepared to accept Douglas Fir poles as an alternative species provided additional penetration aids are carried out and that the pole species marking is updated from "SP" Scots Pine to "DF" Douglas Fir.

Thin sapwood poles like Douglas Fir are resistant to penetration by preservatives and thus unlikely to provide the same product life. As such all Douglas Fir poles shall be incised or bored at the ground line section (600mm above ground and 1200mm below ground) in accordance with ENATS 43-88 issue 6. Additionally this species of pole shall be supplied and fitted with "PoleSaver", groundline protection sleeves.

Note -

All Rutter type poles will be supplied as composite structures with the re-enforcing steel or hardwood keys pre-installed.

The new pole designs are based on overall pole lengths of 12 m – 17 m in 1 m intervals. Although it is possible to obtain higher H pole fabrications for use at road and rail crossings.

3.2.4.1. Intermediate Structures - Windspan Limitations

Pole Arrangement Drawing No.	Pole Fabrication Drawing no.	Support Type	Default Sinking Depth	Support Class	Windspan Limit (Elevation and ground type)			
					Good	Poor	Good	Poor
					Ground level <300m ASL		Ground Level >300m ASL	
1091380006 sht1	1091380006 sht2	Inter (Single)	2.6m	E/Stout (12-15m)	160m	150m	80m	60m
				E/Stout (16-18m)	170m	130m	80m	70m
1091390022 sht1	1091390018 sht2	Inter (H Pole)	2.4m	E/Stout (12-18m)	220m		140m	120m
1091390016 sht1	1091390008 sht2	Inter (Rutter)	3.2m	Stout (12-17m)	220m		140m	130m
1091390017 sht1	1091390008 sht2	Section (Rutter)						
1091390020 sht1	1091390018 sht2	Section (H Pole	2.4m	E/Stout (12-18m)	220m		160m	120m
1091390021 sht1		Section (H Pole) Out of Balance						
1091380006 sht3	1091380006 sht3	Inter 'A' Pole (Renovate)	n/a	Stout 'A' (all pole heights)	160m		80m	
1091231165 sht4	1091231187 sht1	Inter (H Portal Pole) 2.9m centres	2.4m	Stout (14-16m)	173m limited by clashing see notes		160m	150m

Notes

a) The structures capabilities detailed in the table above have been matched to Poplar conductor as defined in clause 3.4 of this code of practice - Please note that whilst selecting a smaller conductor CSA may increase the available windspan, the resulting span may not be achievable due to changes in the conductor strength and available clashing spans. Alternative conductors shall be checked and approved by the Northern Powergrid Overhead Line Policy & Standards Engineer or his representative.
b) All foundations shall include the use of permasoil backfill. Where the maximum allowable clashing figure has been identified to be less than the windspan this value has been set as the windspan value.
c) Where rutter poles are installed in poor ground types the 1300mm upper blocks shall be replaced with 2500mm blocks
d) The windspan is derived from half the sum of the adjacent spans
e) Where the available windspan is in excess of the max clashing span, the max clashing span takes precedence over the windspan
f) 'H' Intermediate structures utilising three vertical post insulators are permitted for use in non-wayleave sensitive locations as an alternative to the use of rutter poles for long spans.

g) 'H' Intermediate Portal structures utilising three suspension strings are generally only for the refurbishment of existing portal construction lines and cannot be mixed with structures containing post insulators in the same section of line without first rolling through a section structure.

h) The maximum allowed span on portal suspension arrangements are limited by the clashing capability of the structures. This span limitation can be increased to 192m where conductors are operating at 23KN but is limited to a single span, for larger single span sections on portal construction, the structure must be converted to a section support.

3.2.4.2. Angle & Terminal Structures – Max Deviations and Staying Requirements

Drawing Arrangement Drawing No.	Pole Fabrication Drawing. No.	Support Type	Sink Depth	Support Class	Pole Length	No of stays & Min angle to Pole	Max Allowed Windspan (Lines < 300m above sea level)	Max Allowed Windspan (Lines >= 300m above sea level)
1091390013 sht1	1091390003 sht2	0º - 10º (Single)	2.4m	E/Stout	13-15m	1 stay @ min 30º	160m	90m *
					16-17m	1 stay @ min 30º	170m	90m *
1091390014 sht1	1091390003 sht2	10º - 20º (Single)	2.4m	E/Stout	13-15m	2 stay @ min 45º	160m	90m *
					16-17m	2 stay @ min 45º	170m	90m *
		20º - 30º (Single)	2.4m	E/Stout	13-15m	2 stay @ min 45º	160m	90m *
					16-17m	3 stay @ min 45º	170m	90m *
		30º - 35º (Single)	2.4m	E/Stout	13-15m	3 stay @ min 45º	160m	90m *
					16-17m	3 stay @ min 45º	170m	90m *
		35º - 40º (Single)	2.4m	E/Stout	13-15m	3 stay @ min 45º	160m	90m *
					16-17m	3 stay @ min 45º	170m	90m *
1091390018 sht1	1091390018 sht2	40º - 60º (H Pole)	2.4m	E/Stout	13-17m	4 stay @ min 45º	175m	160m
1091390019 sht1	1091390019 sht2	H Terminal Pole – No Cable	2.4m	E/Stout	13-17m	4 stay @ min 45º	220m	160m
1091231173 sht4	1091231173 sht5	H Terminal Pole – Cable terminations	2.4m	E/Stout	13-17m	4 stay @ min 45º	220m	160m

Notes

Poles must be ordered to the pole dimensions on fabrication drawings rather than the default pole dimensions normally provided by BS 1990.
(Stay Chart calculated against default Poplar conductor operating at 35.3kN MWT condition in a 150m Basic)

*** Where larger spanning is required, the pole arrangement shall be upgraded to H section structure to 1091390018**

The default pole assembly for 40º - 60º deviations shall be the Large Angled H pole. The single structure pole to drawing no 1091390015 shall only be used in special circumstances and only with the prior approval of the company's Overhead Line Policy & Standards Engineer or his representative.

Additionally to ensure that no loading situation exceeds the maximum allowable design values, an artificial maximum windspan limit has been set at 170m on all single support structures.

Note – The above table has been calculated using the highest design tension associated with the largest suitable conductor size for use with this construction code of practice therefore alternative and perhaps less onerous guyed structure arrangements may be possible if smaller conductor sizes or lower design tensions are used.

Line constructors may offer such alternatives for consideration to the company's Overhead Line Policy & Standards Engineer or his representative.

3.3. Failure Containment

As is common practice for wood pole lines, the failure of a support due to a broken wire condition cannot be totally designed out however the importance of this failure mode has been recognised and the followings design features have been incorporated into this code of practice to minimise the consequences of a broken conductor situation.

a) At intermediate supports with post insulators the insulators have been designed to break before any damage is sustained to the support structures.

b) At Intermediate portal supports the suspension strings will tend towards movement into a limited capability terminal structures supporting the reduced line loads resultant from the effective increase in conductor length brought about from the movement of the suspension string.

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

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

Thus to provide further levels of failure containment a range of further failure containment measures have been designed into all new route designs.

These should include, but not be limited to, the provision of longitudinal stays on selected angle/section structures which shall be designed to arrest cascades (installed both ways under the conductors).

No section of line shall exceed 2000m or 10 spans without a section or angle structure which meets the requirements of failure containment as detailed above, being inserted into the line. Where this cannot be achieved due to wayleave constraints (Longitudinal stays are by far the most effective and cheapest to install) then the following alternative methods may be utilised in the following order of priority

a) Longitudinal Stayed Section/Section Angle poles

b) Section Angle poles with twin splayed stays installed at 45 degrees to the pole

c) H pole (Extra Stout Grade) Section/Section Angle poles

Structures used for FCD	
Single Stout Section Angle Pole or Rutter pole to 1091390013, 1091390014 or 1091390017	2 longitudinal stays in each direction with a minimum stay spread of 30° (typically 7-8m) and 2m separation between stays at ground level
Single (Extra Stout) Section Angle or H pole (Extra Stout) Section / Section Angle 1091390013, 1091390014, 1091390018, 1091390020, 1091390021	2 stays per leg placed in the resultant of the angle with a minimum stay spread of 45° and 2m separation between stays at ground level
H Pole (Extra Stout) Section / Section Angle 1091390018, 1091390020 or 1091390021	This FCD option can be installed without the use of longitudinal stays but only where it is not associated with major road or rail crossings.

Notes

These arrangements will provide full stability in the event of a loss of a single broken wire. Where in very sensitive wayleave area's these requirements can still not be met, it is permissible to install FCD longitudinal stays in one direction only and then install the opposing stays at an adjacent structure located a maximum of two structures away. Where a stayed option simply cannot be accommodated and the site is located at a major road or rail crossing the support type shall be substituted with one of the unstayed self-supporting structures detailed in Appendix D of this specification.

3.4. Conductors

Conductors selected for new or the rebuild of existing lines shall be manufactured and supplied in accordance with of Northern Powergrid product specification NPS/001/007 "*Technical specification for Overhead Line Conductors*" and unless specified otherwise shall be 200 mm² (AAAC), (37/2.87mm) code-named Poplar, designed for a maximum operating temperature of 75°C and with conductor MWT and loading condition as detailed in Clause 3.1.

For information on line ratings reference shall be made to IMP/001/011 "*Code of practice for Overhead Line ratings*"

By default the conductors shall be supplied as AL5 aluminium alloy with a maximum resistivity of 31.2 nΩm at 20ºC.

All conductors shall be installed in accordance with NSP/004/105 "*Guidance on the selection, erection and sagging of O/H line conductors"* which includes the requirement to Pre-stress all new sections of conductor.

Where sections of new line are constructed as diversions or part rebuilds of an existing route then it is permissible to construct the new section of line with the same conductor type and or construction tensions as the section of retained line to avoid the need for out of balance stays and possible lengthy wayleave discussions providing agreement has been sought from the EHV design engineer to confirm this will have no impact on any future network design requirements.

However by careful selection of the line interface locations, perhaps by extending the diversion by a couple of spans, this can offer up good sites for such stays and thus they can often be relatively easily accommodated. The data provided below confirms a selection of the MWT's of conductors associated with historical designs to allow this code of practice to be used with alternative conductors with lower design tensions and thus match in with historical design standards.

Conductor	Design Loadings	Used on the following historical line specifications	Min required MFL for tension Insulator Strings
175mm² AAAC Elm"	17.79 kN (1814 kgf)	OHL4 constructed with 120m Basic	70kN
175mm² ACSR Lynx)	17.79 kN (1814 kgf)	OHL4 constructed with 120m Basic	70kN
125mm² / 0.2" HDBC	17.79 kN (1814 kgf)	Riley & Neate Mast/ M&M construction with 150m Basic	70kN
175mm² ACSR (Lynx)	26.34 kN (2685 kgf)	OHL4 constructed with 150m Basic	125kN
175mm² ACSR (Lynx)	25.740 kN (2624 kgf).	CE/C/37 constructed with 150m Basic	125kN
200mm² AAAC "Poplar"	23.517 kN (2397 kgf).	CE/C/37 (M1) constructed with 150m Basic	70kN
125mm² / 0.2" HDBC	25.0 kN (2549 kgf)	CE/C/37 constructed with 150m Basic	125kN

Note

Where lines are constructed with MWT's of <=23.5kN and they are constructed from homogeneous conductor materials then it is possible to terminate these lines using helical fittings as opposed to compression fittings.

3.4.1. Conductor Clearances

3.4.1.1. External Electrical Clearances – (Clearances to ground and obstacles)

All overhead line clearances shall comply with *NSP/004/011, "Guidance on Overhead Line Clearances",* with all new lines being designed to match the current line operating voltages at a maximum design operating temperature of 75ºC.

Note – where an existing feeder route is retained and it is planned to retain a number of existing structures, it is not necessary to replace structures for ground clearance reasons solely to achieve a 75°C line rating providing the line can achieve the original 50°C design rating unless specified within the project plan.

3.4.1.2. Internal Electrical Clearances

Wire clearances at the supports shall be in accordance with BS EN 50341-1 table 5.6/GB.1 or previously issued Northern Powergrid Policies. The minimum clearance from live metal to live metal or live metal to the structure or the support steelwork and earthed fittings shall not be less than the following:

System Voltage (kV)	Phase to Earth (m) Still Air	Phase to Phase (m) Still Air	Jumper Loops with a maximum swing angle of 30º (m)
132	1.2	1.4	0.9
66	0.7	0.8	0.61
33	0.45	0.45	0.45

All clearances are based on the line conductors at a maximum operating temperature of 75ºC

To facilitate increased phase to earth clearances at section structures operating at 132kV, all pilot insulators shall incorporate the support stool assembly detailed on drawing 1091010487 sht34

3.4.2. Conductor Spacing to Avoid Conductor Clashing

Phase separation shall comply with the requirements of EN 50341-2-9: 2015, Clause 5.8 GB.2.

The structures in this code of practice have been designed to the following clashing criteria:-

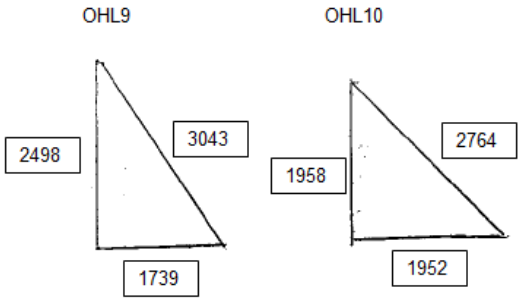
The gust and lull wind pressures shall be 1,832 and 0,546 times the mean wind pressure respectively. The minimum spacing to avoid conductor clash shall be the worst combination of wind and ice, expressed as a straight line between the wind and ice axes, allowing for a withstand factor of 1,10.

For wood pole lines at Normal altitudes, the minimum phase separation shall be defined by weather zone "2B", whilst for lines at High altitude, the minimum recommended phase separation shall be defined by weather zone "3C".

Where "2B" shall be defined as 20mm Diametric Ice thickness and a wind pressure of 380 N/m2 and

Where "3C" shall be defined as 30mm Diametric Ice thickness and a wind pressure of 570 N/m2

For the purposes of clashing calculations the following spacing arrangements have been applied



3.4.3. Conductor Fittings, Clamps and Joints

Unless specified otherwise in the project plan, the conductor terminations, joints and clamps shall be designed for 'Poplar' conductor and supplied in accordance with the appropriate Northern Powergrid product specifications NPS/001/005, NPS/001/002 or NPS/001/016 to suit the fitting or the terminating technology being utilised.

All conductor fittings shall be installed in accordance with NSP/004/106 *"Guidance on the selection and application of conductor joints, terminations and binders"* and NSP/004/107 *"Guidance on the selection of conductor jumpers and non-tension joints"*.

Upon completion of all compression terminations, joints and jumper palms, all interfaces shall be tested in accordance with NSP/004/122 *"Guidance on the Electrical Resistance Testing of O/H Line Joints and Terminations"* to confirm that the electrical resistances are within acceptable norms.

3.4.3.1. Conductor Terminations

Conductor terminations shall be Full tension compression dead-end types supplied complete with jumper terminal flags. See drawing 1091010653 sht3 for details. Jumper palms for connecting jumper loops to dead ends, shall be of the straight compression type on all 132kV jumper arrangements to assist in maintaining jumper clearances. However jumper loops at 33 & 66kV may utilise cranked arrangements. All jumper palms shall be supplied complete with the required bolt assemblies with all bolts and nuts manufactured to grade 8.8/8.0 in accordance with BS 4190 complete with load spreading washers. The load spreading washers shall be 44mm diameter and 9.5mm thick for M16 bolts. To prevent loosening in service the minimum installation torque shall be 90Nm.

Note.

Conductor helical termination fittings may be utilised as a temporary construction termination aid to assist in any emergency return to service mitigation measures but they must be replaced with compression fittings before the job is finally commissioned onto the Northern Powergrid network.

Where conductor types other than 200mm^2 AAAC are being installed, then it is permissible to permanently terminate the conductors utilising helical terminations providing they are only associated with lines requiring the use of 70kN tension insulator assemblies. See clause 3.3.2 for details of minimum mechanical requirements for different conductor types.

3.4.3.2. Conductor Jumpers

Conductors jumpers to pole mounted equipment or cable terminations shall normally be either type 8 PVC covered copper 125mm^2 or Green PVC Flexible Jumpers 120mm^2.

3.4.3.3. Conductor - line post trunnion clamps

Conductors shall be secured at the line post insulator positions using pivot type trunnion clamps which are supplied with the insulators and have been designed to accommodate a conductor diameter of 20.1mm (where Poplar is the specified conductor type). The trunnion (pivot) shall be of the conductor centre-line type.

Where alternative conductor types are used, the project engineer may be required to specify alternative clamp types.

Conductors shall be secured at intermediate pole positions by direct clamping onto the conductors, however all pilot insulator positions on 132kV insulator assemblies have been designed to accommodate armour grip suspension rods to improve the stability of long jumpers.

Prior to any conductor being secured into the trunnion clamps, they shall be wrapped with a layer of aluminium chafing tape (1.27mm x 7.62mm) to BS 1470 EN 573 Alloy ENAW-1050A Class 'A' annealed to 'O' in accordance with BSEN 515 and mechanical properties to BSEN 485-2 Table 4. The tape shall be applied as a continuous single layer such that it extends beyond the ends of the clamp by at least 3 complete turns. Where copper conductors are clamps a similar equivalent copper chafing tape material shall be used.

3.4.3.4. Conductor Tension Joints

The fullest possible use shall be made of the maximum conductor lengths in order to reduce to a minimum the number of mid-span tension joints. Where this cannot be avoided, no more than one mid-span tension joint per conductor will be allowed in any one span.

Mid span Joints shall not be used in the following locations:-

a) Within 3 m of the line post insulator attachment or dead-end tension joint.
b) In spans over railways, navigable rivers, motorways, buildings or spans covered by special wayleave conditions.

Mid-span tension joints and compression dead ends shall be in accordance with the performance and test requirements of NPS/001/016 and IEC 61284.

3.4.3.5. Conductor Non-tension Joints

Non-tension joints shall comply with the performance and test requirements of partial tension fittings as detailed in IEC 61284 and NPS/001/016. The maximum resistance of all joints shall not exceed 75% of the resistance of an equivalent length of conductor. A record of all joint resistances shall be made and retained as part of the overhead line records.

3.4.3.6. Conductor Dampers

The specific requirements for Aeolian Vibration dampers will depend on one or more of the following factors: the geographical orientation of the line with respect to large bodies of water, the frequency of laminar winds (0.5 m/s to 10 m/s), the ground terrain, the nature of the ground cover and the 'everyday' conductor tension. However as a general rule Vibration Dampers shall be installed on all spans erected to the extended design and all spans in excess of 150m on the normal design. Vibration dampers shall be designed and supplied in accordance with Northern Powergrid product specification NPS/001/022. Where vibration dampers are installed over Armour Rods the clamp of the damper shall be correctly sized for this application. Clamp bolts shall be locked in an approved manner. One damper shall be installed at each end (2 per span) on all span lengths in excess of 150m up to and including 220m. See drawing 1091010188 sht1 for details on vibration dampers. Vibration dampers shall be positioned 800 mm from the mouth of the suspension or tension clamp.

3.5. Supports & Steelwork

3.5.1. Crossarm Assemblies

Mild steel crossarm assemblies shall be designed in accordance with BS5950 Part 1 except that a partial material factor γ_m of 0.64 shall be applied to the yield strength of grade S275 steel to EN 10025. For other grades of steel a partial factor equal to the ratio of yield strength to ultimate tensile strength shall be used. Crossarm assemblies shall be supplied in accordance with of Northern Powergrid product specification NPS/001/005.

Following the completion of all fabrication processes on the support steelwork, including nuts, bolts and washers, they shall be hot dip galvanised and tested in accordance with the requirements of BS EN ISO 1461.

Steelwork assemblies for intermediate positions are designed to support a 1:10 conductor downpull on each side of the support with the design based on the conductor downpull acting in a direction such that a tangent of the angle to the horizontal plane in not greater than 1:10 whereas section steelwork has been designed to accommodate a 1:20 conductor downpull under the same loading condition.

3.5.2. Fasteners and Washers

All bolts with the exception of those used to retain post insulators shall be a minimum grade of 4.6 in accordance with BS EN 20898. *All post insulators shall be secured to the crossarm assemblies through the use of high tensile fixing bolts, min grade 8.8 complete with washers and spring washers (these bolts and fixings shall normally be supplied with the post insulators.* All nuts, bolts, fasteners and washers shall be supplied in accordance with of Northern Powergrid product specification NPS/001/010 and ENA TS 43-96.

The length of a bolt or tie rod must be such that after installation there is a minimum of two full threads protruding from the nut. The excess length shall not exceed 25 mm. Where nuts or bolt heads come into contact with wood, or where slotted holes are involved, the use of washers is required and normally a washer will be used under both the bolt head and under the nut to adequately protect the galvanised skin of steelwork.

3.6. Stays / Stayed Structures

3.6.1. Use of Stayed Section supports

Section supports shall normally be used at the following locations:

a) At positions of line deviation
b) At positions where conductor out of balance produced by the use of alternative sag charts or conductors applies.
c) At each of the supports adjacent to a tee-off arrangement.
d) At the penultimate pole adjacent to a cable termination.
e) At power line crossing beneath steel tower lines of similar or higher voltage
f) Where a construction section is additionally justifiable.
g) Where it is not possible to provide the minimum 35% weightspan downpull force at portal suspension intermediate supports or the equivalent minimum -5.6°C cold curve value of -300mm for conductors in potential uplift situations on composite post insulator supports.

For extreme angles of deviation (i.e. above 60°) the line will be terminated in each direction such that the line conductors cross one above the other, the centre of the cross being approximately 6m from each terminal structure, the conductors separated by approximately three metres in the vertical plane and connected by vertical jumpers at the point of cross of each similar phase.

All stays shall be installed in accordance with Northern Powergrid guidance specification NSP/004/104 "*Guidance on the types and installation requirements for stays*".

Stay spreads shall normally be such that an angle of 45° is provided between stay and pole. In circumstances when tighter stay spreads are unavoidable due to physical obstructions, reduced angles can be used, subject to

the approval of the company's Overhead Line Policy & Standards Engineer or his representative. However the minimum allowable stay angle shall be 30º.

At single pole angle supports where a single stay is used the stay shall be set so as to bisect the angle of deviation to counteract the transverse component of the conductor tension. When two or more stays are fitted, they shall be arranged in a splayed formation symmetrical about the angle of deviation bisector.

Triple stays shall comprise two splayed stays as above, set at the approved angle to the pole, the third stay being placed to bisect the two and entering the ground at least 2 metres behind them.

Where structures with multiple stays are required to provide resistance for failure containment purposes, the location of stays shall be chosen to provide adequate longitudinal resistance. The ideal location for the outer stays in such cases is in line with the conductors in the opposite span, but if this does not provide adequate transverse resistance, a compromise position may need to be selected.

Multiple stay baulks shall be installed so that the length of undisturbed ground between the ends of the stay blocks or anchors is not less than 2.0m on single leg supports or in the case of multiple stays on 'H' pole supports then not less than 2.0m between rods on the stays for each leg.

At section positions where change of conductor type or sag chart give rise to the need for out of balance stays, single or double splayed stays per leg will normally be fitted to provide an angle of 45° between pole and stay. Normally, out of balance stays will be set under the line in each direction sufficient in number to be capable of terminating the line in each direction, unless by examination of the appropriate sag charts it can be shown that out of balance tensions do not reverse with change of temperatures, in which case stays may only be fitted against the higher tension conductors at the discretion of the company's Overhead Line Policy & Standards Engineer or his representative. All stay terminations attached to metal fittings shall be fitted with galvanised thimbles.

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

3.6.2. Loading limitations on Guyed Single Structures

To maximise the allowable strut load capability on single Extra Stout supports, this code of practice has amended the minimum acceptable pole diameters as detailed in BS 1990: Part 1 :1984. The tabulated "min" value has been increased to reflect a calculated mean value. The new effective min values are shown in the pole fabrication drawing 1091390003.

Note

Additionally to ensure that no loading situation exceeds the maximum allowable design values, an artificial maximum windspan limit has been set at 170m.

Variations in allowable pole diameters outside of these limits, stay spreads of less than 45º or maximum windspans in excess of these tabulated values may only be allowed with the approval of the of the company's Overhead Line Policy & Standards Engineer or his representative.

A table detailed "Angle & Terminal Structures - Stay Chart calculated against default Poplar conductor operating at 35.3kN MWT condition" has been provided in clause 3.2.3.2 to indicate typical stay requirements for various angle and terminal pole arrangements.

3.6.3. High Speed Road / Rail Crossing Backstays

See guidance provided in clause 3.11 of this document

3.6.4. Stay Ratings

All stays shall be adjustable, utilising 7/4.00 mm grade 1150 galvanised steel stay strand as detailed in ENA TS 43-91. Stay strand shall be supplied in accordance with the Northern Powergrid product specification NPS/001/013. The tensile strength of all components of the stay assembly shall be not less than the stay wire which has a MFL = 101kN. All stays shall be installed in accordance with the of Northern Powergrid code of practice *NSP/004/104 "Guidance on the types and installation requirements for stays"*

3.6.4.1. Stay Insulators

All stays shall be fitted with stay insulator(s) that are compliant with Northern Powergrid product specification NPS/001/006 and ENA TS 43-91.

All stays shall be positioned such that under a broken jumper or a broken stay condition the insulator shall prevent the stay becoming 'live'. The insulator shall therefore be placed below any likely point of contact with live metal, but must remain a minimum of 3.0 m vertically above the ground.

Stay insulators installed on stayed structures located within the approach zone i.e. up to 1.6km from a substation or a cable terminal support connected to a substation shall be installed as earthed stays. For further information on the arrangement of stays see drawing 1091010429 sht8, NSP/004/104 and the table below.

Stay insulators installed in stays on unearthed or normal supports i.e. outside of the approach zone shall be provided with system voltage related insulators inclusive of arc gaps to increase the lightening impulse rating of the support. For further information on the arrangement of stays see drawing 1091010429 sht8, NSP/004/104 and the table below.

Stay Insulators					
System Voltage	**Insulator Type**	**No of Insulators**	**Insulator Drawing No.**	**Insulator Arrangement Drawing No.**	**Arc Gap**
132kV	Unearthed or support	1	1091010372 sht2 Item 1	1091010429 sht8	1120mm
66kV	Unearthed support	1	1091010372 sht2 Item 2		540mm
33kV	Unearthed support	2	1000439107 sht1 item 2	1000439107 sht5	No Arc Gap req
All Voltages	All Earthed Stays	1	1000439107 sht1 item 1	1000439107 sht2	No Arc Gap req

3.6.4.2. Stay Foundations

Stay blocks shall be to ENA TS 43-91 drawing no. 439103 type 2 and installed at a depth of 1.8 m below ground level. Alternatively screw anchors supplied in accordance with the Northern Powergrid product specification NPS/001/020 may be used.

3.7. Support Foundations

Structure foundations shall be designed for three soil conditions with ultimate lateral rupture capacities of 628 kN/m², 471 kN/m² and 314 kN/m² per metre depth for good, good / average and average / poor soils respectively. Unless specific soil strength information is available, all calculations shall be based on 471 kN/m² or "average" soil on the premise that soil additives will be used.

Ground Classification for Foundations

Ground Classification in kN/m^2/m of depth	Soil Description
314	Poor: Soft clay, clay loam, poorly compacted sand clays containing a large amount of silt and vegetable matter, and made ground. Poor soils will normally be wet and have poor drainage.
471	Average(Medium): Compact fine sand, medium clay, compact, well drained sandy loam, loose coarse sand and gravel. Average soils should drain sufficiently well that water does not stand on the surface.
628	Good: Compact well graded sand and gravel, hard clay, well-graded fine and coarse sand, decomposed granite rock and soil. Good material should be well drained and in locations where water will not stand.

The following table of default pole foundations has been created based on the assumed average ground type described above Default Pole Foundations

Support Type	Foundation Type
1091380006 sht1 Single Inter Support	Foundations shall be as shown on the pole arrangement drawings - This arrangement shall be fitted with two wood foundation blocks, a (2500 x 250 x 125mm) top block as detailed on 1091010670 sht 11 and a (1300 x 250 x 125mm) lower block as shown in ENA TS 43-91 fig 3 type 2. The blocks shall be placed as follows: Ground line to top block centres = 500 mm Ground line to lower block centres = 800 mm. The minimum default singing depth shall be 2.6m Note. *Where use of the long top block creates wayleave / installation difficulties e.g. installation of poles adjacent to hedge lines or walls or the potential deep ploughing in fields, the top block may be substituted with a standard (1300 x 250 x 125mm) block. However this amended foundation is only permissible where the ground type has been classified as "good/average" see the table above for details on classifications of soil types*
1091390016 sht1 Rutter Inter Support	Foundations shall be as shown on the pole arrangement drawings - All un-stayed structures shall be fitted with four wood foundation blocks (1300 x 250 x 125mm) as detailed in drawing 1091010675 sht 30. The blocks shall be placed as follows: Ground line to 2 x Top Block Centres = 700 mm Ground line to 2 x Bottom Block Centres = 2800 mm. Note. *Where these structures are installed in poor ground the default top block types shall be replaced by a (2500 x 250 x 125mm) as detailed in drawing 191010675 sht 30.* *The minimum default singing depth shall be 3.2m*
1091231165 sht4 H Portal Inter Support	Foundations shall be as shown on the pole arrangement drawings - All supports shall be fitted with a Wood Block (3600 x 250 x 125mm) as detailed in 1091010650 sht3 item 8, two foundation braces as detailed in 1091010650 sht 3 item 9 and four wood foundation blocks (1300 x 250 x 125mm) as detailed in drawing 439103 type 2. Ground line to top block centres = 500 mm Ground line to lower block centres = 800 mm. The minimum default singing depth shall be 2.4m

All Stayed Structures	For stayed structures an ultimate soil bearing capacity of 429 kN/m² shall be used. Foundations shall be as shown on the pole arrangement drawings – All arrangement will be based on one of the above arrangements but shall include for the supports to be located on wood or concrete blocks in the base of the pole hole.

All pole foundations shall incorporate the use of "Perma-Soil" backfill additives. 25kg of Perma-Soil shall be added per cubic metre of excavated spoil. The mixture shall be replaced in the excavation and fully compacted in layers not exceeding 300mm thick. Initially the bottom baulks only shall be fitted to unstayed structures to facilitate this compaction. The top baulks shall only be fitted when the compacted fill reaches the underside of these baulks.

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

3.8. Insulators

Unless specified otherwise, all insulators shall be manufactured from composite materials and be fully compliant with Northern Powergrid product specification NPS/001/006 and ENA TS 43-93. The specified cantilever load (SCL) shall comply with Clause 8.2 of ENA TS 43-93 and shall therefore be at least 21kN.

The insulators specified within this code of practice have been selected for two purposes:-

a) To provide the necessary electrical parameters to operate the lines at 132kV
b) To provide sufficient conductor separation to allow for the long spans permitted by this code of practice

The original variant of this code of practice specified the use of 132kV post insulators irrespective of the actual line operating voltage due to the need to maintain the required conductor separation distance for conductor clashing purposes with the use of a range of arcing horns installed on the insulators to reduce the lightning impulse withstand level of the insulators when the lines approached cable terminations or substations.

3.8.1. Post Insulators

Following a review of the above practice it has been decided to introduce a new range of hybrid post insulator assemblies that provide the necessary insulation levels for the operating voltage of the line but whilst still maintaining the required spatial distances thus removing the need for complicated arcing horn assemblies and reducing the cost of the overall insulator assembly. This has been achieved through the use of a range of stools which provide the same end interfaces as the original insulators.

	Post Insulators					
System Voltage	**Insulator Type**	**Insulator Drawing No.**	**Insulator Length (mm)**	**Stool Drawing No.**	**Stool length (mm)**	**Overall length (mm)**
132kV	Vertical Post	1091010487 sht 18	1576	Not Req		1576
	Horizontal Post	1091010487 sht 16 Item 1	1616	Not Req		1616
	Horizontal Post Bendable Base	1091010487 sht 16 Item 2	Not Appl	Bendable base for use with item 1 on single pole supports (former OHL9 type)		
66kV	Vertical Post	1091010487 sht 36	930	1091010487 sht 38	646	1576
	Horizontal Post		946	1091010487 sht 39	670	1616
33kV	Vertical Post	1091010487 sht 37	600	1091010487 sht 40	976	1576
	Horizontal Post		616	1091010487 sht 41	1000	1616

Notes

1) *See drawings 1091010487 sht 42 and sht 43 for a illustrative summary arrangement drawing of the different horizontal and vertical arrangement detailed above.*
2) *Drawings 1091010487 sht 36 and sht 37 are universal 66 and 33kV post insulator drawings allowing them to be used as either vertical or horizontal post insulators with their respective associated stool drawings.*

3) *Post insulators on intermediate supports do not require the installation of arcing horns. See notes in clause 3.10*
4) *All post insulators shall be secured to the crossarm assemblies through the use of high tensile fixing bolts, min grade 8.8 complete with washers and spring washers (these bolts and fixings shall normally be supplied with the post insulators. Vertical posts require M16 x 65mm, horizontal posts require M22 x 160mm*

3.8.2. Suspension Insulators

The specified composite suspension insulators shall be ball and socket and have a mechanical rating of 70kN with a standard coupling size of 16 mm. End fittings shall be in accordance with BS EN 61466-1. Sockets shall have "W" type phosphor bronze security clips in accordance with IEC 60372.

Suspension Insulator Strings for use on the Portal H Structures					
System Voltage	Insulator Type	Insulator Arrangement Drawing No.	Insulator Drawing No.	Insulator Length	Arc Gap
66kV	70kN Suspension String	1091010488 sht 6	1091010487 sht 20	700 mm	540mm
33kV	70kN Suspension String		1091010487 sht 23	420 mm	Not req

All suspension insulators strings shall be classified as "suspension string – normal". As such arcing horns are not required on 33kV strings but they are required on 66kV strings. They shall be fitted with a fixed arc gap irrespective of their location on the network as it is assumed that all related cable terminal structures will be fitted with surge arrestors as detailed in clause 3.10

Care must be taken when replacing suspension insulator strings on existing supports to ensure that the existing conductor thermal rating of the line is not compromised by the replacement string assembly as replacement strings lengths can sometimes vary compared to those used many years ago resulting in a potential loss of ground clearance.

3.8.3. Tension Insulators

Unless specified otherwise the default tension insulator type used in this code of practice shall be a composite tension insulators with a ball and socket that has a 120/125 kN mechanical rating that utilises 20mm end fittings in accordance with BS EN 61466-1. All sockets shall be supplied complete with "W" type phosphor bronze security clips.

However it is still permissible to use 70kN tension insulators comprising 16mm end fittings to support the use of conductor sizes that utilise lower erection tensions and thus allow the use of helical termination fittings.
To protect tension insulators and nearby plant and equipment connected to the overhead line route from lightening overvoltage damage, all tension insulators with the exception of 33kV insulators are normally fitted with arcing horns. The gap between the arcing horns or arcing ring is dependent upon the location of the support or if the support is an earthed structure due to the presence of a cable termination or other pole mounted plant i.e. ABSD.

All tension insulators located on unearthed supports or supports outside of the "1.6km Substation Approach Zone" shall be classified as "tension string – normal".

All tension insulators located on earthed supports or supports located inside the "1.6km Substation Approach Zone" shall be classified as "tension string – approach" See also notes in clause 3.9.1

Tension Insulator String Assemblies						
System Voltage	Insulator Type	Insulator Arrangement Drawing No.	Insulator Drawing No.	Insulator Length	Arc Gap	Comments
Default Insulator Rating 120/125kN						
132kV	125kN Tension String - Normal	1091010487 sht 30	1091010487 sht29	1602mm	1120mm	Replacement for 9*178mm
	125kN Tension String - Approach	1091010487 sht 31			1000mm	

66kV	125kN Tension String - Normal	1091010488 sht 9	1091010487 sht21	890mm	540mm	Replacement for 5*178mm
	125kN Tension String - Approach				440mm	
33kV	125kN Tension String – All Situations		1091010487 sht25	534mm	Not Req	Replacement for 3*178mm
Alternative Insulator Rating 70kN for merging with other historical lower tension Lines						
66kV	70kN Tension String - Normal	1091010488 sht 8	1091010487 sht 20	700mm	540mm	5*140mm
	70kN Tension String - Apprach				440mm	
33kV	70kN Tension String		1091010487 sht 23	420mm	Not Req	3*140mm

3.9. Lightning Protection and Earthing

An "Approach Zone" section structure support only needs to be connected to earth if the support was already classified as a earthed support due to it being a cable termination, plant carrying pole, steel support structure or the penultimate support before a cable termination support as this code of practice has been designed to be of unearthed construction as such it is not normally necessary to install lightning overvoltage protection in the form of arc gaps on any post type intermediate support structures. However to avoid a capacitive induced potential on unearthed supports, all insulator support steelwork on intermediate supports shall be bonded together using flexible insulated earthwire bonds. Similarly, all stays shall be bonded at the top of the pole steelwork. See also clause 3.6.3.1 relating to stay insulators.

3.10. Surge Arrestor Installation

The need for surge arrestors at cable termination supports is normally dependent upon the length of installed underground cable or the distance from a cable termination support to a substation. See IMP/007/011 "*COP for the application of lightening protection*" for more details.

However the use of surge arrestors on cable termination supports beyond where they may not be classed as necessary in IMP/007/011 can significantly simplify the selection of tension insulator strings for "Approach Zone" supports as their use negates the need for reduced gap insulator strings allowing all supports to be specified as "Tension String – Normal"

3.10.1. Earthing Structures

Where it is necessary to earth a structure, then the pole crossarms shall be earthed by means of a 70mm PVC (Green) insulated copper cable down the pole, fixed to the pole at intervals of not more than 600 mm and connected to earth rods. Rods shall be driven into the ground as necessary to obtain a maximum earth resistance of 10 ohms. Earthing leads shall be protected by a casing for a distance of 3.05m minimum from ground level. Earth rods and their connectors shall comply with the requirements of ENA TS 43-94 and of Northern Powergrid material specification NPS/002/001 *"Technical Specification for earthing materials"*

In order to enable earth electrodes to be bolted to steel poles, earthing lugs shall be attached to the pole shaft 300mm above the top of the concrete foundation.

3.10.1.1. Earthing requirements at surge arrestor supports

The combined resistance to earth of the electrode and cable sheath for surge diverter installations shall not exceed 10Ω. The surge arrestor main earth conductor shall be kept separate from the general steelwork / earth bonding conductors being installed such that it provides a continuous 70mm PVC insulated copper path direct from the arrestor to the earth electrode following a path which is as straight as possible and avoiding any sharp bends. Connections between the earth terminals of individual arrestors shall be afforded using copper conductors rather than using the connectivity of any supporting steelwork. This shall be achieved through the use of 4mm x 40mm High conductivity Plain Copper Strip in accordance with Northern Powergrid material specification NPS/002/001 *"Technical Specification for earthing materials"*

3.11. Undergrounding Overhead Lines at Road and Rail Crossings

In accordance with IMP/001/913 "*COP for the Economic Development of the EHV System*" it has been common practice to automatically arrange for EHV overhead line routes to be undergrounded when "Constructing new overhead lines or rebuilding / re-conductoring existing lines at the crossing of motorways, high-speed dual carriageways and electrified railways …….. where ever reasonably practicable and economically viable". The main driver for the above statement is the assumption of an increased risk of the likelihood and or consequences of an incident occurring at such crossing points.

As can be seen from the following cost matrix the option of undergrounding is rarely economically viable on a pure cost basis.

		CROSSING TYPE							
		ROAD			RAIL		OTHER		
		MOTORWAY	A DUAL CARRIAGEWAY	OTHER	ELECTRIFIED	NON-ELECTRIFIED	RIVER	RESIDENTIAL	ETC.
COST OF CABLE VERSUS OVERHEAD LINE	X 1	CABLE	CABLE	CABLE	CABLE	CABLE	CABLE	CABLE*	CABLE
	X 2	CABLE	CABLE	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 3	CABLE	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 4	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 5	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 6	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 7	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 8	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 9	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL
	X 10	OHL	OHL	OHL	OHL	OHL	OHL	CABLE*	OHL

* Where there is no technically acceptable offline solution

As such each crossing shall be the subject of a review to determine the typical cost multipliers between retaining the overhead route versus undergrounding the route.

Where it is shown that it is not economically viable to underground the route which will generally be the case, then the existing crossing shall be maintained but only providing that the following mitigating measures can be installed to reduce both the risk and the consequences of any failure occurring over the crossing span.

Mitigation Measures

- Support structures on any non-self-supporting structures located at major road/rail crossing sites shall ideally have failure containment stays installed in both directions but as a minimum the structures shall have stays installed towards the non-road crossing spans to negate the impact of a broken conductor on any of the approach spans.
- Support structures at the crossing sites shall be located sufficient distance away from any high speed roads such that both the supports and any associated failure containment stays are outside the area of risk from possible damage from vehicles leaving the carriageway. In many cases it may be possible to install supports on the far side of any carriageway fence line or perhaps on elevated ground each side of the road. However if sufficient natural protection or distance from the carriageway is not available consideration shall be given to the construction of a small protective crash barrier or impact defence system.
- The crossing span shall be treated as a single span section of line, and not carried onto other supports each side of the crossing allowing it to be quickly replaced and thus minimising the impact on the road/rail infrastructure being crossed.
- Where practicable replacement support structures shall be selected such that they have sufficient height to allow future temporary scaffold systems to be erected beneath the live conductors without the need to isolate the overrunning line but whilst still providing full high load or motorway clearances as defined in NSP/004/011 "Guidance on Overhead Line Clearances". This may not always be possible but should be considered at the planning stage.
- Where crossing spans retain existing conductors that have conductor UTS values of less than 50kN or the crossing span is longer than the normally acceptable clashing span for that section of line then the conductor CSA shall be uprating to a larger size over the crossing span to reduce the risk of ice load or

clashing conductor related failures. Since we will already have backstays in both directions on the supports then any tension differentials will not be an issue.

- In accordance with NSP/004/012 "Guidance on the Risk Assessment of Overhead Lines" the support locations shall be added onto the companies high risk register for more frequent inspections on the supports, fittings and stays due to the increased consequences of failures at these type of sites.

All of the above measures apply equally to high speed road and rail crossings and should not unduly impact on the cost of retaining the span overhead thus mitigating the risks and allowing us to pursue the economic benefits of not requiring the section of line to be undergrounded.

3.12. Re-assessment of Existing Stout Grade Cable Terminal Supports

To match the long spans previously provided by the former Woodhouse Mast Specification, this code of practice makes use of higher line design tensions. However a consequence of this action is that the stays used to terminate these lines now impose increased strut load forces onto the supports. This then results in a number of existing H Terminal structures supporting 33 or 66kV Cable terminations on supports being classified as unsuitable because they are only Stout grade rather than the now required E/Stout grade. Thus potentially otherwise healthy poles are being unnecessarily asked for replacement on renovated line routes with significant cost implications due to the premature cost of replacing cable terminations.

The proposed re-assessment methodology makes use of the fact that many of these supports also contained an additional crossarm member at the top of the poles to terminate the earth continuity conductor from the woodhouse mast lines together with an additional set of backstays, neither of which are required once the line has been refurbished to this code of practice. To minimise these costs the following assumptions and assessment process shall be followed:-

a) It is assumed that the existing wood pole and crossarm are fit for continued use, having first been tested with a PURL or equivalent residual strength measure device in accordance with NSP/004/112 *"Guidance on the Inspection and Testing of Wood & Steel Poles"*.

b) Establish the following set of measurements;

   1. Pole diameter at a point 200mm above the current crossarm mounting bolt used to terminate the existing phase conductors and measurement of this point from current pole top
   2. Pole diameter at Ground level
   3. Confirm the pole diameter at the pole gough mark together with the existing marked pole height and grade.
   4. Confirm the current pole sinking depth

c) From these values the actual pole taper and thus the new equivalent pole grade if the pole length above the conductor fixing point is ignored can be calculated.

d) In most cases this will prove to be the equivalent of an E/Stout grade pole and in addition the strut load can be reduced further without impacting on existing wayleaves by extending the conductor stays out to that point previously utilised by the earth continuity wire stays.

Where this methodology confirms an existing otherwise healthy pole meets the required pole grade, sinking depth and stay spread then it shall be retained within the refurbished line.

3.13. Anti Climbing Devices

Anti-climbing devices (ACD) shall be designed in accordance with the of Northern Powergrid material specification NPS/001/029 "*Technical Specification for Wood Pole & Tower Anti-Climbing Guards*" and be installed in accordance with NSP/004/109 "*Guidance on anti-climbing devices, safety signs and labels required on overhead line supports"*

They shall consist of pre-wrapped barbed wire Anti-climbing guards (Enhanced Design) and shall as a default be installed on all rutter type poles. See drawing 1091010675 sht 33 for further details. The installation of standard types of ACD on all other structure types will be dependent upon their location and other equipment secured to the pole. See NSP/004/109 for further details

3.14. Safety Signs, Labels and Notices

All supports shall be fitted with at least one Safety Sign. The sign shall be mounted approximately 3 m above the ground level, above any anti-climbing guard and clearly visible to an observer on the ground. Safety Signs, labels & notices shall be designed in accordance with Northern Powergrid material specification NPS/001/011 *"Technical specification for Notice Plates and Signs"* and shall be installed in accordance with Northern Powergrid guidance note NSP/004/109.

3.15. Climbing systems and work positioning attachment points

In accordance with the requirements of the Working at Height Regulations 2005, these structures have been designed to accommodate the installation of an assisted temporary climbing system. This system involves the permanent installation of fixing brackets at specific points up the structures during the initial construction process which allow the later installation of a lightweight temporary ladder system. (See Appendix E, item E4 for details). The ladder system provides a combined access and fall arrest system via its internal track system. The internal track system allows a travelling device (See Appendix E, Item E6 for Details) located in the track to follow the direction of the climber and in the event of a fall, the travelling device locks onto the track.

The ladder system is constructed from individual small ladder sections approx 2m in length (See Appendix E, item E5 and E5.1 for details) allowing the climber to provide an access system from a point above the structure ACD to a point above the pole top. A selection of ladders will be provided at a central point within Northern Powergrid to provide access to structures when required.

Additionally all poles have been designed to incorporate fall arrest / work positioning attachment points. These are provided via the installation of M20 eyebolts at strategic points around the pole top working area.

Although this climbing system has been designed into the structures, it is envisaged that in most cases pole top access is likely to be achieved through independent means i.e. mobile access platforms.

Ladders are available in 5 standard sizes. To accommodate the varying pole heights and arrangements the following matrix has been produced to indicate the combinations required in each situation.

Type	Description	Cat Number	No Rungs	Weight in Kgs
A	Common base ladder section 2240mm in length	313080	8	9.2
B	Intermediate ladder section 1960mm in length	313081	7	8.3
C	Intermediate ladder section 1680mm in length	313082	6	7.4
D	Intermediate ladder section 1400mm in length	313083	5	6.5
E	Shaft Entry Top Section 1120mm in length	313084	1	4.5
-	Permanent Female Mounting Brackets	313086	-	-
-	Glidelock Traveller	313085	-	-

Ladder Selection Table

Structure Type	(Rutter Pole)	Bkts Req	Single section poles & H section / terminal poles	Bkts Req
12m	(1 x A) + (1 x B) + (2 x E)	8	(1 x A) + (3 x D)	8
13m	(1 x A) +(1 x C) + (1 x D) + (2 x E)	10	(1 x A) +(1 x B) + (1 x C) + (1 x D)	8
14m	(1 x A) + (3 x D) + (2 x E)	12	(1 x A) + (1 x C) + (3 x D)	10
15m	(1 x A) + (3 x C) + (2 x E)	12	(1 x A) + (5 x D)	12
16m	(1 x A) + (2 x B) + (2 x D) + (2 x E)	14	(1 x A) + (3 x C) + (2 x D)	14
17m	(1 x A) + (5 x D) + (2 x E)	16	(1 x A) + (2 x C) + (4 x D)	16

Note : H pole require the number of brackets and ladders to be doubled (ladders fitted to each leg)

3.16. Specialist Pole Top Working Equipment

3.16.1. Combined Platform / Crane Assembly

To allow insulators and conductors to be manipulated whilst working at the pole top, a combined pole top platform / crane assembly has been designed. The assembly has been constructed in a modular fashion to allow it to be carried up the pole and assembled. Once in place the crane allows conductors to be manipulated in or out of the insulator conductor clamps and or the complete insulator assemblies to be replaced in a controlled manner. The crane assembly has been designed and to incorporate fall arrest attachment points for work required above the pole top. (See Appendix E, item E1 for details)

3.16.2. Pole Platforms

The pole top has been designed to allow installation of the standard 2m long pole top temporary access platform. Once in position the platform is capable of providing full access to the outer insulators.

3.16.3. Insulator Mounted Running Blocks

Specialist insulator mounted running blocks have been designed to allow the conductors to be installed and manipulated into the insulator conductor clamps in a safe controlled manner without the need for any other additional equipment. (See Appendix E, Item E2 and E3 for details)

3.17. Survey and Profiling

Survey and profiling shall be carried out in accordance with the company's guidance document NSP/004/031 – "*Code of practice for the survey of Overhead line Routes*". All proposed routes shall be surveyed to ensure conformance with company's design and clearance criteria.

The survey data together with the proposed pole type and position shall be presented back to the Company in an electronic design file format for inspection and approval.

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

In addition way-leaves shall be obtained and forwarded together with plans to a 1 : 10,000 scale to enable Form B, Section 37, DECC consents to be applied for. Upon completion of a satisfactory design and receipt of way-leaves and consents, line schedules shall be produced for construction and line record purposes. All CAD designs shall be given a unique file reference, related to the line feeder route number and archived.

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

3.17.1. Conductor Design Checks

During the design stage, care shall be taken when selecting support locations and heights to ensure that all new do not create conductor uplift or breaches of the minimum weight span requirements. This condition shall be checked through the use of an unloaded, -6.0 °C conductor catenary curve being applied to the profile to ensure that 0.5m exists between the top of the insulator and the cold curve position or in the case of portal intermediate structures that a minimum of 35% of the calculated weightspan is acting on every suspension string as failure to do so can result in accelerated fittings wear, and or uncoupling of the insulator string.

Where uplift situations are designed out of the line by increasing the support heights, this process shall not result in excessive pole heights i.e. typically only two or three additional pole increments before the pole is sectioned to remove the issue.
All Lines shall be checked for conformance with the clearance requirements of Northern Powergrid guidance document NSP/004/011.

3.17.2. Conductor Design Guidance

3.17.2.1. Conductor Sagging Bases

Conductors shall be installed to comply with the sagging bases detailed below:

Condition	Temp	Radial ice	Ice	Wind	Tension	Comment

	(ºC)	thickness (mm)	Density (k/m³)	Pressure (N/m²)	Limit	
High wind	-5.6	N/A	N/A	1740		
Combined wind and ice (normal altitude)	-5.6	9.5	913	380	RBL/γ_m	Maximum working tension limit
Combined wind and ice (high altitude)	-5.6	12.5	913	570		Maximum working tension limit
Still air	15	N/A	N/A		BL/5.0	Aeolian vibration limit
Max. operating	75	N/A	N/A	N/A		

Where RBL is the rated breaking load of the conductor.

3.17.2.2. Conductor Creep Compensation

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

(i) Over-Tensioning

The reduction of sag due to the increased tension compensates for the increase in sag due to conductor creep during the life of the line. The over tension can be applied either as a temperature shift or as a percentage increase over the design tension. The following over-tension values should be used.

Conductor Type	Spans less than or equal to 150m	Spans greater than 150m
AAAC	10% increase in tension	-20ºC temperature shift
ACSR	10% increase in tension	-20ºC temperature shift

(ii) Ordinate Shift

Longitudinal profiles for overhead lines commonly use the "Optimal, PoleCad Software" to design overhead lines and to ensure that all statutory clearance requirements have been met. The calculations used in the production of ground clearance curves apply a technique of modifying the clearance ordinates by reducing the conductor tension by a specific percentage. This process builds in a small safety factor into the clearances. All percentage reduction values are based on an application temperature of 15°C. Lines to this code of practice shall utilise a 10 % reduction

3.18. Inspection

All lines shall be inspected before commissioning.

3.19. Guidance on the Refurbishment of Existing EHV routes

The Northern Powergrid policy for the rebuild of refurbishment of existing EHV overhead lines routes is driven from the results of the CBRM and common methodology Health Models held for each component/support located in the overhead line route. The data used to populate these models is generally obtained from the scheduled overhead line inspection process as detailed in MNT/004 “Policy for the inspection and maintenance of Overhead Systems”.

As such the models provide a targeted plan detailing the timing and level of intervention required against each structure/component contained in each line. Dependant on the quantities and actual component requiring replacement the final intervention level will vary between partial or whole line replacements to that of individual supports or components parts of a support.

With the exception of the woodhouse mast lines, the level of intervention normally associated with EHV overhead lines routes generally involves the replacement of a number of the supports in the route rather than the complete rebuild of the line. Whilst this type of refurbishment practice results in a cost effective refurbishment process by only replacing those components or structures that are no longer fit for service, it does result in an increased level of risk that less obvious or hidden failure mechanisms are retained in a refurbished

line. As such if left unidentified they have the potential to negate all of the benefits achieved by replacing the other line components. Hence whilst our company policy is to replace components on a condition basis rather than an age basis, we still recognise that certain components can sometimes mask their true condition from standard non-intrusive inspection procedures and thus require time based replacement.

Suspension Insulator assemblies are one such example where they shall be replaced on a time based frequency. As such all existing line design types that incorporate suspension insulator string assemblies shall have all components that make up the assembly from the attachment point on the crossarm to the conductor clamp replaced once the fittings on the line exceed 45 years of age.
Note

Suspension insulator string replacement shall also include for the installation of a AGS Armour Grip Suspension Units or the use of conductor line splice(s) used in conjunction with the replacement suspension clamp(s) rather than just a direct replacement to reduce the risk of premature conductor failures due to work hardening of the conductors at the points where the conductors exited the old clamps.

Unless actual site condition demands otherwise, it is not proposed to replace the tension insulator assemblies at this time as these fittings should normally have life expectancies in excess of their associated wood section/terminal poles and will therefore always be replaced when the poles are replaced.

Where lines are refurbished that contain intermediate supports using pin or post insulators, then it is anticipated that unless local conditions dictate otherwise that these insulators and their associated binders/clamps will be suitable for continued use on the system to a point beyond that of the normal expected age of a wood pole support and hence will not require replacement until the wood pole is replaced.

Therefore once a line has been identified for refurbishment rather than a total rebuild, the following steps shall be completed and their results documented. The inspections shall be carried out before the work on the line is started to ensure that the work requirement for the refurbishment has been fully scoped.

- A patrol of the complete line with a dead line climbing inspection of a minimum of 10% of the supports contained in the overhead line route with the selection of supports being biased towards those supports located at high risk locations. Guidance in the identification of high risk locations can be found by making reference to NSP/004/012 – "*Guidance on the Risk Assessment of Overhead Lines*".
- All poles shall be subjected to a ground patrol pole inspection as detailed in NSP/004/112 – "*Guidance for the inspection and testing of wood & Steel Poles"*
- Conductor samples shall be taken at two separate locations along the route. Each set of samples will consist of 3 separate lengths of conductor a minimum of 5.0m in length. For details on where conductor shall be taken and how the samples shall be managed see a similar process for obtaining conductor samples identified in NSP/004/030 "*Specification for the construction and refurbishment of 33-132kV Tower lines*", clause 3.4.7.2
- A line survey of the existing route shall be commissioned to confirm that all spans have the required minimum ground clearances in accordance with NSP/004/011 "*Guidance of Overhead Line Clearances*" both for their original max design temp and or opportunities for being uprated. The results of these being discussed with the EHV design team.
- A vegetation report confirming the current level of compliance with MNT/013 "*Policy for the Management and Control of Vegetation near Overhead Lines*" and the need for any tree trimming interventions.
- The last thermal vision report associated with the circuit shall be reviewed to confirm any suspect electrical connections at all current carrying clamps, joints and connections. Where no report exists then all connections not planned for replacement shall be tested during the refurbishment works in accordance with NSP/004/122 and or the process outlined in NSP/004/030 clause 3.5.4.4 this process is especially important where the line is being considered for thermal uprating as one of the refurbishment deliverables.
- Where the line contains steel lattice supports that have been initially identified as suitable for being retained the foundations associated with those supports shall be subjected to a combination of both

intrusive and non-intrusive inspections – Further guidance on the type and frequency of inspections can be found in NSP/004/030 clause 3.10.

At the time of these refurbishment works, unless site condition dictates otherwise the following components shall be assumed as requiring replacement:-

- All signs, notices and anti-climbing devices – see *NSP/004/109 "Guidance on anti-climbing devices, safety signs and labels required on overhead line supports"*
- All unless thermal inspection reports exist confirming that all electrical connections are satisfactory, then all connections shall be ductor tested in accordance with NSP/004/122 "*Guidance on the electrical Resistance Testing of O/H Line Joints and Terminations"*
- Testing and inspection of all earth connections and resistance values e.g. at cable terminal poles and plant poles

Where inspection activities have confirmed that supports require replacement in legacy line constructions, the following table shall be used as a guide to the selection of the modern replacement pole arrangement drawing.

Recommended modern equivalent arrangement drawing for historical EHV Wood Pole designs

Existing or replacement Pole Assembly Drawing	Pole Fabrication Drawing	Description
OHL4 (Single Pole Design)	MWT of design 17.79kN utilising 70kN suspension and tension fittings Typical max span for 100mm AAAC – 168m on 16m stout grade poles or 200m on E/Stout (see foundations & clashing limits in Engineering Instruction O.311) Typical max span for 175mm ACSR – 100m on 16m stout grade poles or 130 on E/Stout (see foundations & clashing limits in Engineering Instruction O.311)	
1091231190 sht3	1091231186 sht1	Single pole intermediate Structure
1091231191 sht1		Single pole Straight line Section Structure
1091231192 sht1		Single pole, Section Angle, small angle structure 100mm AAAC / 100mm ACSR - 25° (Stout) or 45° (E/Stout) 175mm ACSR - 5° (Stout) or 20° (E/Stout)
1091231193 sht1 (Obs) Replace with 1091390014 sht1 or 1091390018 sht1	1000434002	Obsolete - 1.83m Ctrs H Pole, Section Angle (Large Angle) Structure Replace with Single E/Stout Pole , Section Angle structure, 20º – 40º or 2.9m Ctrs H Pole, Large Section Angle 40º – 60º
1091231172 sht3 (obs) or 1091231173 sht1 (obs) Replace with 1091390019 sht1 or 1091231173 sht 4	n/a 1091011187 sht1 Replace with 1091390019 sht2 or 1091231173 sht5	Obsolete – 2.4m ctrs H Terminal (No Cable) or Obsolete - 2.9m Ctrs H Terminal Structure (No Cable) Replaced with 2.9m Ctrs H Terminal Structure (No Cable) or 2.9m Ctrs H Terminal Structure (Single Core Self Supporting Cable Termination)
1091231173 sht2 (obs) Replace with 1091390021 sht 1	1091011187 sht 1 Replace with 1091390018 sht2	Obsolete - 2.9m Ctrs H Pole, Out of Balance – Straight Line Sect Assembly (Extra ordinary long Spans) Replace with 2.9m Ctrs H Pole, Out of Balance – Straight Line Section Assembly (Extra ordinary long Spans)
1091231173 sht 13	1091231173 sht 14	2.9m Ctrs H Pole, Straight Line Section with In Line Cable Tee
1091231160 sht1	Existing 'A' Pole	Info Only – 'A' pole refurbishment – details of suspension insulator attachment plate
1091231190 sht4		'A' Pole, Intermediate refurbishment assembly
1091231191 sht2		A' Pole, Straight Line Section refurbishment assembly
1091231192 sht2		'A' Pole, Section Angle, small angle refurbishment assembly
Existing or replacement Pole Assembly Drawing	**Pole Fabrication Drawing**	**Description**
OHL4 (Long Span Portal	MWT of design 17.79kN utilising 70kN fittings	

Existing or replacement Pole Assembly Drawing	Pole Fabrication Drawing	Description
Design)	Typical max span for 100mm AAAC – 200+m on 16m stout grade H poles (see foundations & clashing limits in Engineering Instruction O.311)Typical max span for 175mm ACSR – 170m on 16m stout grade H poles (see foundations & clashing limits in Engineering Instruction O.311)	
1091231165 sht1 (Obs) Replace with 1091231165 sht4	1091231187 sht1	Obsolete - 2.9m Ctrs H Intermediate Suspension Structure Replace with 2.9m Ctrs H Intermediate Suspension Structure
Historic Intermediate Portal Crossarms 66.5/10.1161 sht3	1091010706 – Suspension Insulator attachment plate – to be replaced when insulator strings are being replaced on historical assemblies	
1091231162 sht1 (Obs) or 1091231162 sht2 (obs) Replace with 1091390014 sht1 orr 1091390018 sht1	1091231187 sht1 Replace with 1091390003 sht2 or 1091390018 sht2	Obsolete - 2.9m Ctrs H Poles, Large Section Angle or Obsolete - Application of standard crossarm to existing pole dressed to 66.5/10.1162 Replace with Single E/Stout Pole , Section Angle structure, 20º – 40º or 2.9m Ctrs H Pole, Large Section Angle Pole 40º – 60º
1091231163 sht1 (obs) or 1091231163 sht2 (obs) Replace with 1091390013 sht1 or 1091390020 sht1	1091231187 sht1 Replace with 1091390003 sht 2 or 1091390018 sht2	Obsolete - 2.9m Ctrs H Pole , Straight Line Section Structure or Application of standard crossarm to existing 2.74m or 2.44m Ctrs H Poles dressed to 1091231163 replace with Single E/Stout Pole , Straight Line Section Pole (any conductor) or 2.9m Ctrs H Pole, Straight Line Section Pole
For available terminal, cable terminal and out of balance line section structures in portal lines see 1091390019 sht1, 1091231173 sht 4, 1091231173 sht13 and 1091390019sht 4		
1091231164 sht1	1091231164 sht3	Large Section Angle Structure, Application of standard crossarm to existing 2.44m Ctrs H Poles dressed to 33.41/1.640 or 66.5/10.1164

Existing or replacement Pole Assembly Drawing	Pole Fabrication Drawing	Description	
CE/C/37 - Portal Design	MWT of design = 25kN utilising 125kN fittings Typical max span for 175mm ACSR – 180m on 16m stout grade H poles **Similar construction type historic design specifications – CE/C/13**		
CE/C/37 (M1) - Portal Design	Upgraded Specification – to cater for 200mm AAAC. MWT of design 23kN utilising 125kN fittings Typical max span for 200mm AAAC – 180m on 16m stout grade H poles		
Y104L0101 (Obs) or Y104L0112 (Obs) Replace with 1091231165 sht4	Y003X3103 Y003X3103 Replace with 1091231187 sht1	Obsolete – 2.44mm Ctrs H Portal H Intermediate Suspension Structure Replace with 2.9m Ctrs H Portal H Intermediate Suspension Structure	
Y104L0102 (Obs) or Y104L0113 (Obs) Replace with 1091390013 sht1 or 1091390020 sht1	Y003X3103 Y003X3103 Replace with 1091390003 SHT 2 or 1091390018 SHT2	Obsolete – 2.44m Ctrs H Pole Straight Line Section – see DSS/004/040 for details Replace with Single E/Stout Pole , Straight Line Section Pole or 2.9m Ctrs H Pole, Straight Line Section Pole	
Y104L0103 (Obs) or Y104L0114 (Obs) Replace with 1091390013 sht1 or 1091390018 sht1	Y003X3103 Replace with 1091390003 SHT 2 or 1091390018 SHT2	Obsolete – 2.44m Ctrs H Pole Angle Section 0-10º – see DSS/004/040 for details Replace with Single E/Stout Pole , Section Angle structure, 0º – 20º or 2.9m Ctrs H Pole, Large Section Angle Pole 40º – 60º	
Y104L0104 (Obs) or Y104L0115 (Obs) Replace with 1091390014 sht1 or 1091390018 sht1	Y003X3103 Replace with 1091390003 SHT 2 or 1091390018 SHT2	Obsolete – 2.44m Ctrs H Pole Angle Section 10-60º – see DSS/004/040 for details Replace with Single E/Stout Pole , Section Angle structure, 20º – 40º 2.9m Ctrs H Pole, Large Section Angle Pole 40º – 60º	
MWT of conductors used with this design and thus minimum ratings for tension fittings		Min Tension Fitting Rating	New Drawing No

Existing or replacement Pole Assembly Drawing	Pole Fabrication Drawing	Description	
0.175" / 175mm ACSR – erected pre 1999 = 26kN , Post 1999 = 25.7kN		Requires 125kN Fittings	1091010488 sht 9
.2" / 125mm HDBC – erected pre 1974 = 25kN			
200mm AAAC – Post 1998 – 23.51kN		Requires 70kN Fittings	1091010488 sht8
.15" / 150mm ACSR – erected pre 1974 = 22.49kN), Post 1974 = 19.68kN			
.15" / 100mm HDBC erected pre 1974 = 18.97kN, Post 1974 = 18.81kN			
.1" / 70mm HDBC – erected pre 1974 = 13kN, post 1974 = 13.43kN			

Existing or replacement Pole Assembly Drawing	Pole Fabrication Drawing	Description
CE/C/36 – 33kV Design	MWT of design - Various Tensions utilising 70kN or 125kN fittings Typical max span for 175mm ACSR – 76 or 91m on 16m stout grade poles **Similar construction type historic design specifications – CE/C/20, CE/C/31, CE/C/32 & CE/C/35**	
Y003X1102 (obs) Replace with 1000434004	1000434001	Obsolete - 33kV Intermediate Pole with pin or post insulators on a single pole Replace with 33kV Intermediate Pole on a single pole (43-40)
Y003X1102 (obs) Replace with 1000434005	1000434001	Obsolete - 33kV Straight Line Section - Rutter Pole Replace with 33kV Single Straight Line Section pole on single pole (43-40)
Y003X1102 (obs) Replace with 1000434004 or 1000434005	1000434001	Obsolete - 33kV Section Angle Pole - Rutter Pole -0º – 40º Replace with 33kv Pin Angle – Single Stout Pole 6º Deviation or 33kV Section Angle Pole – Single E/Stout Pole 40º dev (175mm ACSR) or 34º dev for (125mm HDBC)
Y104L0104 (obs) or Y104L0115 (obs) Replace with		Obsolete – 2.44m Ctrs H Pole Angle Section 40-60º – see DSS/004/040 for details Replace with

Existing or replacement Pole Assembly Drawing	Pole Fabrication Drawing	Description	
1091390018 sht1	1091390018 sht2	2.9m Ctrs H Pole, Large Section Angle Pole 40º – 60º	
Y104L0106 (obs) or Y104L0109 (obs) Replace with 1000434011 sht1 or 1000434011 sht6 or 1000434011 sht8	1000434002 sht2	Obsolete – 33kV H Cable Terminal Poles Replace with 33kV 1.83m Ctrs H Terminal Pole – No Cable 33kV 1.83m Ctrs H Cable Terminal Pole – Heat Shrink Cable 33kV 1.83m Ctrs H Cable Terminal Pole – Self Supporting Cable Term	
MWT of conductors used with this design and thus minimum ratings for tension fittings		Min Tension Fitting Rating	New Drawing No
.2” / 125mm HDBC – erected pre 1974 = 25kN		Requires 125kN Fittings	1091010488 sht 9
0.175”/175mm ACSR – erected pre 1974 = 22.27kN , Post 1974 = 22.85kN		Requires 70kN Fittings	1091010488 sht8
.15” / 150mm ACSR – erected pre 1974 = 22.49kN), Post 1974 = 19.68kN			
.15” / 100mm HDBC erected pre 1974 = 18.97kN, Post 1974 = 18.81kN			
.1” / 70mm HDBC – erected pre 1974 = 13kN, post 1974 = 13.43kN			
175 0r 200mm AAAC – erected 2010 23.33kN			

4. References

4.1. External Documentation

Reference	Title
BS EN 14429	Wood Poles for Overhead Power and Telecommunication Lines
BS EN 485-2	Aluminium and aluminium alloys. Sheet, strip and plate. Mechanical properties
BS EN 50341-1:2012	Overhead electrical lines exceeding AC 45kV Part 1: General Requirements - Common Code of practices
BS EN 50341-2-9:2015	Overhead Electrical lines exceeding AC 1kV. National Normative Aspects (NNA) for Great Britain and Northern Ireland (based on EN 50341-1:2012).
BS EN 515	Aluminium and aluminium alloys. Wrought products. Temper designations
BS EN573-4	Aluminium and aluminium alloys. Chemical composition and form of wrought products. Forms of products
BSEN 61466-1	Composite string insulator units for overhead lines with a nominal voltage greater than 1000 V - Part 1: Standard strength and end fittings
DECC	Department of Energy and Climate Change
ENA TS 43-88	Selection and treatment of wood poles and associated timber for overhead lines.
ENA TS 43-90	Anti-Climbing devices and Safety signs for HV lines up to and including 400kV.
ENA TS 43-91	Stay strands and stay fittings for overhead lines
ENA TS 43-93	Line insulators
ENA TS 43-94	Code of practice for Earth Rods and Connectors
ENA TS 43-95	Steelwork for overhead lines
ENA TS 43-96	Fasteners and washers for wood pole overhead lines
ESQCR	The Electricity Safety, Quality and Continuity Regulations 2002, SI 2665
IEC 61284	Overhead lines. Requirements and tests for fittings

4.2. Internal Documentation

Reference	Title
CE/C/36	Legacy Specification for Yorkshire Electricity Overhead Lines to CE/C/36 – (YEB 33/66kV Single Wood Pole using post Insulators – with a Max Span of 91M
CE/C/37	Legacy Specification for Yorkshire Electricity Overhead Lines to CE/C/37 (M) and CE/OM/DC1(M) – (YEB 33/66kV H portal construction specification with a max span of 150M)
IMP/001/011	Code of practice for Overhead Line Ratings and Parameters
IMP/007/011	Code of practice for the Application of Lightening Protection
IMP/001/913	Code of Practice for the Economic Development of the EHV System
MNT/013	Policy for the Management and Control of Vegetation near Overhead Lines
NPS/001/001	Technical Specification for Wood Poles and Associated Products for Overhead Lines
NPS/001/002	Technical Specification for Helical Products
NPS/001/005	Technical Specification for Overhead Line Steelwork, Conductor Fittings, Insulator Fittings and Stay Fittings
NPS/001/006	Technical Specification for Insulators for Overhead Lines up to and Including 132kV
NPS/001/007	Technical Specification for Overhead Line Conductors
NPS/001/010	Technical Specification for Fasteners And Fixings for Wood Pole Overhead Lines and General Construction Works
NPS/001/011	Technical Specification for Notice Plates and Signs
NPS/001/013	Technical Specification for Galvanised Steel Stay Wire
NPS/001/015	Technical Specification for Barbed Wire
NPS/001/020	Technical Specification for Stay Ground Anchors for Overhead Lines
NPS/001/029	Technical Specification for Wood Pole and Tower Anti-Climbing Guards
NPS/002/001	Technical Specification for Earthing Materials
NSP/004/011	Guidance on Overhead Line Clearances
NSP/004/012	Guidance on the Risk Assessment of Overhead Lines
NSP/004/030	Specification for the Construction and Refurbishment of 33-132kV Tower Lines
NSP/004/031	Code of Practice for the Survey of Overhead Line Routes
NSP/004/042	Specification for HV Wood Pole Lines up to and including 33kV
NSP/004/101	(OHI 1) Guidance on Pole and Stay Holes
NSP/004/102	(OHI 2) Guidance on Erecting Single or 'H' poles
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/004/108	(OHI 8) Guidance on the Installation of Compression Joints
NSP/004/109	(OHI 9) Guidance on anti-climbing devices, safety signs and labels required on overhead line supports
NSP/004/112	(OH 12) Guidance for the Inspection and Testing of Wood and Steel Poles
NSP/004/122	Guidance on the Electrical Resistance Testing of O/H Line Joints and Terminations
NSP/004/127	(OHI 27) Guidance on the Selection and Application of Insulators
OHL 4	Legacy NEEB Specification - 66kV Single Circuit Overhead Lines on Single and 'H' Wood Poles – (NEEB 66kV specification built using Single supports or H Portal Supports)
Riley & Neate Mast	Legacy NEEB Specification - 66kV Single Circuit Overhead Lines on steel masts built to wood pole design criteria with typical spanning up to 180m)
WoodHouse Mast	Legacy 33/66kV Yorkshire Electricity Overhead Lines Specification constructed using single Member steel structures allowing max spans up to 220m

4.3. Amendments from Previous Version

Reference	Description
Whole Document	Doc approved by email Paul Black 30/10/2023 Doc republished to grid and externally - LB 07/02/2024

5. Definitions

Term	Definition
Aeolian Vibration	Conductor Oscillation caused by low winds (1 m/s to 7 m/s) blowing steadily across the conductor.
Average Span	The arithmetic average of a number of spans in a line or section of line
Maximum Clashing Span	The maximum span prior to the risk of electrical contact between two dissimilar line conductors of an overhead line displaced from their normal position by environmental forces such that the conductors are likely to touch.
Conductor CSA	Conductor Cross Sectional Area
Conductor Creep	Permanent long term elongation of the conductor
Conductor Downpull	The vertical loading imposed by conductors corresponding to a gradient measured between adjacent pole tops
Design Span	The design or equivalent span is the average span used for sag/tension calculations and most closely models the behaviour of the line
Everyday Tension (EDT)	The design stress in an unloaded conductor at 5°C. Used in sag / tension calculations to limit harmful conductor vibrations
Freezing Point Tension (FPT)	The design tension of an unloaded conductor at 0°C in still air.
FCD	A Failure Containment Device – A device, structure or methodology designed to stop cascade pole failure created as a result of broken conductor
Intermediate Support	A support in a straight run of line on which the conductors are supported on post insulators or hung from suspension insulators on Portal Structures
Longitudinal Force	A force applied in line with the direction of the conductors
Maximum Conductor Weight (MCW)	The maximum vertical component of applied conductor load, including the weight of accreted ice, if present.
Maximum Span	The maximum permitted length of any span
Maximum Working Tension (MWT)	The absolute maximum conductor tension assessed at -5.6°C with wind and ice loading.
MASL	Metres above Sea Level
Over-tensioning	Excess tension applied above normal tension at time of erection to compensate for conductor creep.
Portal Construction	Describes an overhead line structure type consisting of two supports connected by a common crossarm with suspension insulators hung from the crossarm
Pre- tensioning	The tension treatment applied to a conductor for a short duration before final erection tension is established to remove a proportion of conductor creep.
Sag	The vertical distance, under any system of conductor loading, between the conductor and a straight line joining adjacent supporting points, measured at mid-span
Section Angle Support	A support at which a line deviates and the conductors are made off on either side of the crossarm on tension insulator sets
Section Support	A support in a straight line on which the conductors are made off on either side of the crossarm on tension insulator sets
Span	The horizontal distance between adjacent supports. Individual spans will normally be within 20% of the chosen basic span
Transverse Force	A force applied at right angles to the direction of the conductors
Wind Co-ordinate	The intercept on the wind axis of the weather incidence load line (See ENA TR 111) whose value is given for differing height and UK locations in the associated weather maps
Weather Zone	A geographical area in which the likely mean wind pressure and absolute maximum ice accretion thickness may be described by a numeral and letter respectively. The wind co-ordinate is described in 190N/m^2 increments, whilst the ice co-ordinate is measured in 10mm diametric thickness increments.
Windspan	Half the sum of the spans adjacent to the support.

6. Authority for Issue

6.1. CDS Assurance

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

		Date
Liz Beat	Governance Administrator	07/02/2024

6.2. Author

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

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

Standard CDS review of 3 years	Non Standard Review Period & Reason	
Yes	**Period:** n/a	**Reason:** n/a
Should this document be displayed on the Northern Powergrid external website?		Yes

		Date
Ged Hammel	Senior Policy & Standards Engineer	06/09/2016

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
Steven Salkeld	Policy & Standards Engineer	06/09/2016
Mike Wilson	Overhead Line Project Engineer	07/09/2016

6.4. Authorisation

Authorisation is granted for publication of this document

		Date
Paul Black	Head of System Engineering	30/10/2023

APPENDIX A – DRAWING LIST

Drawing Number	Sheet No	Title
Pole Arrangement Drawings		
1 09 138 0006	1	33 - 132kV Single Pole Intermediate Structure
1 09 139 0016	1	33 - 132kV Rutter Type Intermediate Pole Arrangement
1 09 139 0022	1	33 - 132kV 2.9m Ctres Intermediate Post H Pole Arrangement
109 123 1165	4	33-66kV 2.9m Ctres Portal H Suspension Pole Arrangement
1 09 139 0017	1	33 - 132kv Rutter Pole Tension Arrangement 0-2º Deviation
1 09 139 0013	1	33 - 132kv Single Pole Straight Line Section and Section Angle 2º-20º Deviation
1 09 139 0014	1	33 - 132kV Single Pole Section Angle 20-40 Degree Deviation
1 09 139 0015	1	33- 132kV Single Pole Section Angle 40-60º Dev. (Special Structure – Consult company Policy an Standard Eng)
1 09 139 0018	1	33 - 132kV Large Section Angle Structure 2.9m Centres H Pole, 40-60º Deviation
1 09 139 0019	1	33 - 132kV Terminal Structure 2.9m Centres H Pole – No Cable
1 09 139 0020	1	33 - 132kV Straight Line Section Structure 2.9m Centres H Pole
1 09 139 0021	1	33 - 132kV Out Of Balance Section Structure 2.9m Centres H Pole
1 00 043 4011	8	33kV Terminal Support With Surge Arrestors And Cable Termination – Restricted spanning and Conductor Tensions
1 09 123 1173	9	33 KV Terminal Support With Surge Arrestors And Cable Termination – No Restrictions
1 09 123 1173	4	33 & 66kV Terminal Support With Surge Arrestors And Cable Termination – No Restrictions
1 00 043 5012	1	132kV Terminal Support with Surge Arrestors And Cable Termination – No Restrictions
Pole Fabrication Drawings		
1 09 139 0003	2	132kv Drilling, Scarfing & Markings For Single Angle Pole Arrangement
1 09 139 0003	3	Additional Fabrication Details For The Attachment Of The Hcl Climbing Access System To Drawing 1091390003 Sht 2, 1091390018 Sht 2 & 1091390019 Sht2
1 09 139 0006	2	132kv Drilling, Scarfing & Markings For Single Pole Intermediate Structure
1 09 139 0016	2	132kv Drilling, Scarfing & Markings For Rutter Type Medium And Stout Poles For Use With Timber And Heavy Duty Steel Shear Blocks
1 09 139 0016	3	Additional Fabrication Details For The Attachment Of The Hcl Climbing Access System To Drg 1091390016 Sht 1
1 09 139 0018	2	132kv Drilling, Scarfing & Marking For Large Angle H-Pole
1 09 139 0019	2	132kv Drilling, Scarfing & Marking For Terminal H-Pole – No Cable
1 00 043 4002	5	33kV Drilling, Scarfing & Marking For Cable Terminal H-Pole
109 123 1187	1	33/66kV Drilling, Scarfing & Markings For H Portal Pole Arrangement
1 09 123 1173	10	33 Kv Drilling, Scarfing & Marking For Cable Terminal H-Pole Terminal Support With Surge Arrestors And Cable Termination
1 09 139 1173	5	66kV Drilling, Scarfing & Marking For Cable Terminal H-Pole
ENA TS 43-50 fig 4		132kv Single Circuit Overhead Lines Drilling, Scarfing & Marking For 132kv Terminal Support With Surge Arrestors And Cable Termination (Main Pole)
ENA TS 43-50 fig 5		132kv Single Circuit Overhead Lines Drilling, Scarfing & Marking For 132kv Terminal Support With Surge Arrestors And Cable Termination (Auxiliary Pole)

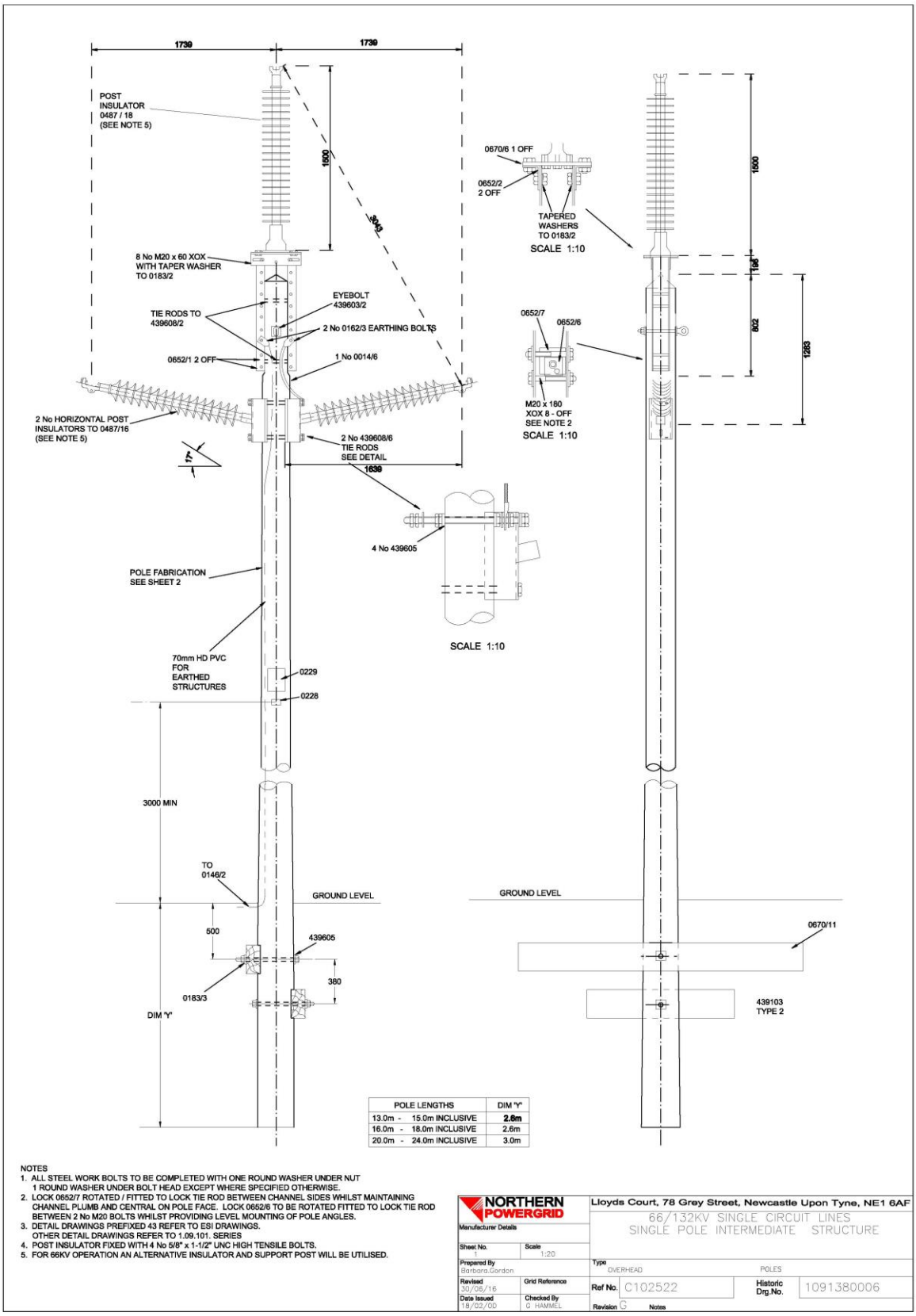
Appendix A – Drawing List (continued)

Drawing Number	Sheet No	Title
Insulators & Insulator fittings		
1 09 101 0487	16	132kv Composite Horizontal Post Insulator – Technical Parameters
1 09 101 0487	18	132kv Composite Vertical Line/Pilot Post Polymer Insulator – Technical Parameters
1 09 101 0487	29	132kv Composite Tension / Stay Insulator (120kn With 20mm Ball / Socket Coupling)
1 09 101 0487	30	132kv Composite Tension Set Insulator Assembly Drawing – (Normal Situations) For Use With Drawing 1091010487 Sht 29
1 09 101 0487	31	132kv Tension Set Insulator Assembly Drawing – (Approach Situations) For Use With Drawing 1091010487 Sht 29
1 09 101 0487	32	132kv Composite Vertical Line/Pilot Post Insulator - Arcing Horn Assembly For (Approach Situations) For Use On Drawing 1091010487 Sht18
1 09 101 0487	33	132kv Composite Horizontal Post Insulator - Arcing Horn Assembly For (Approach Situations) For Use On Drawing 1091010487 Sht16
1 09 101 0487	34	Support Stool For Use With Composite Line Post Insulators On Drawing 1091010487 Sht 18 At Pilot Positions
1 09 101 0487	36	66kV Universal 21kN Polymer Line Post Insulator
1 09 101 0487	37	33kV Universal 21kN Polymer Line Post Insulator
1 09 101 0487	38	66kV Polymer 21kN Line Post Insulator – 646mm Vertical Stool
1 09 101 0487	39	66kV Polymer 21kN Line Post Insulator – 670mm Horizontal Stool
1 09 101 0487	40	33kV Polymer 21kN Line Post Insulator – 976mm Vertical Stool
1 09 101 0487	41	33kV Polymer 21kN Line Post Insulator – 1000mm Horizontal Stool
1 09 101 0487	42	Illustrative General set up for 33-132kV (Horizontal Post Drawings)
1 09 101 0487	43	Illustrative General set up for 33-132kV (Vertical Post Drawings)
1 09 101 0488	8	66kv tension insulator assembly – rated to 70kN
1 09 101 0488	8	33kv tension insulator Assembly – rated to 125kN
Stays and Stay Fittings		
1 09 101 0372	2	132kv Composite Stay Insulator Assembly Drawing (Unearthed Arrangements C/W Arcing Horn Assemblies)
1 09 101 0429	8	132kv Single Circuit Method Of Fixing Stays
1 09 101 0675	16	132kv Overhead Lines Stay Yoke Leg Detail (1000 Long X 65 X 8)
1 09 101 0675	24	132kv Overhead Lines Stay Yoke Array For 1, 2 & 3 Stay Options
1 09 101 0675	46	132kv Overhead Lines 10º Cranked Stay Strap
1 09 101 0675	47	132kv Overhead Lines 45º Cranked Stay Strap
1 09 101 0675	48	132kv Overhead Lines 40º Cranked Stay Stap For Terminal H Pole Stays

Appendix A – Drawing List (continued)

Drawing Number	Sheet No	Title
Pole top steelwork		
1 09 101 0651	3	66kV Renovation crossarm for R &N 'A' pole Intermediate poles
1 09 101 0670	6	Post Insulator Base Plate
1 09 101 0652 sht1	Item 1	Angles (Post)
1 09 101 0652 Sht1	Item 2	Channels (Post)
1 09 101 0652 Sht 1	Item 7	Horizontal Lock
1 09 101 0652 Sht 1	Item 6	Vertical Locks
1 09 101 0675	1	Post Insulator Support / Tension Plate (565 Long X 220 X 15)
1 09 101 0675	2	Crossarm 40-60 Degrees (5260 Long X 150 X 90 X 15)
1 09 101 0675	4	Crossarm Brace (518 Long X 50 X 50)
1 09 101 0675	5	Crossarm Support Channel (1118 Long X 230 X 75 Channel)
1 09 101 0675	6	Crossarm 0-40 Degrees (4860 Long X 150 X 90 X 15)
1 09 101 0675	7	Short Crossarm For In-Line Poles (650 Long X 150 X 90 X 15)
1 09 101 0675	8	Side Insulator Support Plate For In-Line Poles (409 Long X 250 X 12)
1 09 101 0675	9	Insulator Support Plate Bracket For In-Line Poles (250 Long X 150 X 90 X 15)
1 09 101 0675	10	Short Xarm Support Channel For In-Line Poles (1263 Long X 230 X 74 Channel)
1 09 101 0675	29	M20 Tie Rod Schedule
1 09 101 0675	30	"Rutter" Type Pole Shear Block Schedule
1 09 101 0675	31	"Rutter" Pole Crossarm Oº - 2º Deviation (4860 X 150 X 90 X 15mm Unequal Angle)
1 09 101 0675	32	Horizontal Insulator Support Angle (250 Long X 100 X 75 X 12)
1 09 101 0675	34	Enhanced Anti-Climbing Device For Extra Stout Pole Assembly
1 09 101 0675	39	Rutter Type Pole Heavy Duty Welded Shear Block
1 09 101 0675	40	Crossarm Strut (1460 Long X 50 X 50 X 5)
1 09 101 0675	50	H Pole Crossarm Components
1 09 101 0650	3	2.9m Centres H Pole Foundation Steelwork
Miscellaneous Items		
1 09 101 0653	3	COMPRESSION ANCHOR CLAMP – POPLAR CONDUCTOR
1 09 101 0188	1	Vibration Dampers
1 09 101 0461	1	125kN Shackle
Appendix B – Self-supporting steel masts - Drawing list		
1 09 139 0034	1	132kv Fabricated Assembly Of Octagonal Section Steel Suspension Poles
1 09 139 0035	1	132kv Fabricated Assembly Of Octagonal Section Steel Poles Line Deviation 0º – 10º
1 09 139 0036	1	132kv Fabricated Assembly Of Octagonal Section Steel Poles Line Deviation 10º - 30º
1 09 139 0037	1	132kv Fabricated Assembly Of Octagonal Section Steel Poles Line Deviation 30º - 45º
Refurbishment Drawings - Drawing list		
1 09 138 0006	3	33 - 132kv Overhead Line Refurbishment Of Existing 'A' Pole Structure

APPENDIX B - ARRANGEMENT DRAWINGS AND MATERIALS LISTS



POLE LENGTHS	DIM 'Y'
13.0m - 15.0m INCLUSIVE	2.6m
16.0m - 18.0m INCLUSIVE	2.6m
20.0m - 24.0m INCLUSIVE	3.0m

NOTES
1. ALL STEEL WORK BOLTS TO BE COMPLETED WITH ONE ROUND WASHER UNDER NUT 1 ROUND WASHER UNDER BOLT HEAD EXCEPT WHERE SPECIFIED OTHERWISE.
2. LOCK 0652/7 ROTATED / FITTED TO LOCK TIE ROD BETWEEN CHANNEL SIDES WHILST MAINTAINING CHANNEL PLUMB AND CENTRAL ON POLE FACE. LOCK 0652/6 TO BE ROTATED FITTED TO LOCK TIE ROD BETWEEN 2 No M20 BOLTS WHILST PROVIDING LEVEL MOUNTING OF POLE ANGLES.
3. DETAIL DRAWINGS PREFIXED 43 REFER TO ESI DRAWINGS. OTHER DETAIL DRAWINGS REFER TO 1.09.101. SERIES
4. POST INSULATOR FIXED WITH 4 No 5/8" x 1-1/2" UNC HIGH TENSILE BOLTS.
5. FOR 66KV OPERATION AN ALTERNATIVE INSULATOR AND SUPPORT POST WILL BE UTILISED.

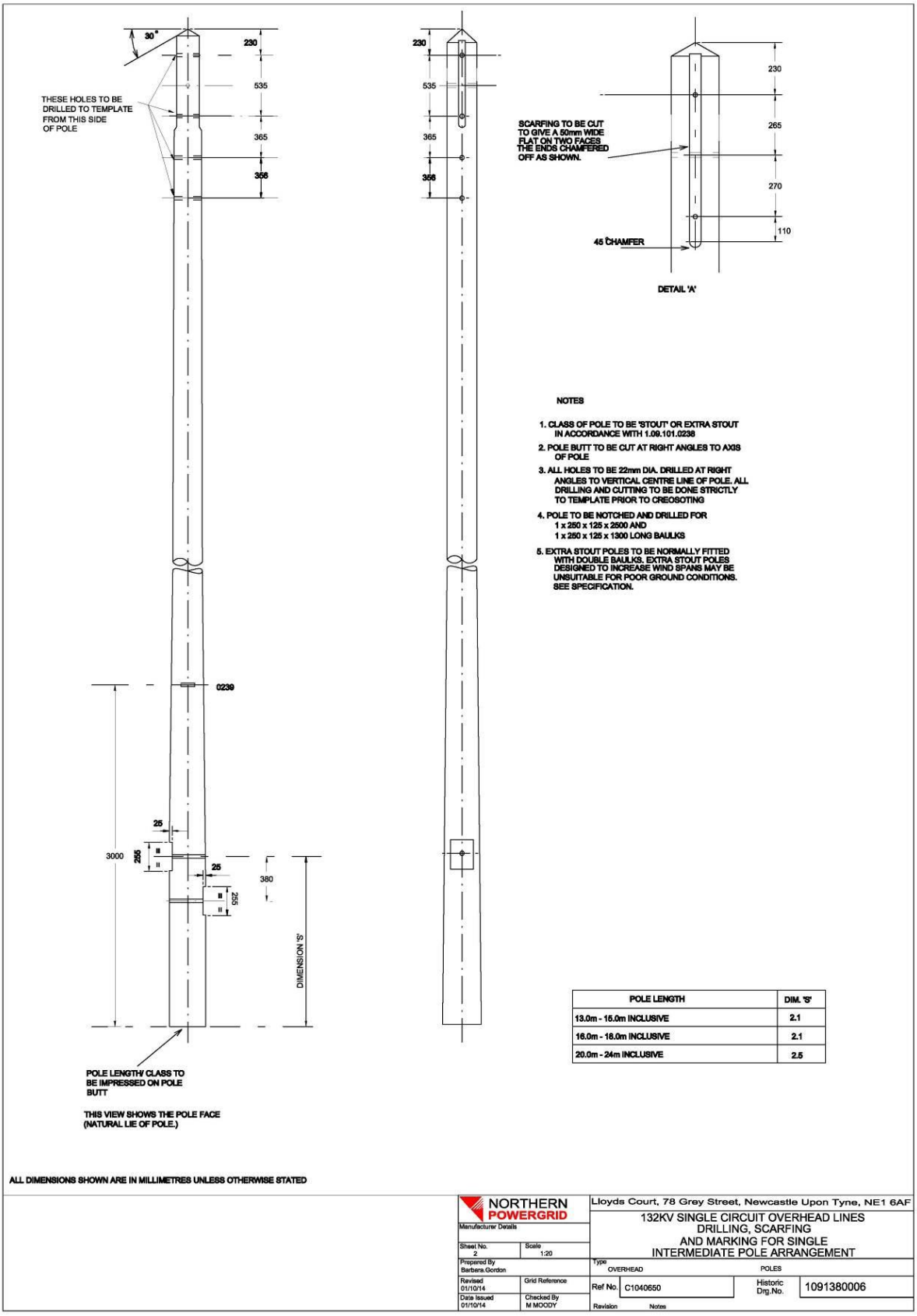
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV SINGLE CIRCUIT LINES
SINGLE POLE INTERMEDIATE STRUCTURE
Manufacturer Details
Sheet No. 1 | Scale 1:20
Prepared By Barbara.Gordon
Type OVERHEAD | POLES
Revised 30/06/16 | Grid Reference
Date Issued 18/02/00 | Checked By G. HAMMEL
Ref No. C102522 | Historic Drg.No. 1091380006
Revision G | Notes

MATERIAL LIST FOR 1 09 138.0006 SHEET No.1 (Intermediate)

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Wood Pole	109.138.0006/2	1	-
Anti Split Bolts / Climbing Attachment Point			
Eyebolts, M20 x 300, Galvd	439603/2	1	368059
Washers, Square Curved	439605	2	368078
Foundations			
Bolts, M20 x 530 Galvd	-	2	372815
Washers, Square Curved	439605	2	368078
Washer, Square Flat	0183/3	2	368063
Foundation Baulk 2500x225x125	0670/11	1	346581
Foundation Baulk 1300x225x125	439103/2	1	235124
Vertical Insulators			
132kV Polymeric Post Insulator -	0487/18	1	251551
or			
66kV Polymeric Post Insulator – 930mm long c/w bolts	0487/36	1	346402
66kV – 646mm Long Stool for Vertical Post Insulator c/w bolts	0487/38	1	346403
or			
33kV Polymeric Post Insulator – 600mm long c/w bolts	0487/37	1	346405
33kV – 976mm Long Stool for Vertical Post Insulator c/w bolts	0487/40	1	346406
Post Insulator Base Plate	0670/6	1	346539
Bolts, M20 x 60, Galvd	-	8	378703
Square M20 Tapered Washer, Galvd	0183/2	8	374473
Angles (Post)	0652/2	2	252702
Channels (Post)	0652/1	2	252685
Tie Rod, M20 x 450, Galvd	439608/2	2	375832
Earthing Bolts, M20 x 60	0162/3	2	370504
Bolts, M20 x 180, Galvd	-	8	374098
Washers, M20, Round, Galvd	-	8	375616
Horizontal Lock	0652/7	4	252755
Vertical Locks	0652/6	4	252740
Earthing Strap –22mm lugs 750mm long	0014/6	1	251786
Horizontal Insulators			
132kv Horizontal Post Insulator c/w with bendable base	0487/16	2	251549
or			
66kV Polymeric Post Insulator – 930mm long c/w bolts	0487/36	1	346402
66kV – 670mm Long Stool for Horizontal Post Insulator c/w bolts	0487/39	2	346404
or			
33kV Polymeric Post Insulator - – 600mm long c/w bolts	0487/37	2	346405
33kV – 1000mm Long Stool for Horizontal Post Insulator c/w bolts	0487/41	2	346407
Tie Rod, M20 x 600, Galvd	439608/6	4	371225
Washers, Square Curved	439605	4	368078
Washers, M20, Round, Galvd	-	6	375616
Nuts M20	-	8	378915
Notices			

Safety Sign	0229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	0028	1	243258
Pole Numbers	0028	To Suit	-

Eathed Structures Only			
Comp Lug – M22 Hole (70mm PVC Cu)	0237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m Approx.	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	0149/3	1	235548
Earth Rod	3143	As Req.	354249
Rod Coupling	3143	As Req.	354361
Driving Bolt	3143	As Req.	354408
Saddle Clamp	3143/2	As Req.	354338



NOTES

1. CLASS OF POLE TO BE 'STOUT' OR EXTRA STOUT IN ACCORDANCE WITH 1.09.101.0238
2. POLE BUTT TO BE CUT AT RIGHT ANGLES TO AXIS OF POLE
3. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREOSOTING
4. POLE TO BE NOTCHED AND DRILLED FOR
   1 x 250 x 125 x 2500 AND
   1 x 250 x 125 x 1300 LONG BAULKS
5. EXTRA STOUT POLES TO BE NORMALLY FITTED WITH DOUBLE BAULKS. EXTRA STOUT POLES DESIGNED TO INCREASE WIND SPANS MAY BE UNSUITABLE FOR POOR GROUND CONDITIONS. SEE SPECIFICATION.

POLE LENGTH	DIM. 'S'
13.0m - 15.0m INCLUSIVE	2.1
16.0m - 18.0m INCLUSIVE	2.1
20.0m - 24m INCLUSIVE	2.5

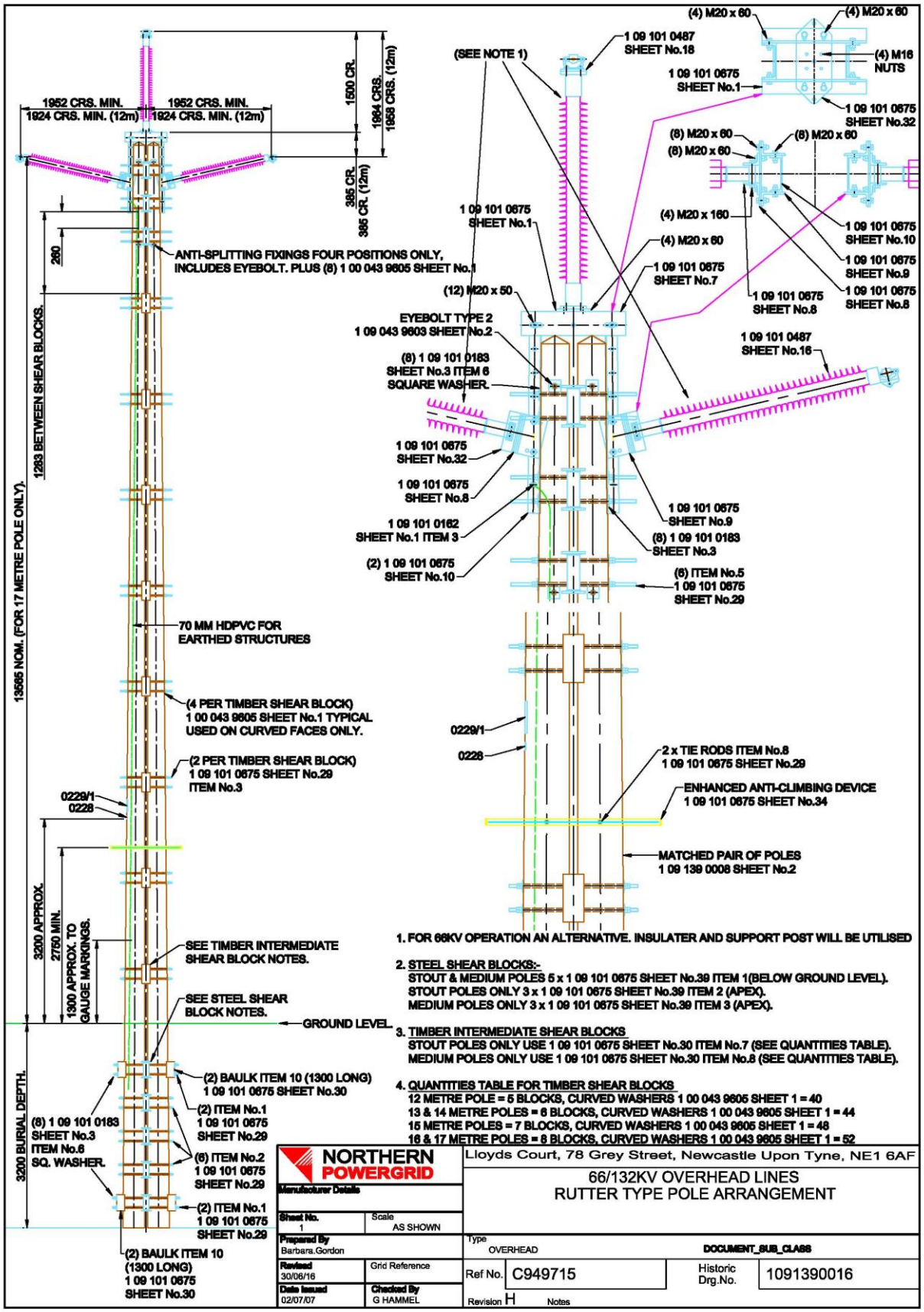
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

NORTHERN POWERGRID
Manufacturer Details

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

132KV SINGLE CIRCUIT OVERHEAD LINES
DRILLING, SCARFING
AND MARKING FOR SINGLE
INTERMEDIATE POLE ARRANGEMENT

Sheet No. 2	Scale 1:20		
Prepared By Barbara.Gordon		Type OVERHEAD	POLES
Revised 01/10/14	Grid Reference	Ref No. C1040650	Historic Drg.No. 1091380006
Date Issued 01/10/14	Checked By M MOODY	Revision	Notes


1952 CRS. MIN.
1924 CRS. MIN. (12m)
1952 CRS. MIN.
1924 CRS. MIN. (12m)
1500 CR.
1964 CRS.
1958 CRS. (12m)
385 CR.
385 CR. (12m)
260
1283 BETWEEN SHEAR BLOCKS.
13565 NOM. (FOR 17 METRE POLE ONLY).
ANTI-SPLITTING FIXINGS FOUR POSITIONS ONLY, INCLUDES EYEBOLT. PLUS (8) 1 00 043 9605 SHEET No.1
70 MM HDPVC FOR EARTHED STRUCTURES
(4 PER TIMBER SHEAR BLOCK) 1 00 043 9605 SHEET No.1 TYPICAL USED ON CURVED FACES ONLY.
(2 PER TIMBER SHEAR BLOCK) 1 09 101 0675 SHEET No.29 ITEM No.3
0229/1
0228
3200 APPROX.
2750 MIN.
1300 APPROX. TO GAUGE MARKINGS.
SEE TIMBER INTERMEDIATE SHEAR BLOCK NOTES.
SEE STEEL SHEAR BLOCK NOTES.
GROUND LEVEL
3200 BURIAL DEPTH.
(8) 1 09 101 0183 SHEET No.3 ITEM No.6 SQ. WASHER.
(2) BAULK ITEM 10 (1300 LONG) 1 09 101 0675 SHEET No.30
(2) ITEM No.1 1 09 101 0675 SHEET No.29
(6) ITEM No.2 1 09 101 0675 SHEET No.29
(2) ITEM No.1 1 09 101 0675 SHEET No.29
(2) BAULK ITEM 10 (1300 LONG) 1 09 101 0675 SHEET No.30
(SEE NOTE 1)
1 09 101 0487 SHEET No.18
1 09 101 0675 SHEET No.1
(4) M20 x 60
(4) M16 NUTS
1 09 101 0675 SHEET No.32
(8) M20 x 60
(4) M20 x 160
1 09 101 0675 SHEET No.10
1 09 101 0675 SHEET No.9
1 09 101 0675 SHEET No.8
1 09 101 0675 SHEET No.7
(12) M20 x 50
EYEBOLT TYPE 2 1 09 043 9603 SHEET No.2
(8) 1 09 101 0183 SHEET No.3 ITEM 6 SQUARE WASHER.
1 09 101 0487 SHEET No.16
1 09 101 0675 SHEET No.32
1 09 101 0675 SHEET No.8
1 09 101 0162 SHEET No.1 ITEM 3
(2) 1 09 101 0675 SHEET No.10
1 09 101 0675 SHEET No.9
(8) 1 09 101 0183 SHEET No.3
(6) ITEM No.5 1 09 101 0675 SHEET No.29
0229/1
0228
2 x TIE RODS ITEM No.8 1 09 101 0675 SHEET No.29
ENHANCED ANTI-CLIMBING DEVICE 1 09 101 0675 SHEET No.34
MATCHED PAIR OF POLES 1 09 139 0008 SHEET No.2
1. FOR 66KV OPERATION AN ALTERNATIVE. INSULATER AND SUPPORT POST WILL BE UTILISED
2. STEEL SHEAR BLOCKS:-
STOUT & MEDIUM POLES 5 x 1 09 101 0675 SHEET No.39 ITEM 1(BELOW GROUND LEVEL).
STOUT POLES ONLY 3 x 1 09 101 0675 SHEET No.39 ITEM 2 (APEX).
MEDIUM POLES ONLY 3 x 1 09 101 0675 SHEET No.39 ITEM 3 (APEX).
3. TIMBER INTERMEDIATE SHEAR BLOCKS
STOUT POLES ONLY USE 1 09 101 0675 SHEET No.30 ITEM No.7 (SEE QUANTITIES TABLE).
MEDIUM POLES ONLY USE 1 09 101 0675 SHEET No.30 ITEM No.8 (SEE QUANTITIES TABLE).
4. QUANTITIES TABLE FOR TIMBER SHEAR BLOCKS
12 METRE POLE = 5 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 40
13 & 14 METRE POLES = 6 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 44
15 METRE POLES = 7 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 48
16 & 17 METRE POLES = 8 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 52
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 1
Scale AS SHOWN
Prepared By Barbara.Gordon
Revised 30/06/16
Grid Reference
Date Issued 02/07/07
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV OVERHEAD LINES
RUTTER TYPE POLE ARRANGEMENT
Type OVERHEAD
DOCUMENT_SUB_CLASS
Ref No. C949715
Historic Drg.No. 1091390016
Revision H
Notes

MATERIAL LIST FOR 1 09 139 0016 SHEET No.1 (Intermediate)

CAT. No.	Pole Height	Fabrication Drawing
233992	12m Stout Pole	1 09 139 0008 Sht2 Item 'A Stout'
233993	13m Stout Pole	1 09 101 0008 Sht2 Item 'B Stout'
233994	14m Stout Pole	1 09 101 0008 Sht2 Item 'C Stout'
233995	15m Stout Pole	1 09 101 0008 Sht2 Item 'D Stout'
233996	16m Stout Pole	1 09 101 0008 Sht2 Item 'E Stout'
233997	17m Stout Pole	1 09 101 0008 Sht2 Item 'F Stout'

Note

Poles are supplied fabricated into structures using the materials listed below

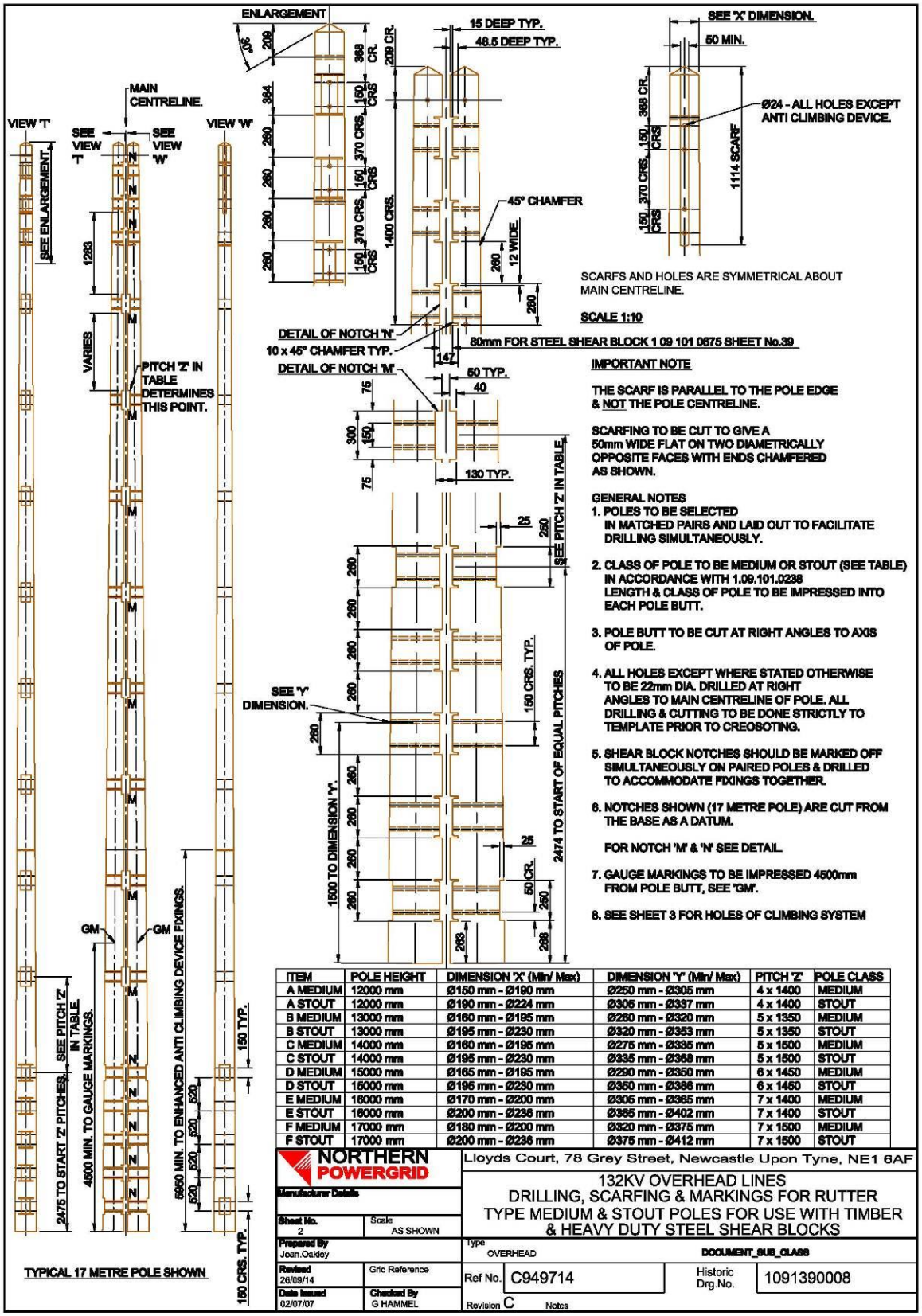
VARIABLE QUANTITIES	17M	16M	15M	14M	13M	12M
Curved Washer 1 00 043 9605 Sht1	56	56	52	48	48	44
Wood Shear Blocks 1 09 101 0675 Sht 30 Item 7 (Stout Poles)	8	8	7	6	6	5
Wood Shear Block 1 09 101 0675 Sht 30 Item 8 (Medium Poles)	8	8	7	6	6	5

QUANTITY	CAT NO.	DESCRIPTION	DETAIL DRAWING	NOTES
5		Steel Shear Block (Below GL)	1 09 101 0675 Sht39 Item 1	(Med & Stout)
3		Steel Shear Block (Below Gl)	1 09 101 0675 Sht39 Item 1	(Stout Only)
3		Steel Shear Block (Below Gl)	1 09 101 0675 Sht39 Item 1	(Med Only)
4*	234476	Wood Baulks (1300mm)	1 09 101 0675 Sht 30 Item 10	
4		M20 Tie Rod (1200 Lg)	1 09 101 0675 Sht29 Item 1	
6		M20 Tie Rod (980 Lg)	1 09 101 0675 Sht29 Item 2	
16		M20 Tie Rod (940 Lg)	1 09 101 0675 Sht29 Item 3	
6		M20 Tie Rod (700 Lg)	1 09 101 0675 Sht29 Item 5	
* Where structures are installed in poor ground the top block type shall be changed as shown below				
2	234477	Wood Baulks (2500mm)	1 09 101 0675 Sht 30 Item 9	

Additional materials to complete pole arrangement not associated with the pole fabrication

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Insulators			
132kv Polymeric Vertical Post Insulator -	1 09 101 0487 Sht 18	1	251551
or			
66kV Polymeric Post Insulator – 930mm long c/w bolts	0487/36	1	346402
66kV – 646mm Long Stool for Vertical Post Insulator c/w bolts	0487/38	1	346403
or			
33kV Polymeric Post Insulator – 600mm long c/w bolts	0487/37	1	346405
33kV – 976mm Long Stool for Vertical Post Insulator c/w bolts	0487/40	1	346406
Horizontal Post Insulators (no bendable base)	1 09 101 0487 Sht 16	2	251548
or			
66kV Polymeric Post Insulator – 930mm long c/w bolts	0487/36	1	346402
66kV – 670mm Long Stool for Horizontal Post Insulator c/w bolts	0487/39	2	346404
or			
33kV Polymeric Post Insulator - – 600mm long c/w bolts	0487/37	2	346405
33kV – 1000mm Long Stool for Horizontal Post Insulator c/w bolts	0487/41	2	346407
Steelwork			

Insulator/ Tension Plate	1 09 101 0675 Sht1	1	346474
Short Crossarm	1 09 101 0675 Sht7	2	346479
Crossarm Support Channel	1 09 101 0675 Sht10	2	346482
Insulator Support Plate Bkt	1 09 101 0675 Sht9	4	346481
Insulator Support Plate	1 09 101 0675 Sht8	2	346480
Horiz. Ins. Support Angle	1 09 101 0675 Sht32	4	346501
Pole Number Plate	1 09 101 0228 sht 3	1	To suit
Pole Safety Sign	1 09 101 0229 Sht1	1	363318
Enhanced Anti-Climbing Device (If Required)	1 09 101 0675 Sht34	1	244981
M16 Tie Rod (474 Lg	1 09 101 0675 Sht29 Item 8	2	346496
M20 Tie Rod (360 Lg) (Anti-Split)	1 09 101 0675 Sht29 Item 4	3	346487
Eye Bolt Type 2	1 09 043 9603 Sht1	1	36 8059
Square Curved Washer	1 00 043 9605 Sht1	8	368078
Earthing Fastenings	1 09 101 0162 Sht1	1	370504
Bolt Ms Hex Galv M20 X 160 Lg		8	372816
Bolt Ms Hex Galv M20 X 60 Lg		40	378703
Plain Washer Ms Galv M20		72	375616
Nut Ms Hex Galv M20		36	378915
Nut Ms Hex Galv M16		4	337630
Plain Washer Ms Galv M16		4	378987
Notices			
Safety Sign	0229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	0028	1	243258
Pole Numbers	0028	To Suit	-
Earthed Structures Only			
Comp Lug – M22 Hole (70mm PVC Cu)	0237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	0149/3	1	235548
Earth Rod	3143	As Req.	354249
Rod Coupling	3143	As Req.	354361
Saddle Clamp	3143/2	As Req.	354338

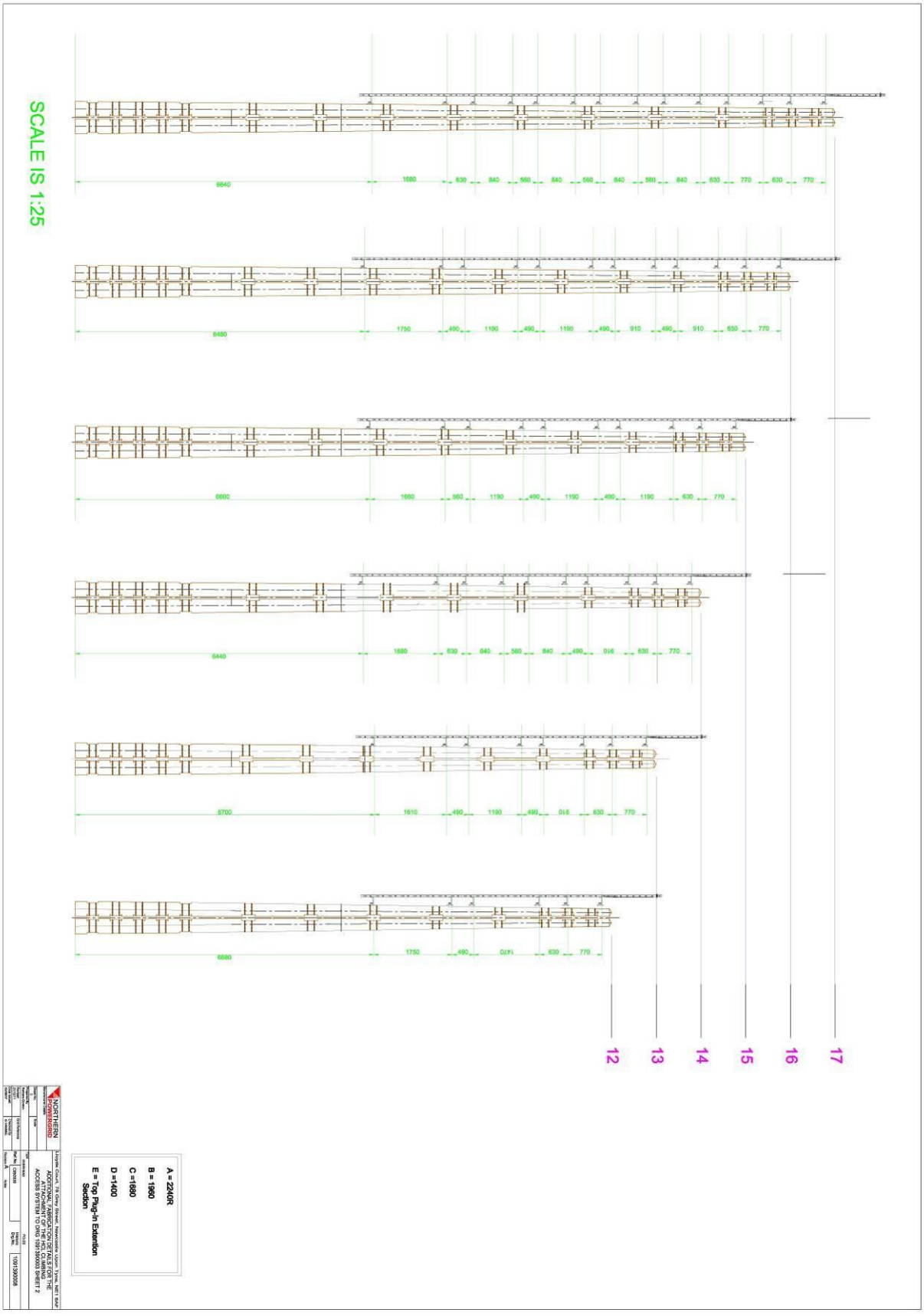


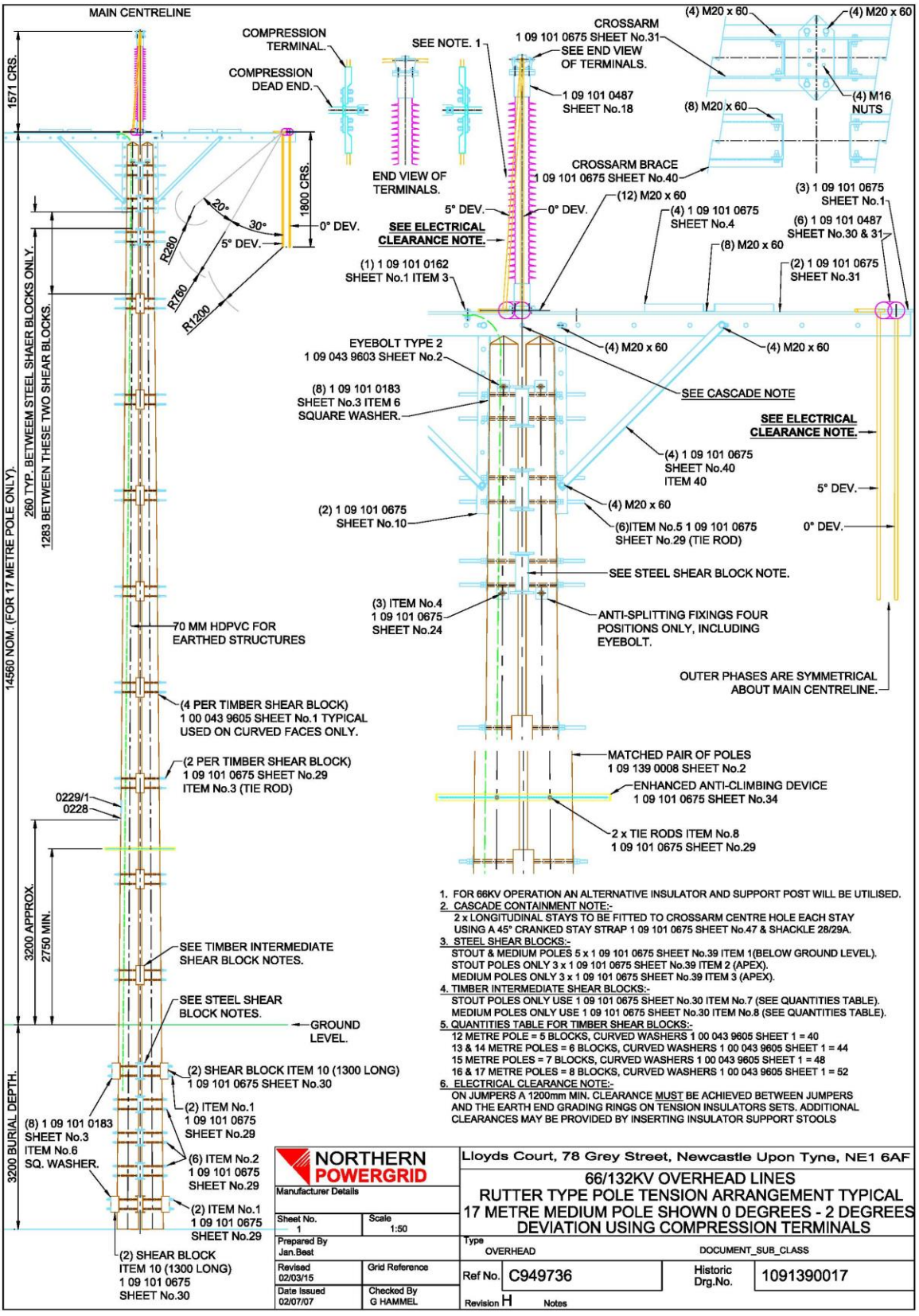
ITEM	POLE HEIGHT	DIMENSION 'X' (Min/ Max)	DIMENSION 'Y' (Min/ Max)	PITCH 'Z'	POLE CLASS
A MEDIUM	12000 mm	Ø150 mm - Ø190 mm	Ø250 mm - Ø305 mm	4 x 1400	MEDIUM
A STOUT	12000 mm	Ø190 mm - Ø224 mm	Ø305 mm - Ø337 mm	4 x 1400	STOUT
B MEDIUM	13000 mm	Ø160 mm - Ø195 mm	Ø280 mm - Ø320 mm	5 x 1350	MEDIUM
B STOUT	13000 mm	Ø195 mm - Ø230 mm	Ø320 mm - Ø353 mm	5 x 1350	STOUT
C MEDIUM	14000 mm	Ø160 mm - Ø195 mm	Ø275 mm - Ø335 mm	5 x 1500	MEDIUM
C STOUT	14000 mm	Ø195 mm - Ø230 mm	Ø335 mm - Ø368 mm	5 x 1500	STOUT
D MEDIUM	15000 mm	Ø165 mm - Ø195 mm	Ø290 mm - Ø350 mm	6 x 1450	MEDIUM
D STOUT	15000 mm	Ø195 mm - Ø230 mm	Ø350 mm - Ø386 mm	6 x 1450	STOUT
E MEDIUM	16000 mm	Ø170 mm - Ø200 mm	Ø305 mm - Ø365 mm	7 x 1400	MEDIUM
E STOUT	16000 mm	Ø200 mm - Ø236 mm	Ø365 mm - Ø402 mm	7 x 1400	STOUT
F MEDIUM	17000 mm	Ø180 mm - Ø200 mm	Ø320 mm - Ø375 mm	7 x 1500	MEDIUM
F STOUT	17000 mm	Ø200 mm - Ø236 mm	Ø375 mm - Ø412 mm	7 x 1500	STOUT

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

132KV OVERHEAD LINES
DRILLING, SCARFING & MARKINGS FOR RUTTER TYPE MEDIUM & STOUT POLES FOR USE WITH TIMBER & HEAVY DUTY STEEL SHEAR BLOCKS

Sheet No. 2	Scale AS SHOWN	Type OVERHEAD	DOCUMENT_SUB_CLASS
Prepared By Joan.Oakley			
Revised 26/09/14	Grid Reference	Ref No. C949714	Historic Drg.No. 1091390008
Date Issued 02/07/07	Checked By G HAMMEL	Revision C	Notes


SCALE IS 1:25
12
13
14
15
16
17
A = 2240R
B = 1960
C = 1680
D = 1400
E = Top Plug-In Extention Section


MAIN CENTRELINE
COMPRESSION TERMINAL.
COMPRESSION DEAD END.
SEE NOTE. 1
END VIEW OF TERMINALS.
CROSSARM 1 09 101 0675 SHEET No.31
SEE END VIEW OF TERMINALS.
1 09 101 0487 SHEET No.18
(4) M20 x 60
(4) M16 NUTS
(8) M20 x 60
CROSSARM BRACE 1 09 101 0675 SHEET No.40
(3) 1 09 101 0675 SHEET No.1
(12) M20 x 60
(4) 1 09 101 0675 SHEET No.4
(6) 1 09 101 0487 SHEET No.30 & 31
(8) M20 x 60
(2) 1 09 101 0675 SHEET No.31
(1) 1 09 101 0162 SHEET No.1 ITEM 3
1571 CRS.
1800 CRS.
20°
30°
0° DEV.
5° DEV.
R280
R760
R1200
SEE ELECTRICAL CLEARANCE NOTE.
EYEBOLT TYPE 2 1 09 043 9603 SHEET No.2
(8) 1 09 101 0183 SHEET No.3 ITEM 6 SQUARE WASHER.
SEE CASCADE NOTE
SEE ELECTRICAL CLEARANCE NOTE.
(4) 1 09 101 0675 SHEET No.40 ITEM 40
(2) 1 09 101 0675 SHEET No.10
(6)ITEM No.5 1 09 101 0675 SHEET No.29 (TIE ROD)
SEE STEEL SHEAR BLOCK NOTE.
(3) ITEM No.4 1 09 101 0675 SHEET No.24
ANTI-SPLITTING FIXINGS FOUR POSITIONS ONLY, INCLUDING EYEBOLT.
OUTER PHASES ARE SYMMETRICAL ABOUT MAIN CENTRELINE.
14560 NOM. (FOR 17 METRE POLE ONLY).
260 TYP. BETWEEN STEEL SHAER BLOCKS ONLY.
1283 BETWEEN THESE TWO SHEAR BLOCKS.
70 MM HDPVC FOR EARTHED STRUCTURES
(4 PER TIMBER SHEAR BLOCK) 1 00 043 9605 SHEET No.1 TYPICAL USED ON CURVED FACES ONLY.
(2 PER TIMBER SHEAR BLOCK) 1 09 101 0675 SHEET No.29 ITEM No.3 (TIE ROD)
0229/1
0228
3200 APPROX.
2750 MIN.
SEE TIMBER INTERMEDIATE SHEAR BLOCK NOTES.
SEE STEEL SHEAR BLOCK NOTES.
GROUND LEVEL.
3200 BURIAL DEPTH.
(2) SHEAR BLOCK ITEM 10 (1300 LONG) 1 09 101 0675 SHEET No.30
(2) ITEM No.1 1 09 101 0675 SHEET No.29
(8) 1 09 101 0183 SHEET No.3 ITEM No.6 SQ. WASHER.
(6) ITEM No.2 1 09 101 0675 SHEET No.29
(2) ITEM No.1 1 09 101 0675 SHEET No.29
(2) SHEAR BLOCK ITEM 10 (1300 LONG) 1 09 101 0675 SHEET No.30
MATCHED PAIR OF POLES 1 09 139 0008 SHEET No.2
ENHANCED ANTI-CLIMBING DEVICE 1 09 101 0675 SHEET No.34
2 x TIE RODS ITEM No.8 1 09 101 0675 SHEET No.29
1. FOR 66KV OPERATION AN ALTERNATIVE INSULATOR AND SUPPORT POST WILL BE UTILISED.
2. CASCADE CONTAINMENT NOTE:-
2 x LONGITUDINAL STAYS TO BE FITTED TO CROSSARM CENTRE HOLE EACH STAY USING A 45° CRANKED STAY STRAP 1 09 101 0675 SHEET No.47 & SHACKLE 28/29A.
3. STEEL SHEAR BLOCKS:-
STOUT & MEDIUM POLES 5 x 1 09 101 0675 SHEET No.39 ITEM 1(BELOW GROUND LEVEL).
STOUT POLES ONLY 3 x 1 09 101 0675 SHEET No.39 ITEM 2 (APEX).
MEDIUM POLES ONLY 3 x 1 09 101 0675 SHEET No.39 ITEM 3 (APEX).
4. TIMBER INTERMEDIATE SHEAR BLOCKS:-
STOUT POLES ONLY USE 1 09 101 0675 SHEET No.30 ITEM No.7 (SEE QUANTITIES TABLE).
MEDIUM POLES ONLY USE 1 09 101 0675 SHEET No.30 ITEM No.8 (SEE QUANTITIES TABLE).
5. QUANTITIES TABLE FOR TIMBER SHEAR BLOCKS:-
12 METRE POLE = 5 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 40
13 & 14 METRE POLES = 6 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 44
15 METRE POLES = 7 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 48
16 & 17 METRE POLES = 8 BLOCKS, CURVED WASHERS 1 00 043 9605 SHEET 1 = 52
6. ELECTRICAL CLEARANCE NOTE:-
ON JUMPERS A 1200mm MIN. CLEARANCE MUST BE ACHIEVED BETWEEN JUMPERS AND THE EARTH END GRADING RINGS ON TENSION INSULATORS SETS. ADDITIONAL CLEARANCES MAY BE PROVIDED BY INSERTING INSULATOR SUPPORT STOOLS
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 1
Scale 1:50
Prepared By Jan.Best
Revised 02/03/15
Grid Reference
Date Issued 02/07/07
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV OVERHEAD LINES
RUTTER TYPE POLE TENSION ARRANGEMENT TYPICAL
17 METRE MEDIUM POLE SHOWN 0 DEGREES - 2 DEGREES DEVIATION USING COMPRESSION TERMINALS
Type OVERHEAD
DOCUMENT_SUB_CLASS
Ref No. C949736
Historic Drg.No. 1091390017
Revision H
Notes

MATERIAL LIST FOR 1 09 139 0017 SHEET No.1 (0º - 2º Deviation)

CAT. No.	Pole Height	Fabrication Drawing
233992	12m Stout Pole	1 09 139 0008 Sht2 Item 'A Stout'
233993	13m Stout Pole	1 09 101 0008 Sht2 Item 'B Stout'
233994	14m Stout Pole	1 09 101 0008 Sht2 Item 'C Stout'
233995	15m Stout Pole	1 09 101 0008 Sht2 Item 'D Stout'
233996	16m Stout Pole	1 09 101 0008 Sht2 Item 'E Stout'
233997	17m Stout Pole	1 09 101 0008 Sht2 Item 'F Stout'

Note

Poles are supplied fabricated into structures using the materials listed below

VARIABLE QUANTITIES	17M	16M	15M	14M	13M	12M
Curved Washer 1 00 043 9605 Sht1	56	56	52	48	48	44
Wood Shear Blocks 1 09 101 0675 Sht 30 Item 7 (Stout Poles)	8	8	7	6	6	5
Wood Shear Block 1 09 101 0675 Sht 30 Item 8 (Medium Poles)	8	8	7	6	6	5

QUANTITY	CAT NO.	DESCRIPTION	DETAIL DRAWING	NOTES
5		Steel Shear Block (Below GL)	1 09 101 0675 Sht39 Item 1	(Med & Stout)
3		Steel Shear Block (Below Gl)	1 09 101 0675 Sht39 Item 1	(Stout Only)
3		Steel Shear Block (Below Gl)	1 09 101 0675 Sht39 Item 1	(Med Only)
4*	234476	Wood Baulks (1300mm)	1 09 101 0675 Sht 30 Item 10	
4		M20 Tie Rod (1200 Lg)	1 09 101 0675 Sht29 Item 1	
6		M20 Tie Rod (980 Lg)	1 09 101 0675 Sht29 Item 2	
16		M20 Tie Rod (940 Lg)	1 09 101 0675 Sht29 Item 3	
6		M20 Tie Rod (700 Lg)	1 09 101 0675 Sht29 Item 5	
* Where structures are installed in poor ground the top block type shall be changed as shown below				
2	234477	Wood Baulks (2500mm)	1 09 101 0675 Sht 30 Item 9	

Materials Not supplied with Poles

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Insulators			
132kV Operation			
132kv Polymeric Post Insulator + support stool	1 09 101 0487 Sht 18	1	251550
Pilot Insulator Support Stool (See above)	1 09 101 0487 sht 34	1	Inc above
Post insulator fixing bolts – 5/8" Unc, Grade 8.8	0487/6	4	239892
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kv Polymeric Post Insulator – No Stool	1 09 101 0487 Sht 36	1	251550
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539

COMPONENT	DRAWING NO	QUANTITY	CAT NO

33Kv Operation			
33kV Polymeric Post Insulator – No Stool	1 09 101 0487 Sht 37	1 or 2	261909
33 kV - 70kN Tension Insulator Assembly c/w arcing horns (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly c/w arcing horns (All Situations)	1091010488 sht 9	6	251546
Steelwork			
Insulator/ Tension Plate	1 09 101 0675 Sht1	1	346474
Crossarm Strut	1 09 101 0675 Sht40 Item 40	4	346502
Crossarm Brace	1 09 101 0675 Sht4	4	346476
Rutter Pole Crossarm	1 09 101 0675 Sht31	2	346500
Crossarm Support Channel	1 09 101 0675 Sht10	2	346482
M16 Tie Rod (474 Lg)	1 09 101 0675 Sht29 Item 8	2	346496
M20 Tie Rod (360 Lg)	1 09 101 0675 Sht29 Item 4 (Anti-Split)	3	346487
Eye Bolt Type 2	1 09 043 9603 Sht1	1	36 8059
Square Curved Washer	1 00 043 9605 Sht1	8	368078
Earthing Fastenings	1 09 101 0162 Sht1	3	370504
Bolt Ms Hex Galv M20 X 160 Lg		8	372816
Bolt Ms Hex Galv M20 X 60 Lg		36	378703
Plain Washer Ms Galv M20		72	375616
Nut Ms Hex Galv M20		36	378915
Nut Ms Hex Galv M16		4	337630
Conductor Terminations			
Poplar Comp. dead end c/w straight lug	1 09 101 0653 sht 3	6	243240
Conductor terminations to suit	To suit	6	To Suit
Signs & Notices			
Safety Sign	0229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	0028	1	243258
Pole Numbers	0028	To Suit	-
ACD			
Enhanced Anti-Climbing Device	1 09 101 0675 Sht34 **(If Required)**	1	244981
Earthed Structures Only			
Comp Lug – M22 Hole (70mm PVC Cu)	0237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	0149/3	1	235548
Earth Rod	3143	As Req.	354249
Rod Coupling	3143	As Req.	354361
Driving Bolt	3143	As Req.	354408
Saddle Clamp	3143/2	As Req.	354338

CASCADE CONTAINMENT

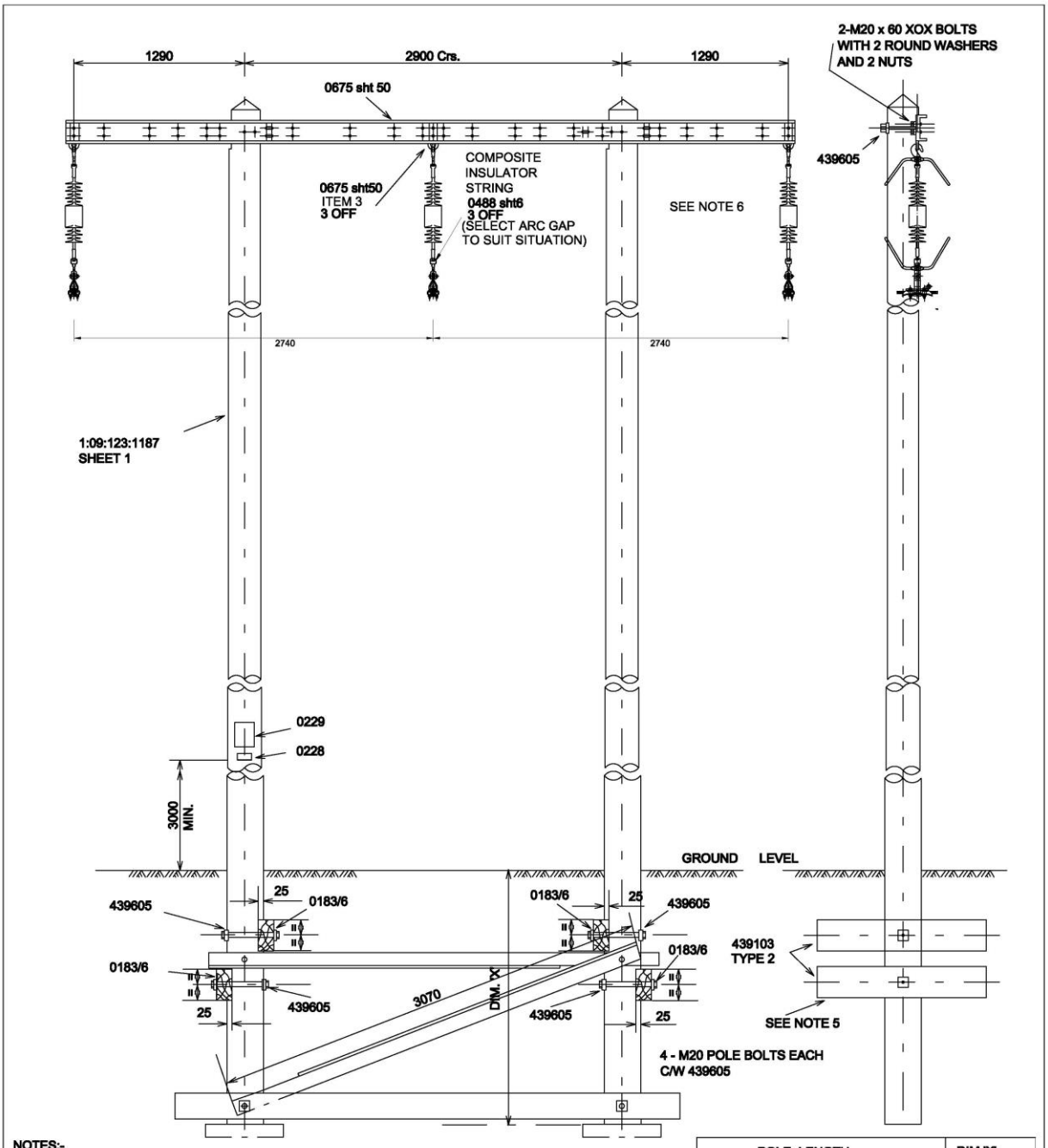
The Following Items Are Required Per Pole To Prevent Cascade Effect On Unstayed Sections

COMPONENT	DRAWING NO	QUANTITY	CAT NO
45˚ Cranked Stay Strap	1 09 101 0675 Sht46	2	346503
Shackle 28/29a		2	226365
Bolt Ms Hex Galv M24 X 60 Lg c/w M24 Nut		2	337631
Plain Washer Ms Galv M24		4	229195

Stays

See separate material list for drawing 1091010429 sht 8

2 Stays assemblies (using the double stay solution shown on the drawing above, but replacing the 10º cranked strap with the 45º cranked strap listed above) are to be installed in both directions against the direction of the overhead conductors.



NOTES:-

1. ALL POLE BOLTS TO BE M20 DIA.
2. DETAIL DRGS. PREFIXED 43 REFER TO ESI BASED DRGS. OTHER DETAIL DRGS. REFER TO 1:09:101 SERIES
3. THIS ARRANGEMENT MAY BE USED WITH EXISTING POLES TO EARLY ISSUE OF 1:09:123:1165 AND 66.5/10.1161 POLE TOP REFABRICATION WILL BE REQUIRED IN THE LATTER CASE TO ACCEPT THE CROSSARM TO 1:09:101:0675
4. ALL UNUSED POLE HOLES TO BE PLUGGED ON SITE.
5. LOWER BAULKS TO BE FITTED WHERE ABNORMAL AND CONDITIONS WARRANT IT.
6. INSULATOR STRING TO COMPRISE OF 700mm (5 x 140mm) COMPOSITE INSULATOR ASSEMBLY.

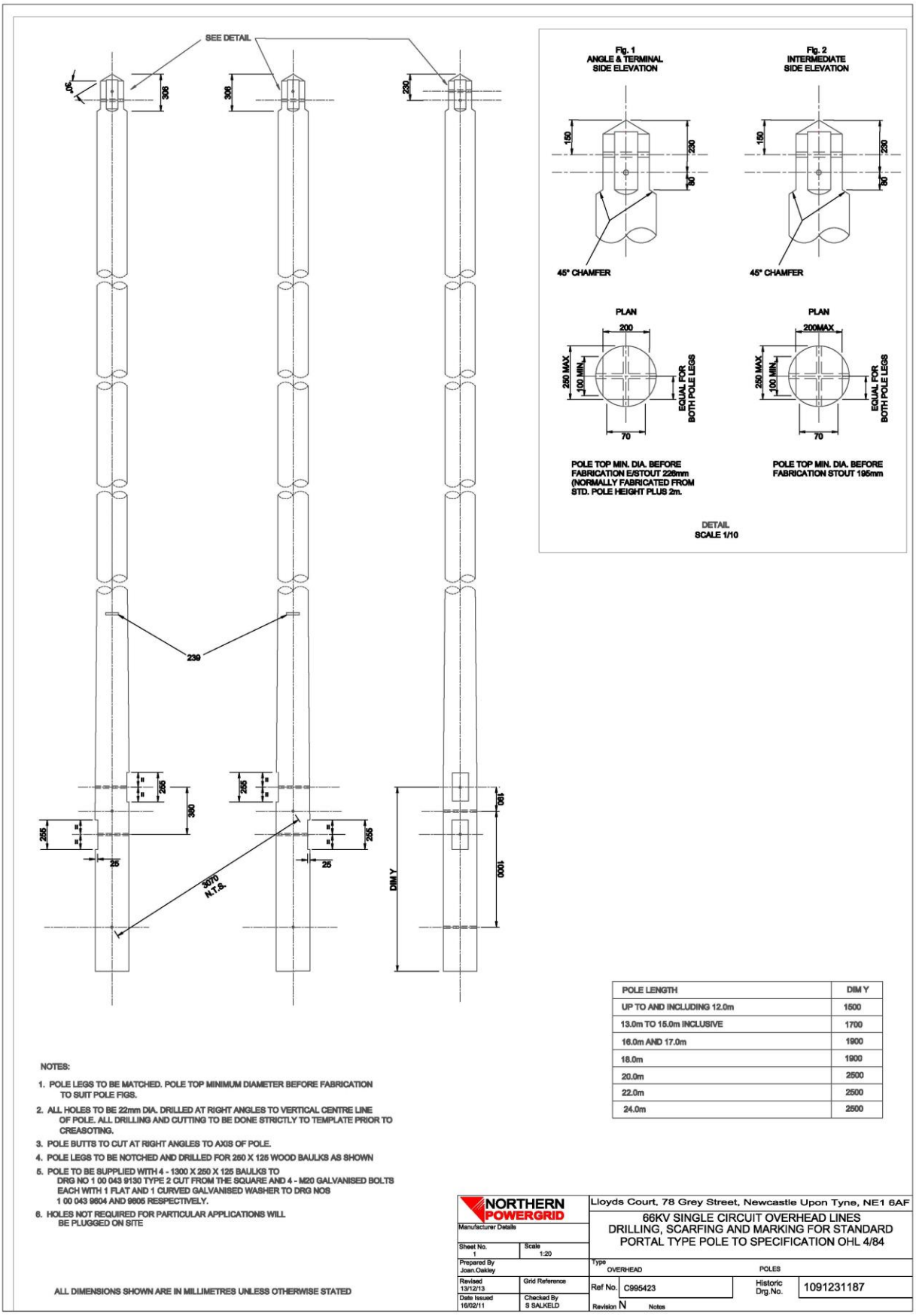
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

POLE LENGTH	DIM 'X'
UP TO AND INCLUDING 12.0m	2.0m
13.0m TO 15.0m INCLUSIVE	2.2m
16.0m TO 18.0m INCLUSIVE	2.4m
20.0m TO 24.0m INCLUSIVE	3.0m

WORK SPEC. 04/223

NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66KV SINGLE CIRCUIT OVERHEAD LINES
PORTAL POLE ARRANGEMENT

Sheet No. 4	Scale 1:20		
Prepared By Arron.Turner		Type OVERHEAD	POLES
Revised 23/09/16	Grid Reference	Ref No. C987017	Historic Drg.No. 1091231165
Date Issued 12/05/10	Checked By G HAMMEL	Revision A	Notes



POLE LENGTH	DIM Y
UP TO AND INCLUDING 12.0m	1500
13.0m TO 15.0m INCLUSIVE	1700
16.0m AND 17.0m	1900
18.0m	1900
20.0m	2500
22.0m	2500
24.0m	2500

NOTES:

1. POLE LEGS TO BE MATCHED. POLE TOP MINIMUM DIAMETER BEFORE FABRICATION TO SUIT POLE FIGS.
2. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREASOTING.
3. POLE BUTTS TO CUT AT RIGHT ANGLES TO AXIS OF POLE.
4. POLE LEGS TO BE NOTCHED AND DRILLED FOR 250 X 125 WOOD BAULKS AS SHOWN
5. POLE TO BE SUPPLIED WITH 4 - 1300 X 250 X 125 BAULKS TO DRG NO 1 00 043 9130 TYPE 2 CUT FROM THE SQUARE AND 4 - M20 GALVANISED BOLTS EACH WITH 1 FLAT AND 1 CURVED GALVANISED WASHER TO DRG NOS 1 00 043 9604 AND 9605 RESPECTIVELY.
6. HOLES NOT REQUIRED FOR PARTICULAR APPLICATIONS WILL BE PLUGGED ON SITE

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

NORTHERN POWERGRID
Manufacturer Details

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

66KV SINGLE CIRCUIT OVERHEAD LINES
DRILLING, SCARFING AND MARKING FOR STANDARD PORTAL TYPE POLE TO SPECIFICATION OHL 4/84

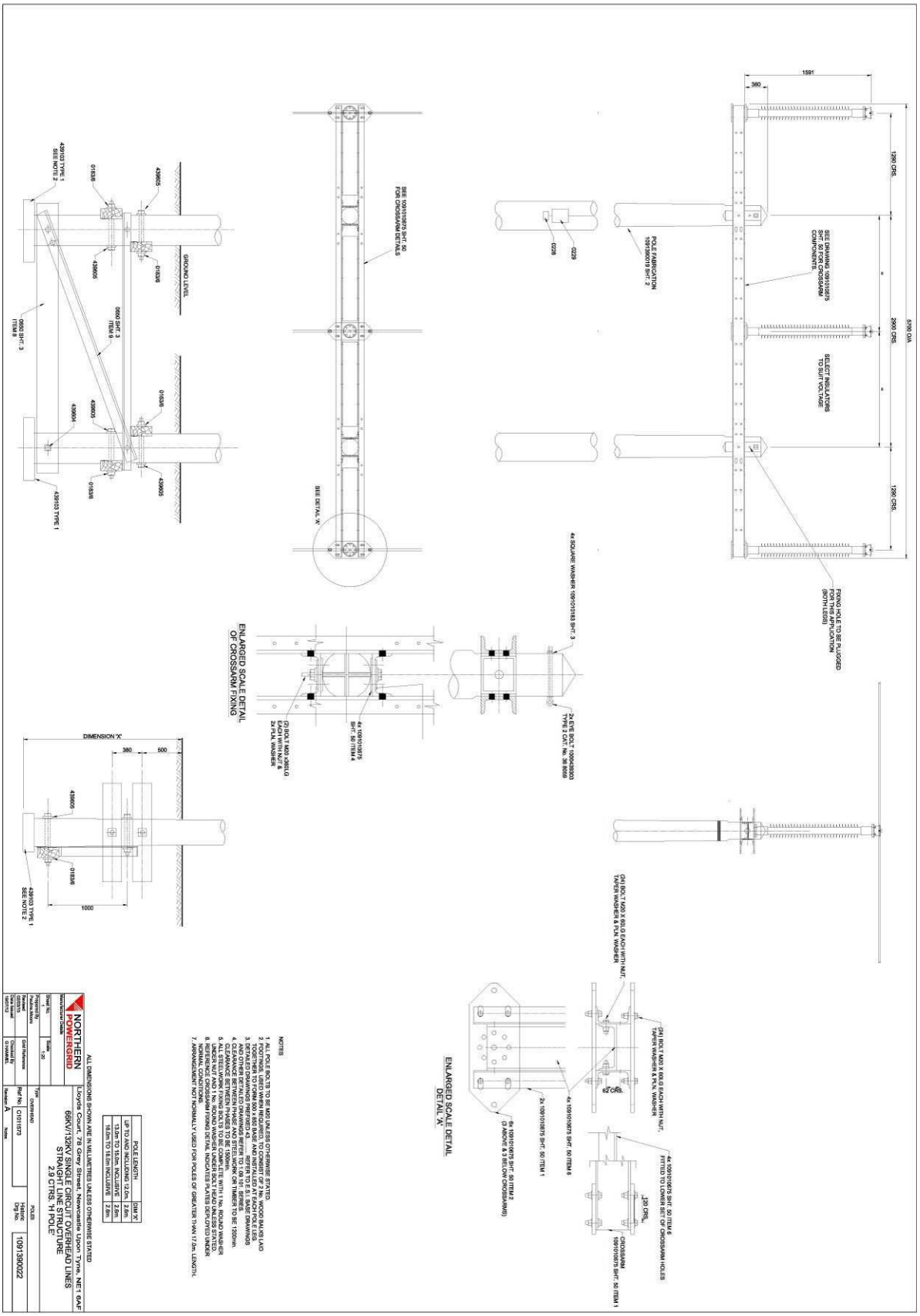
Sheet No. 1	Scale 1:20		
Prepared By Joan.Oakley		Type OVERHEAD	POLES
Revised 13/12/13	Grid Reference	Ref No. C995423	Historic Drg.No. 1091231187
Date Issued 16/02/11	Checked By S SALKELD	Revision N	Notes

MATERIAL LIST FOR 1 09 123 1165 SHEET No.4 (Int Portal 'H' Structure)

	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Stout H Pole	1 09 123 1187 Sht1	1	233896
13m Stout H Pole	1 09 123 1187 Sht1	1	233909
14m Stout H Pole	1 09 123 1187 Sht1	1	233913
15m Stout H Pole	1 09 123 1187 Sht1	1	233947
16m Stout H Pole	1 09 123 1187 Sht1	1	233932
17m Stout H Pole	1 09 123 1187 Sht1	1	233951
18m Stout H Pole	1 09 123 1187 Sht1	1	233966
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	1	346507
Insulator suspension plates	1010675 sht 50 item 3	3	258709
Bolts, M20 x 300, Galvd		2	378794
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Bolts, M20 x 60, Galvd		6	378703
Nuts, M20, Galvd		6	378915
Washers, M20, Round, Galvd		14	375616
Insulator Assemblies			
66kV - 70kN Suspension Insulator Assembly incl. (Normal arcing horns), socket clevis and ball hook fitting see NSP/004/127	Assembly - 1091010488 sht 6 Insulator – 1091010487 sht20	3	251541
Or			
66kV - 70kN Suspension Insulator Assembly incl. (Approach arcing horns), socket clevis and ball hook fitting see NSP/004/127	Assembly - 1091010488 sht 6 Insulator – 1091010487 sht20	3	251542
Or			
33kV - 70kN Suspension Insulator Assembly incl. suitable for Normal or Approach (no arcing horns req) see NSP/004/127	Assembly - 1091010488 sht 6 Insulator – 1091010487 sht23	3	216150
70kN M16 Shackle. Bs3288 fig 15/29A	1091010443 sht1	3	264428
Ball Ended Eye Link, BS3288 ref 15/30	1091010455 sht1	3	251907
Socket Clevis , bs3288 ref 15/31	1091010448 sht1	3	250622
Suspension Clamp, bs3288 fig 74 **	1091010498 sht1	3	246010
Aluminium Chaffing tape		To suit	331716

** Liners to suit conductor material

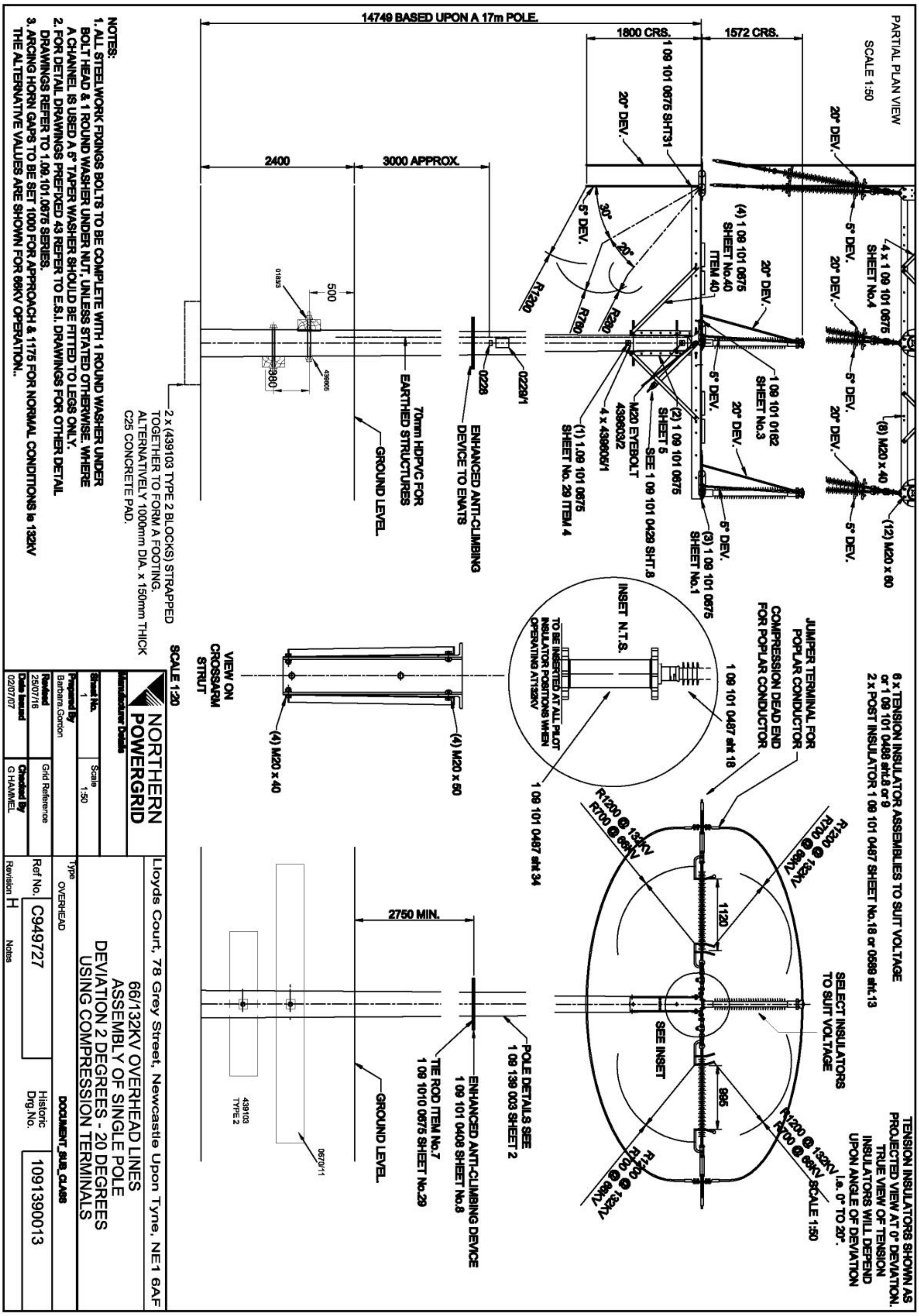
Signs & Numbers			
Safety Sign	1091010229	2	363318
Fibre Washer, 14mm dia x 6mm thick		10	374581
Fibre Washer, 14mm dia x 2mm thick	-	10	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	10	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	2	251362


66KV/132KV SINGLE CIRCUIT OVERHEAD LINES
STRAIGHT LINE STRUCTURE
2.9 CTRS 'H POLE'
ENLARGED SCALE DETAIL OF CROSSARM FIXING
ENLARGED SCALE DETAIL 'A'
DIMENSION 'X'
NOTES
1591
380
1290 CRS.
2900 CRS.
5700 O/A
GROUND LEVEL
SEE DETAIL 'A'
FIXING HOLE TO BE PLUGGED (BOTH LEGS)
1000
500
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

MATERIAL LIST FOR 1 09 139 0022 SHEET No.1 (Int 'H' Structure)

	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Stout H Pole	1 09 139 0019 Sht2	1	234005
13m Stout H Pole	1 09 139 0019 Sht2	1	234006
14m Stout H Pole	1 09 139 0019 Sht2	1	234007
15m Stout H Pole	1 09 139 0019 Sht2	1	234008
16m Stout H Pole	1 09 139 0019 Sht2	1	234009
17m Stout H Pole	1 09 139 0019 Sht2	1	234010
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	2	346507
Post Insulator & tension plates	1010675 sht50 item 2	6	346508
Pole Cheek plate	1010675 sht50 item 4	4	252670
Square plate for item 4 - Spacer Plates	1010675 sht50 item 5	8	240739
Crossarm Spacer Channels	1010675 sht50 item 6	4	346510
Bolts, M20 x 400, Galvd		2	372904
Washers, M20, Square Flat, Galvd	1091010183 sht 3 item 6	4	368063
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1	2	368059
Bolts, M20 x 60, Galvd		88	378703
Washers, M20, Tapered, Galvd	0183/4	88	374488
Nuts, M20, Galvd		86	378915
Washers, M20, Round, Galvd		88	375616
Insulators			
132 kV Operation			
132kV Post Insulator with 127mm PCD Flange Base	1 09 101 0487 Sht 18	3	251551
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base	109 101 0487 sht 36	3	346402
33kV Operation			
33kV Post Insulator with 127mm PCD Flange Base	1091010487 sht 37	1 or 2	346405

Signs & Numbers			
Safety Sign	1091010229	2	363318
Fibre Washer, 14mm dia x 6mm thick		10	374581
Fibre Washer, 14mm dia x 2mm thick	-	10	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	10	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	2	251362

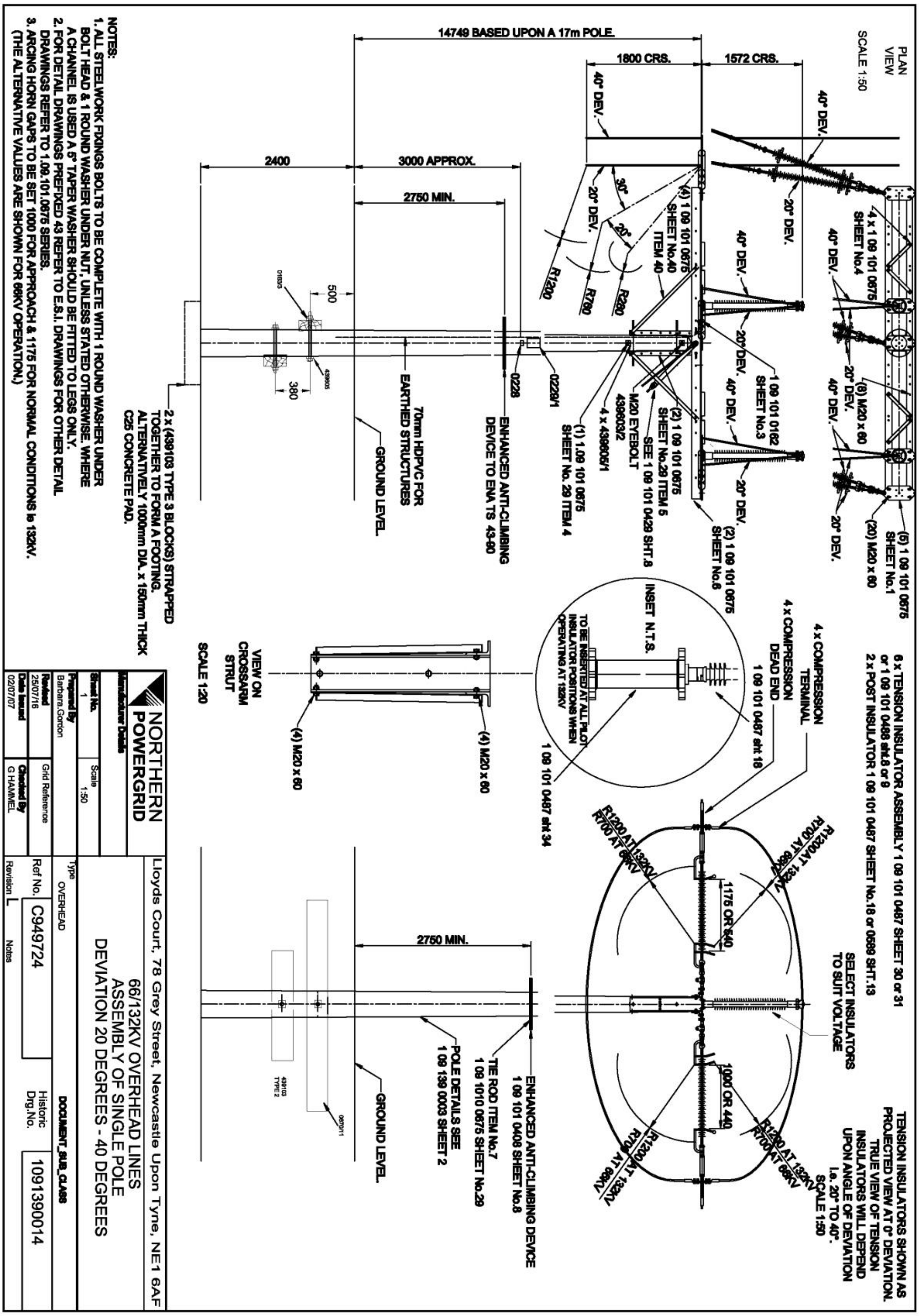


NOTES:
1. ALL STEELWORK FIXINGS BOLTS TO BE COMPLETE WITH 1 ROUND WASHER UNDER BOLT HEAD & 1 ROUND WASHER UNDER NUT, UNLESS STATED OTHERWISE. WHERE A CHANNEL IS USED A 5° TAPER WASHER SHOULD BE FITTED TO LEGS ONLY.
2. FOR DETAIL DRAWINGS PREFIXED 43 REFER TO E.S.I. DRAWINGS FOR OTHER DETAIL DRAWINGS REFER TO 1.09.101.0675 SERIES.
3. ARCING HORN GAPS TO BE SET 1000 FOR APPROACH & 1175 FOR NORMAL CONDITIONS Ie 132KV THE ALTERNATIVE VALUES ARE SHOWN FOR 66KV OPERATION.
14749 BASED UPON A 17m POLE.
PARTIAL PLAN VIEW
SCALE 1:50
1800 CRS.
1572 CRS.
2400
3000 APPROX.
2750 MIN.
GROUND LEVEL.
EARTHED STRUCTURES
ENHANCED ANTI-CLIMBING DEVICE TO ENATS
VIEW ON CROSSARM STRUT
SCALE 1:20
INSET N.T.S.
SEE INSET
SELECT INSULATORS TO SUIT VOLTAGE
TENSION INSULATORS SHOWN AS PROJECTED VIEW AT 0° DEVIATION. TRUE VIEW OF TENSION INSULATORS WILL DEPEND UPON ANGLE OF DEVIATION i.e. 0° TO 20°.
SCALE 1:50
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV OVERHEAD LINES
ASSEMBLY OF SINGLE POLE
DEVIATION 2 DEGREES - 20 DEGREES
USING COMPRESSION TERMINALS
Scale 1:50
Type OVERHEAD
Ref No. C949727
Historic Drg.No. 1091390013
Revision H
Prepared By Barbara.Gordon
Checked By G HAMMEL
Date Issued 02/07/07
Revised 25/07/16

MATERIAL LIST FOR 1 09 139 0013 SHEET No.1 (2º - 20º Deviation)

DESCRIPTION	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Extra Stout Pole	1.09.139.0003 Sheet 1	1	233999
13m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234000
14m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234001
15m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234002
16m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234003
17m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234004
Foundation Blocks			
Foundation Baulk 1300x225x125	439103 Type 2 Blocks	1	235124
Foundation Baulk 2500x225x125	0670/11	1	346581
Bolts, M20 x 530 Galvd		2	372815
Washers, Square Curved	439605	2	368078
Washer, Square Flat	0183/3	2	368063
Steelwork			
Insulator / Tension Plate	109 101 0675 sht1	5	346474
0-40º Crossarm	109 101 0675 sht6	2	346478
Crossarm strut	109 101 0675 sht40	4	346502
Crossarm Brace	109 101 0675 sht4	4	346476
Crossarm Support	109 101 0675 sht5	2	346477
M20 Tie Rod x 360, Galvd	1091010675 sht29 item 4	1	346487
Eye bolt type 2	100 043 9603 sht1	1	368059
Square Curved washer	100 043 9605 sht1	4	368078
Earthing fastenings	109101 0162 sht1	1	370504
Bolts M20 x 60 Galv		36	378703
Plain Washers M20 Flat		60	375616
M20 Tie rod (700mm lg)	109101 0675 sht29 item 5	2	346493
Nuts M16 Galv		8	337630
Plain washers M16 , round flat		8	378987
Conductor Terminations (to suit conductor type)			
Poplar Comp. dead end c/w straight lug	1 09 101 0653 sht 3	6	243240
Helical Deadends and socket Thimbles to suit			To suit
Insulator Assemblies			
132kV Operation			
Post Insulator + (Support Stool)	1091010487 sht18	1 or 2	251550
Post Insulator Support Stool (see above)	1091010487 sht34	1 or 2	Inc above
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 36	1 or 2	346402
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach) OHL4	1091010488 sht 8	6	251559
Or			

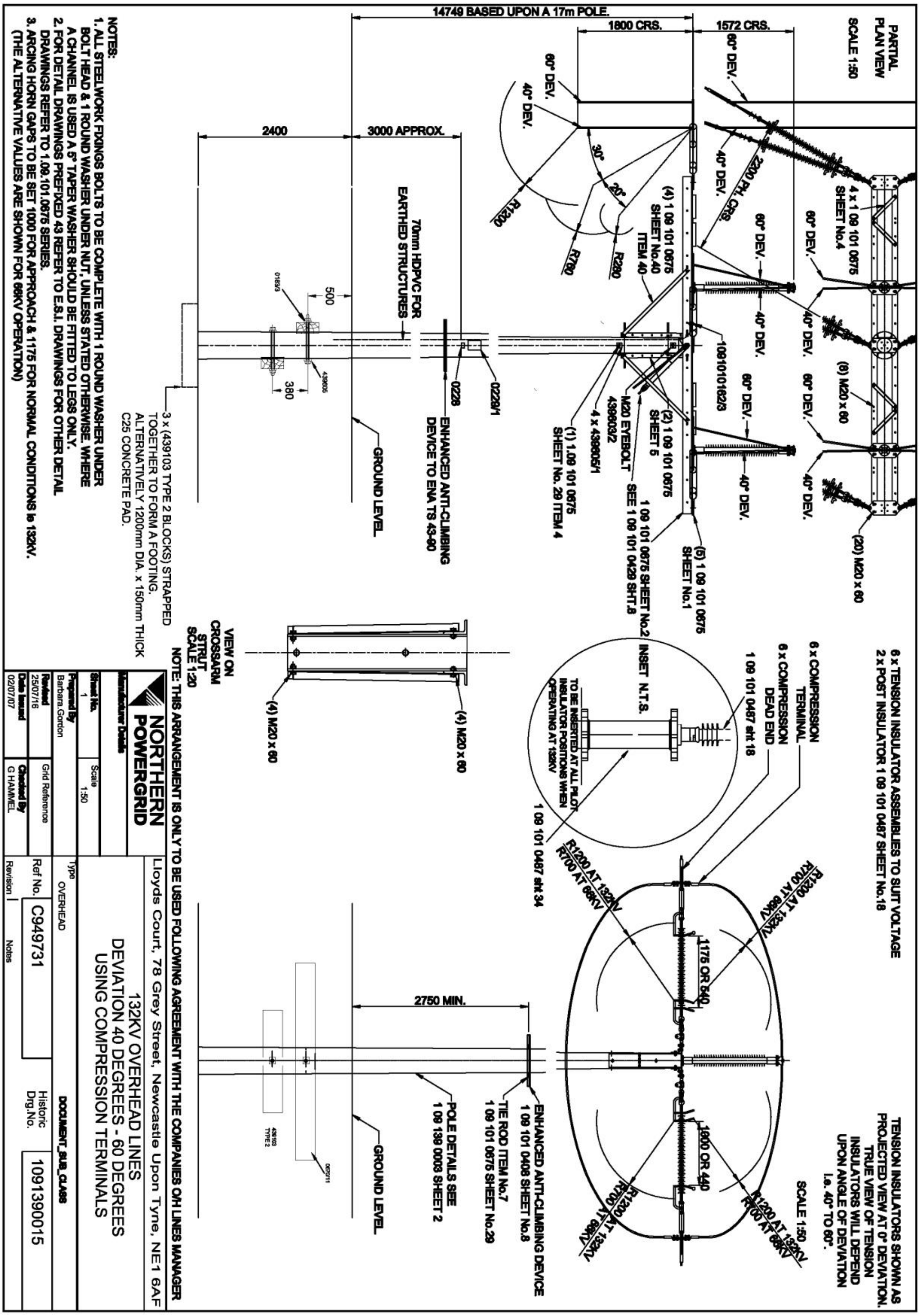
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
Or			
66 kV - 70kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 8	6	251560
Or			
66 kV - 120kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 9	6	251536
33Kv Operation			
33kV Post Insulator with 127mm PCD Flange Base	1091010487 sht 37	1 or 2	346405
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
Stays			
For details on stay requirements see the following detailed stay drawings:			
* For 1 To 3 Stays (1 Per Stay) Refer To Drawing	1 09 101 0429 Sht8		
* For 1 To 3 Stays Refer To Stay Yoke Array Drawing	1 09 101 0675 Sht24		
Earth Materials (Only where required)			
Comp Lug – M22 Hole (70mm PVC Cu)	1091010237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	1091010149/3	1	235548
Earth Rod	1091193143	As Req.	354249
Rod Coupling	1091193143	As Req.	354361
Driving Bolt	1091193143	As Req.	354408
Saddle Clamp	1091193143/2	As Req.	354338
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	1	251362


PLAN VIEW
SCALE 1:50
14749 BASED UPON A 17m POLE.
1800 CRS.
1572 CRS.
3000 APPROX.
2750 MIN.
2400
40° DEV.
20° DEV.
GROUND LEVEL.
70mm HDPVC FOR EARTHED STRUCTURES
ENHANCED ANTI-CLIMBING DEVICE TO ENA TS 43-90
2 x (439103 TYPE 3 BLOCKS) STRAPPED TOGETHER TO FORM A FOOTING. ALTERNATIVELY 1000mm DIA. x 150mm THICK C25 CONCRETE PAD.
NOTES:
1. ALL STEELWORK FIXINGS BOLTS TO BE COMPLETE WITH 1 ROUND WASHER UNDER BOLT HEAD & 1 ROUND WASHER UNDER NUT, UNLESS STATED OTHERWISE. WHERE A CHANNEL IS USED A 5° TAPER WASHER SHOULD BE FITTED TO LEGS ONLY.
2. FOR DETAIL DRAWINGS PREFIXED 43 REFER TO E.S.I. DRAWINGS FOR OTHER DETAIL DRAWINGS REFER TO 1.09.101.0675 SERIES.
3. ARCING HORN GAPS TO BE SET 1000 FOR APPROACH & 1175 FOR NORMAL CONDITIONS Ie 132KV. (THE ALTERNATIVE VALUES ARE SHOWN FOR 66KV OPERATION.)
INSET N.T.S.
VIEW ON CROSSARM STRUT
SCALE 1:20
SELECT INSULATORS TO SUIT VOLTAGE
TENSION INSULATORS SHOWN AS PROJECTED VIEW AT 0° DEVIATION. TRUE VIEW OF TENSION INSULATORS WILL DEPEND UPON ANGLE OF DEVIATION i.e. 20° TO 40°.
SCALE 1:50
POLE DETAILS SEE 1 09 139 0003 SHEET 2
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV OVERHEAD LINES
ASSEMBLY OF SINGLE POLE
DEVIATION 20 DEGREES - 40 DEGREES
C949724
1091390014
G HAMMEL
Barbara.Gordon

MATERIAL LIST FOR 1 09 139 0014 SHEET No.1 (20º - 40º Deviation)

DESCRIPTION	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Extra Stout Pole	1.09.139.0003 Sheet 1	1	233999
13m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234000
14m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234001
15m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234002
16m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234003
17m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234004
Foundation Blocks			
Foundation Baulk 1300x225x125 (used to sit poles on in the pole hole)	439103 Type 2 Blocks	2	235124
Steelwork			
Insulator / Tension Plate	109 101 0675 sht1	5	346474
0-40º Crossarm	109 101 0675 sht6	2	346478
Crossarm strut	109 101 0675 sht40	4	346502
Crossarm Brace	109 101 0675 sht4	4	346476
Crossarm Support	109 101 0675 sht5	2	346477
M20 Tie Rod x 360, Galvd	1091010675 sht29 item 4	1	346487
Eye bolt type 2	100 043 9603 sht1	1	368059
Square Curved washer	100 043 9605 sht1	4	368078
Earthing fastenings	109101 0162 sht1	1	370504
Bolts M20 x 60 Galv		36	378703
Plain Washers M20 Flat		60	375616
M20 Tie rod (700mm lg)	109101 0675 sht29 item 5	2	346493
Nuts M16 Galv		8	337630
Plain washers M16 , round flat		8	378987
Conductor Terminations (to suit conductor type)			
Poplar Comp. dead end c/w straight lug	1 09 101 0653 sht 3	6	243240
Helical Deadends and socket Thimbles to suit			To suit
Insulator Assemblies			
132kV Operation			
Post Insulator + (Support Stool)	1091010487 sht18	1 or 2	251550
Post Insulator Support Stool (see above)	1091010487 sht34	1 or 2	Inc above
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 36	1 or 2	346402
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
Or			
66 kV - 70kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 8	6	251560
Or			

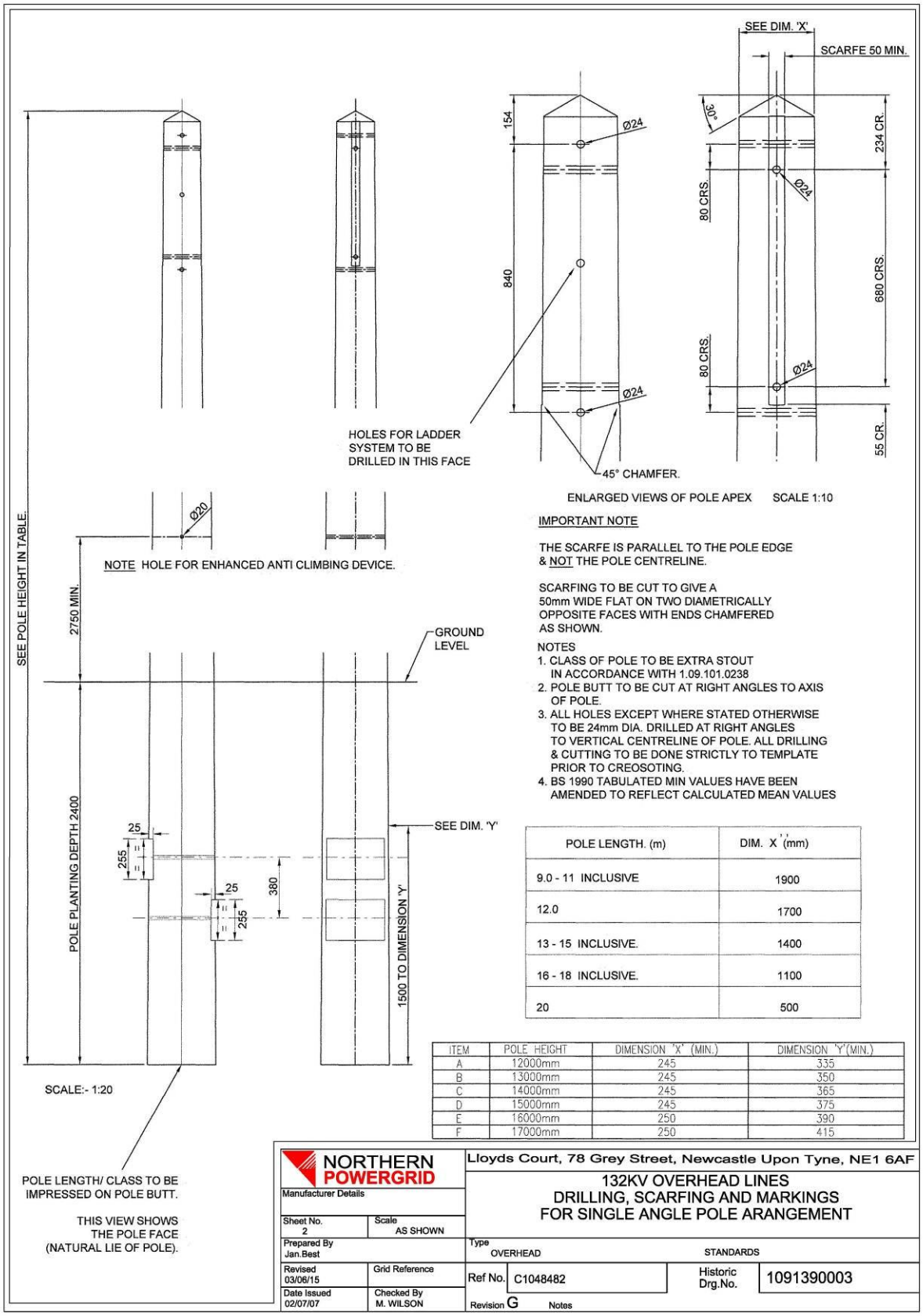
66 kV - 120kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 9	6	251536
33Kv Operation			
33kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 37	1 or 2	346405
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
Stays			
For details on stay requirements see the following detailed stay drawings:			
* For 1 To 3 Stays (1 Per Stay) Refer To Drawing	1 09 101 0429 Sht8		
* For 1 To 3 Stays Refer To Stay Yoke Array Drawing	1 09 101 0675 Sht24		
Earth Materials (Only where required)			
Comp Lug – M22 Hole (70mm PVC Cu)	1091010237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	1091010149/3	1	235548
Earth Rod	1091193143	As Req.	354249
Rod Coupling	1091193143	As Req.	354361
Driving Bolt	1091193143	As Req.	354408
Saddle Clamp	1091193143/2	As Req.	354338
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	1	251362

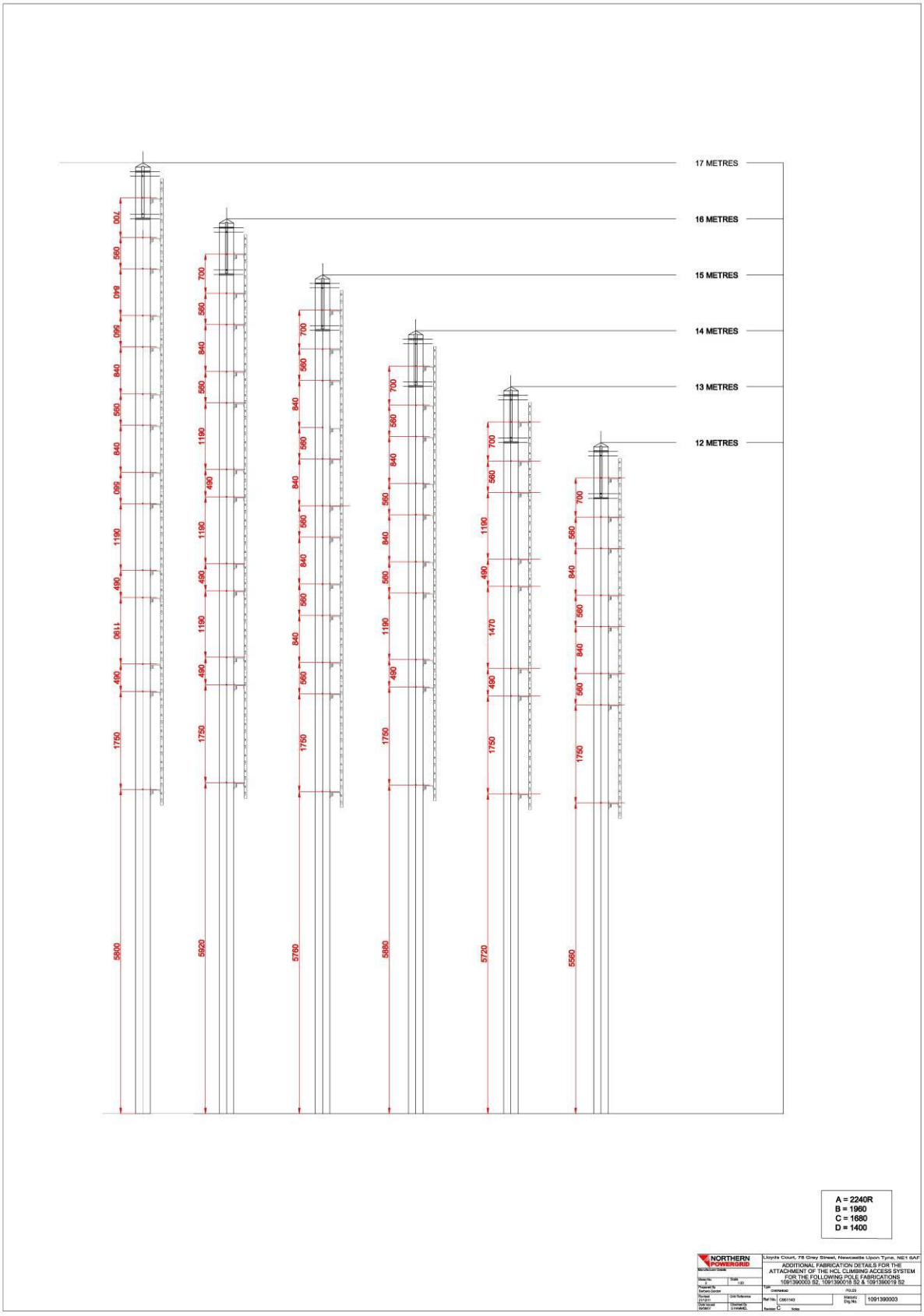

14749 BASED UPON A 17m POLE.
1800 CRS.
1572 CRS.
PARTIAL PLAN VIEW SCALE 1:50
60° DEV.
40° DEV.
2200 PH. CRS.
R1200
R700
R280
3000 APPROX.
2400
70mm HDPVC FOR EARTHED STRUCTURES
GROUND LEVEL
ENHANCED ANTI-CLIMBING DEVICE TO ENA TS 43-90
3 x (439103 TYPE 2 BLOCKS) STRAPPED TOGETHER TO FORM A FOOTING. ALTERNATIVELY 1200mm DIA. x 150mm THICK C25 CONCRETE PAD.
NOTES:
1. ALL STEELWORK FIXINGS BOLTS TO BE COMPLETE WITH 1 ROUND WASHER UNDER BOLT HEAD & 1 ROUND WASHER UNDER NUT, UNLESS STATED OTHERWISE. WHERE A CHANNEL IS USED A 5° TAPER WASHER SHOULD BE FITTED TO LEGS ONLY.
2. FOR DETAIL DRAWINGS PREFIXED 43 REFER TO E.S.I. DRAWINGS FOR OTHER DETAIL DRAWINGS REFER TO 1.09.101.0675 SERIES.
3. ARCING HORN GAPS TO BE SET 1000 FOR APPROACH & 1175 FOR NORMAL CONDITIONS Ie 132KV. (THE ALTERNATIVE VALUES ARE SHOWN FOR 66KV OPERATION)
VIEW ON CROSSARM STRUT SCALE 1:20
(4) M20 x 60
6 x TENSION INSULATOR ASSEMBLIES TO SUIT VOLTAGE
2 x POST INSULATOR 1 09 101 0487 SHEET No.18
6 x COMPRESSION TERMINAL
6 x COMPRESSION DEAD END
INSET N.T.S.
TO BE INSERTED AT ALL PILOT INSULATOR POSITIONS WHEN OPERATING AT 132KV
R1200 AT 132KV
R700 AT 66KV
1175 OR 640
1000 OR 440
2750 MIN.
TENSION INSULATORS SHOWN AS PROJECTED VIEW AT 0° DEVIATION. TRUE VIEW OF TENSION INSULATORS WILL DEPEND UPON ANGLE OF DEVIATION I.e. 40° TO 60°. SCALE 1:50
ENHANCED ANTI-CLIMBING DEVICE 1 09 101 0408 SHEET No.8
TIE ROD ITEM No.7 1 09 101 0675 SHEET No.29
POLE DETAILS SEE 1 09 139 0003 SHEET 2
NOTE: THIS ARRANGEMENT IS ONLY TO BE USED FOLLOWING AGREEMENT WITH THE COMPANIES OH LINES MANAGER
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
DEVIATION 40 DEGREES - 60 DEGREES
USING COMPRESSION TERMINALS
Prepared By Barbara Gordon
Checked By G HAMMEL
Scale 1:50
Type OVERHEAD
Ref No. C949731
Historic Drg.No. 1091390015

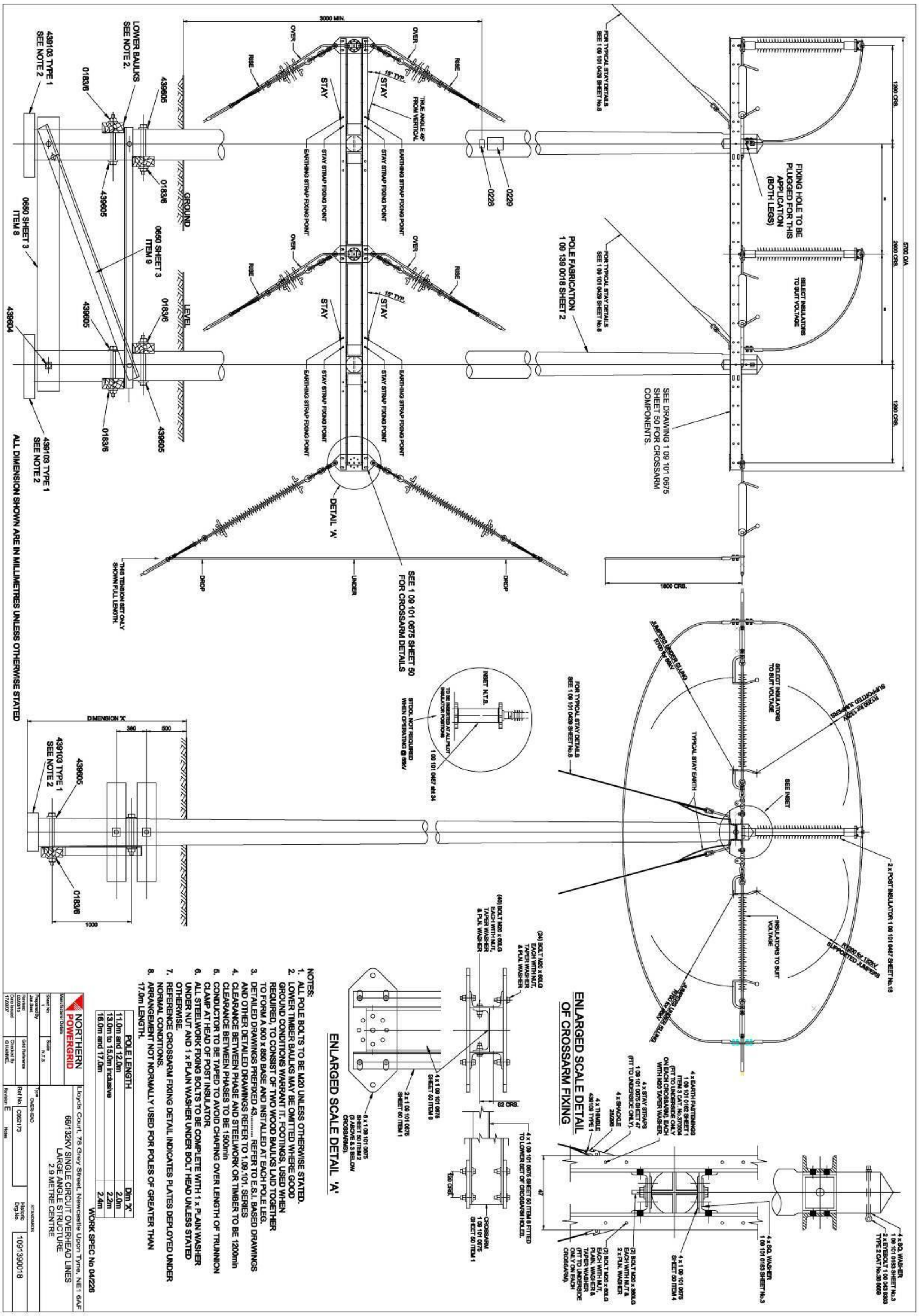
MATERIAL LIST FOR 1 09 139 0015 SHEET No.1 (40º - 60º Deviation)

DESCRIPTION	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Extra Stout Pole	1.09.139.0003 Sheet 1	1	233999
13m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234000
14m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234001
15m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234002
16m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234003
17m Extra Stout Pole	1.09.139.0003 Sheet 1	1	234004
Foundation Blocks			
Foundation Baulk 1300x225x125 (used to sit poles on in the pole hole)	439103 Type 2 Blocks	2	235124
Steelwork			
Insulator / Tension Plate	109 101 0675 sht1	5	346474
40 - 60º Crossarm	109 101 0675 sht2	2	366475
Crossarm strut	109 101 0675 sht40	4	346502
Crossarm Brace	109 101 0675 sht4	4	346476
Crossarm Support	109 101 0675 sht5	2	346477
M20 Tie Rod x 360, Galvd	1091010675 sht29 item 4	1	346487
Eye bolt type 2	100 043 9603 sht1	1	368059
Square Curved washer	100 043 9605 sht1	4	368078
Earthing fastenings	109101 0162 sht1	1	370504
Bolts M20 x 60 Galv		36	378703
Plain Washers M20 Flat		60	375616
M20 Tie rod (700mm lg)	109101 0675 sht29 item 5	2	346493
Nuts M16 Galv		8	337630
Plain washers M16 , round flat		8	378987
Conductor Terminations (to suit conductor type)			
Poplar Comp. dead end c/w straight lug	1 09 101 0653 sht 3	6	243240
Helical Deadends and socket Thimbles to suit			To suit
Insulator Assemblies			
132kV Operation			
Post Insulator + (Support Stool)	1091010487 sht18	1 or 2	251550
Post Insulator Support Stool (see above)	1091010487 sht34	1 or 2	Inc above
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 36	1 or 2	346402
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
Or			
66 kV - 70kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 8	6	251560
Or			

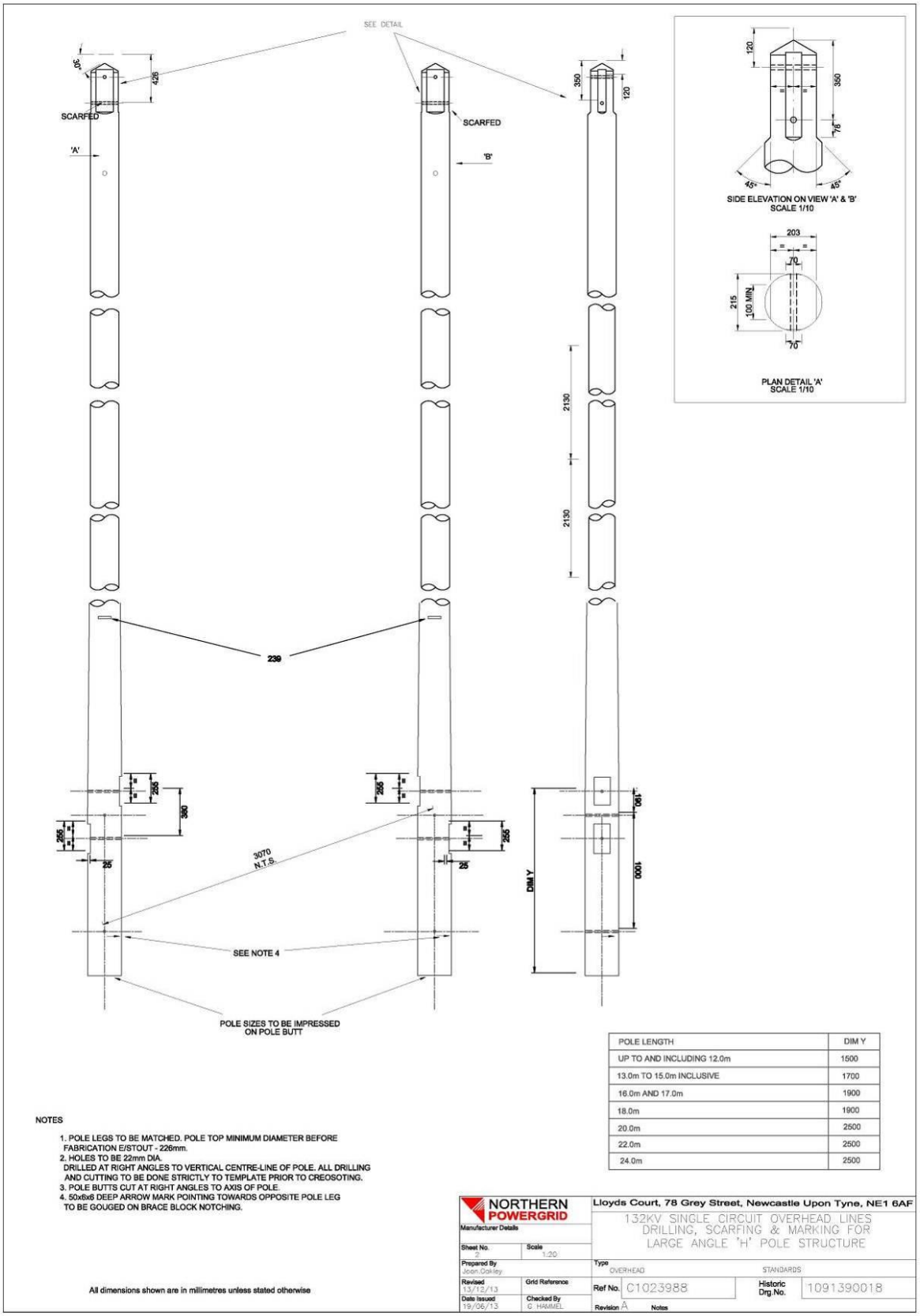
66 kV - 120kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 9	6	251536
33Kv Operation			
33kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 37	1 or 2	346405
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
Stays			
For details on stay requirements see the following detailed stay drawings:			
* For 1 To 3 Stays (1 Per Stay) Refer To Drawing	1 09 101 0429 Sht8		
* For 1 To 3 Stays Refer To Stay Yoke Array Drawing	1 09 101 0675 Sht24		
Earth Materials (Only where required)			
Comp Lug – M22 Hole (70mm PVC Cu)	1091010237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	1091010149/3	1	235548
Earth Rod	1091193143	As Req.	354249
Rod Coupling	1091193143	As Req.	354361
Driving Bolt	1091193143	As Req.	354408
Saddle Clamp	1091193143/2	As Req.	354338
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	1	251362


SEE DIM. 'X'
SCARFE 50 MIN.
154
Ø24
840
Ø24
30°
234 CR.
80 CRS.
Ø24
680 CRS.
80 CRS.
Ø24
55 CR.
HOLES FOR LADDER SYSTEM TO BE DRILLED IN THIS FACE
45° CHAMFER.
ENLARGED VIEWS OF POLE APEX SCALE 1:10
Ø20
NOTE HOLE FOR ENHANCED ANTI CLIMBING DEVICE.
SEE POLE HEIGHT IN TABLE.
2750 MIN.
GROUND LEVEL
POLE PLANTING DEPTH 2400
25
255
25
255
380
SEE DIM. 'Y'
1500 TO DIMENSION 'Y'
SCALE:- 1:20
POLE LENGTH/ CLASS TO BE IMPRESSED ON POLE BUTT.
THIS VIEW SHOWS THE POLE FACE (NATURAL LIE OF POLE).
IMPORTANT NOTE
THE SCARFE IS PARALLEL TO THE POLE EDGE & NOT THE POLE CENTRELINE.
SCARFING TO BE CUT TO GIVE A 50mm WIDE FLAT ON TWO DIAMETRICALLY OPPOSITE FACES WITH ENDS CHAMFERED AS SHOWN.
NOTES
1. CLASS OF POLE TO BE EXTRA STOUT IN ACCORDANCE WITH 1.09.101.0238
2. POLE BUTT TO BE CUT AT RIGHT ANGLES TO AXIS OF POLE.
3. ALL HOLES EXCEPT WHERE STATED OTHERWISE TO BE 24mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRELINE OF POLE. ALL DRILLING & CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREOSOTING.
4. BS 1990 TABULATED MIN VALUES HAVE BEEN AMENDED TO REFLECT CALCULATED MEAN VALUES
POLE LENGTH. (m) | DIM. X'' (mm)
9.0 - 11 INCLUSIVE | 1900
12.0 | 1700
13 - 15 INCLUSIVE. | 1400
16 - 18 INCLUSIVE. | 1100
20 | 500
ITEM | POLE HEIGHT | DIMENSION 'X' (MIN.) | DIMENSION 'Y' (MIN.)
A | 12000mm | 245 | 335
B | 13000mm | 245 | 350
C | 14000mm | 245 | 365
D | 15000mm | 245 | 375
E | 16000mm | 250 | 390
F | 17000mm | 250 | 415
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
DRILLING, SCARFING AND MARKINGS
FOR SINGLE ANGLE POLE ARANGEMENT
Sheet No. 2
Scale AS SHOWN
Prepared By Jan.Best
Type OVERHEAD
STANDARDS
Revised 03/06/15
Grid Reference
Ref No. C1048482
Historic Drg.No. 1091390003
Date Issued 02/07/07
Checked By M. WILSON
Revision G
Notes


17 METRES
16 METRES
15 METRES
14 METRES
13 METRES
12 METRES
A = 2240R
B = 1960
C = 1680
D = 1400
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ADDITIONAL FABRICATION DETAILS FOR THE ATTACHMENT OF THE HCL CLIMBING ACCESS SYSTEM FOR THE FOLLOWING POLE FABRICATIONS 1091390003 S2, 1091390018 S2 & 1091390019 S2
1091390003



ENLARGED SCALE DETAIL 'A'
ENLARGED SCALE DETAIL OF CROSSARM FIXING
ALL DIMENSION SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED



POLE LENGTH	DIM Y
UP TO AND INCLUDING 12.0m	1500
13.0m TO 15.0m INCLUSIVE	1700
16.0m AND 17.0m	1900
18.0m	1900
20.0m	2500
22.0m	2500
24.0m	2500

NOTES

1. POLE LEGS TO BE MATCHED. POLE TOP MINIMUM DIAMETER BEFORE FABRICATION E/STOUT - 226mm.
2. HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE-LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREOSOTING.
3. POLE BUTTS CUT AT RIGHT ANGLES TO AXIS OF POLE.
4. 50x8x6 DEEP ARROW MARK POINTING TOWARDS OPPOSITE POLE LEG TO BE GOUGED ON BRACE BLOCK NOTCHING.

All dimensions shown are in millimetres unless stated otherwise

NORTHERN POWERGRID

Manufacturer Details

Sheet No. 2 | Scale 1:20

Prepared By Joan.Oakley

Revised 13/12/13 | Grid Reference

Date Issued 19/06/13 | Checked By C. HAMMEL

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

132KV SINGLE CIRCUIT OVERHEAD LINES
DRILLING, SCARFING & MARKING FOR
LARGE ANGLE 'H' POLE STRUCTURE

Type OVERHEAD | STANDARDS

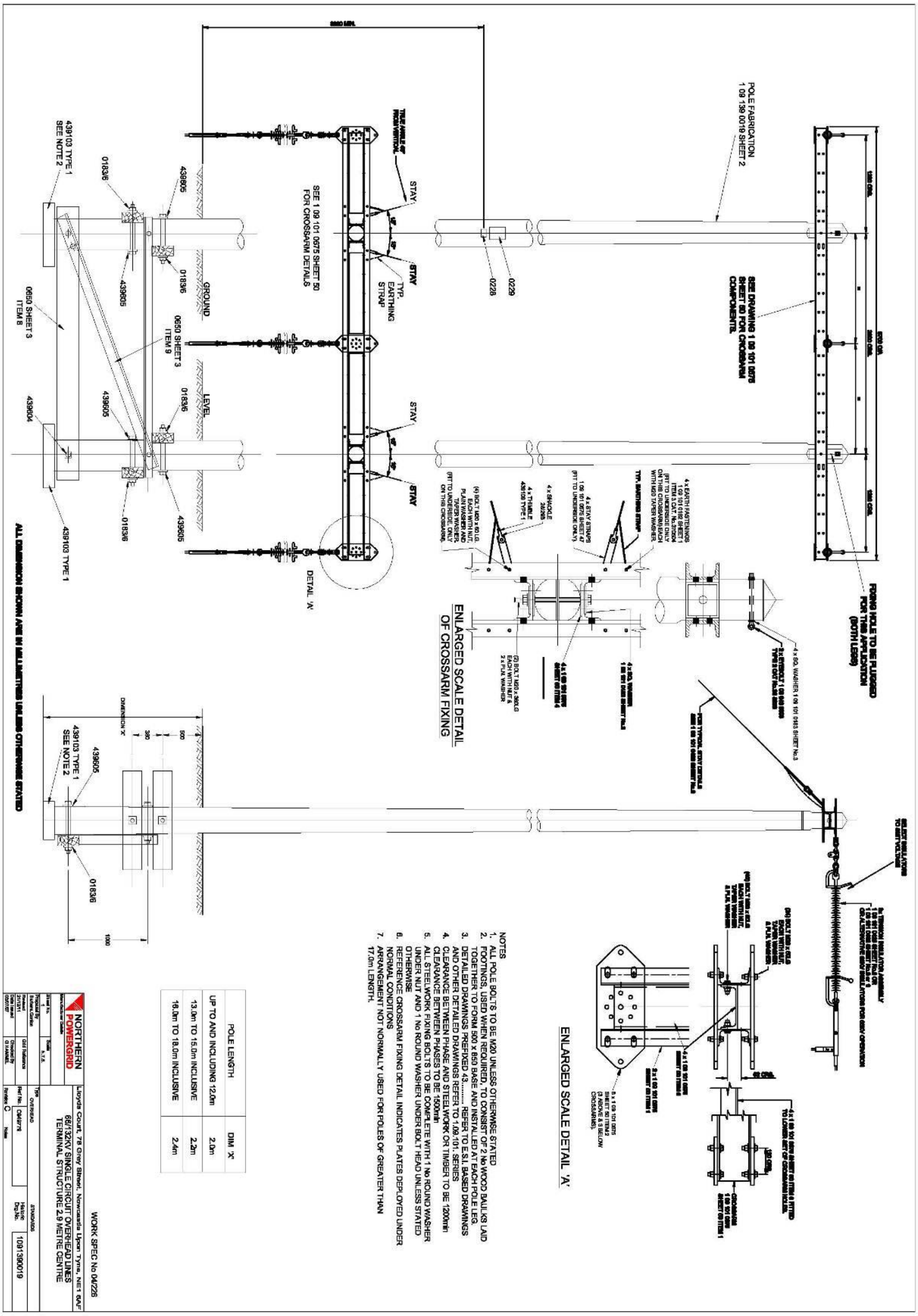
Ref No. C1023988 | Historic Drg.No. 1091390018

Revision A | Notes

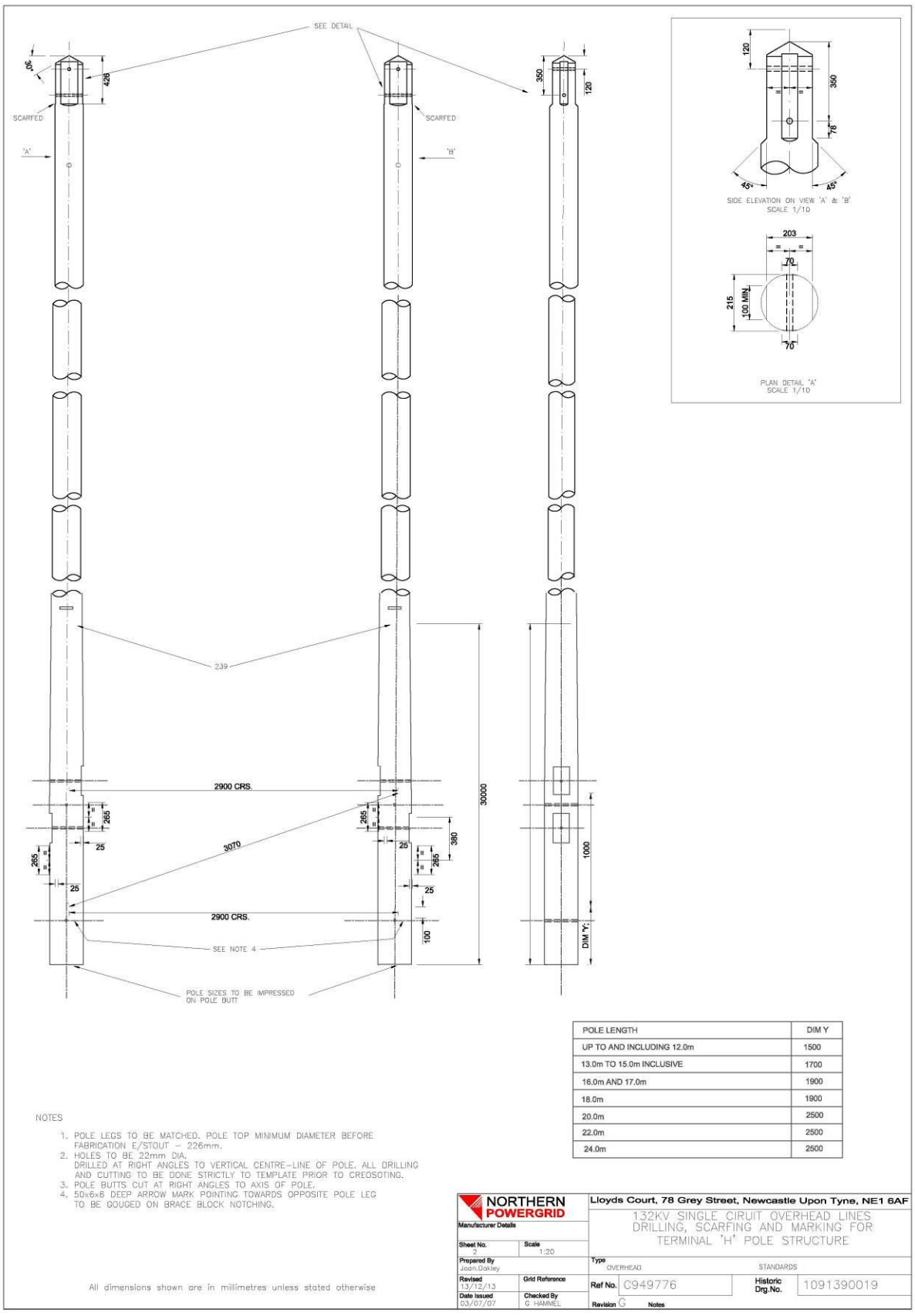
MATERIAL LIST FOR 1 09 139 0018 SHEET No.1(40º - 60º Deviation)

DESCRIPTION	DRAWING NO	QUANTITY	CAT NO
Poles			
12m E Stout H Pole	1 09 139 0018 Sht2	1	234005
13m E Stout H Pole	1 09 139 0018 Sht2	1	234006
14m E Stout H Pole	1 09 139 0018 Sht2	1	234007
15m E Stout H Pole	1 09 139 0018 Sht2	1	234008
16m E Stout H Pole	1 09 139 0018 Sht2	1	234009
17m E Stout H Pole	1 09 139 0018 Sht2	1	234010
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	2	346507
Post Insulator & tension plates	1010675 sht50 item 2	6	346508
Pole Cheek plate	1010675 sht50 item 4	4	252670
Square plate for item 4 - Spacer Plates	1010675 sht50 item 5	8	240739
Crossarm Spacer Channels	1010675 sht50 item 6	4	346510
Bolts, M20 x 400, Galvd		2	372904
Washers, M20, Square Flat, Galvd	1091010183 sht 3 item 6	4	368063
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1	2	368059
Bolts, M20 x 60, Galvd		84	378703
Washers, M20, Tapered, Galvd	0183/4	88	374488
Nuts, M20, Galvd		86	378915
Washers, M20, Round, Galvd		88	375616
Earthing Bolt, M20 x 60, galv	1 09 101 0162 Sht1	4	370504
Conductor Terminations (to suit conductor type)			
Poplar Comp. dead end c/w straight lug	1 09 101 0653 sht 3	6	243240
Helical Deadends and socket Thimbles to suit			To suit
Insulator Assemblies			
132kV Operation			
Post Insulator with 127mm PCD + (Support Stool)	1091010487 sht18	1 or 2	251550
Post Insulator Support Stool (see above)	1091010487 sht34	1 or 2	Inc above
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 36	1 or 2	346402

66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
Or			
66 kV - 70kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 8	6	251560
Or			
66 kV - 120kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 9	6	251536
33Kv Operation			
33kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 37	1 or 2	346405
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
2 Stays per Leg			
45 Degree Stay Strap	1 09 101 0675 Sht 47	4	346504
Bolts, M20 x 60, Galvd		4	378703
Nuts, M20, Galvd		4	378915
Washers, M20, Round, Galvd		8	375616
7/4.00mm Grade 1150 Staywire	-	20	231481
Stay Dead End	1091010541 sht 1	16	255217
Stay thimble	1000439109	16	244922
Type 2 Stay Rod	1000439101	4	231477
Wood Stay Block	1000439103 item 2	4	235124
Barbed wire	-	2	366829
Stay Insulators			
Polymeric Stay Insulator - 132kV Unearthed Poles	1091010372 sht2 item 1	4	251547 or
Polymeric Stay Insulator - 66kV Unearthed Poles	1091010372 sht2 item 2	4	346596 or
Polymeric Stay Insulator - 33kV Unearthed Poles	1000439107 sht 1 item 2	8	253743 and
Stay Link Assembly - 33kV Unearthed poles Only	1000439107 sht 3	4	260183 or
Stay Insulator Earthed – all voltages	1000439107 sht1 item 1	4	248232
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	2	251362



ENLARGED SCALE DETAIL OF CROSSARM FIXING
ENLARGED SCALE DETAIL 'A'
DETAIL 'A'
GROUND
LEVEL
STAY
TYP. EARTHING STRAP
SEE 1 09 101 0675 SHEET 50 FOR CROSSARM DETAILS
POLE FABRICATION 1 09 139 0019 SHEET 2
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
NOTES
1. ALL POLE BOLTS TO BE M20 UNLESS OTHERWISE STATED
2. FOOTINGS, USED WHEN REQUIRED, TO CONSIST OF 2 No WOOD BAULKS LAID TOGETHER TO FORM 500 x 650 BASE AND INSTALLED AT EACH POLE LEG.
3. DETAILED DRAWINGS PREFIXED 43....... REFER TO E.S.I. BASED DRAWINGS AND OTHER DETAILED DRAWINGS REFER TO 1.09.101. SERIES
4. CLEARANCE BETWEEN PHASE AND STEELWORK OR TIMBER TO BE 1200min
5. CLEARANCE BETWEEN PHASES TO BE 1500min
6. ALL STEELWORK FIXING BOLTS TO BE COMPLETE WITH 1 No ROUND WASHER UNDER NUT AND 1 No ROUND WASHER UNDER BOLT HEAD UNLESS STATED OTHERWISE
7. REFERENCE CROSSARM FIXING DETAIL INDICATES PLATES DEPLOYED UNDER NORMAL CONDITIONS
8. ARRANGEMENT NOT NORMALLY USED FOR POLES OF GREATER THAN 17.0m LENGTH.
POLE LENGTH | DIM 'X'
UP TO AND INCLUDING 12.0m | 2.0m
13.0m TO 15.0m INCLUSIVE | 2.2m
16.0m TO 18.0m INCLUSIVE | 2.4m
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132kV SINGLE CIRCUIT OVERHEAD LINES TERMINAL STRUCTURE 2.9 METRE CENTRE
WORK SPEC No 04226
1091390019



POLE LENGTH	DIM Y
UP TO AND INCLUDING 12.0m	1500
13.0m TO 15.0m INCLUSIVE	1700
16.0m AND 17.0m	1900
18.0m	1900
20.0m	2500
22.0m	2500
24.0m	2500

NOTES

1. POLE LEGS TO BE MATCHED. POLE TOP MINIMUM DIAMETER BEFORE FABRICATION E/STOUT – 226mm.
2. HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE-LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREOSOTING.
3. POLE BUTTS CUT AT RIGHT ANGLES TO AXIS OF POLE.
4. 50x6x6 DEEP ARROW MARK POINTING TOWARDS OPPOSITE POLE LEG TO BE GOUGED ON BRACE BLOCK NOTCHING.

All dimensions shown are in millimetres unless stated otherwise

NORTHERN POWERGRID
Manufacturer Details

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

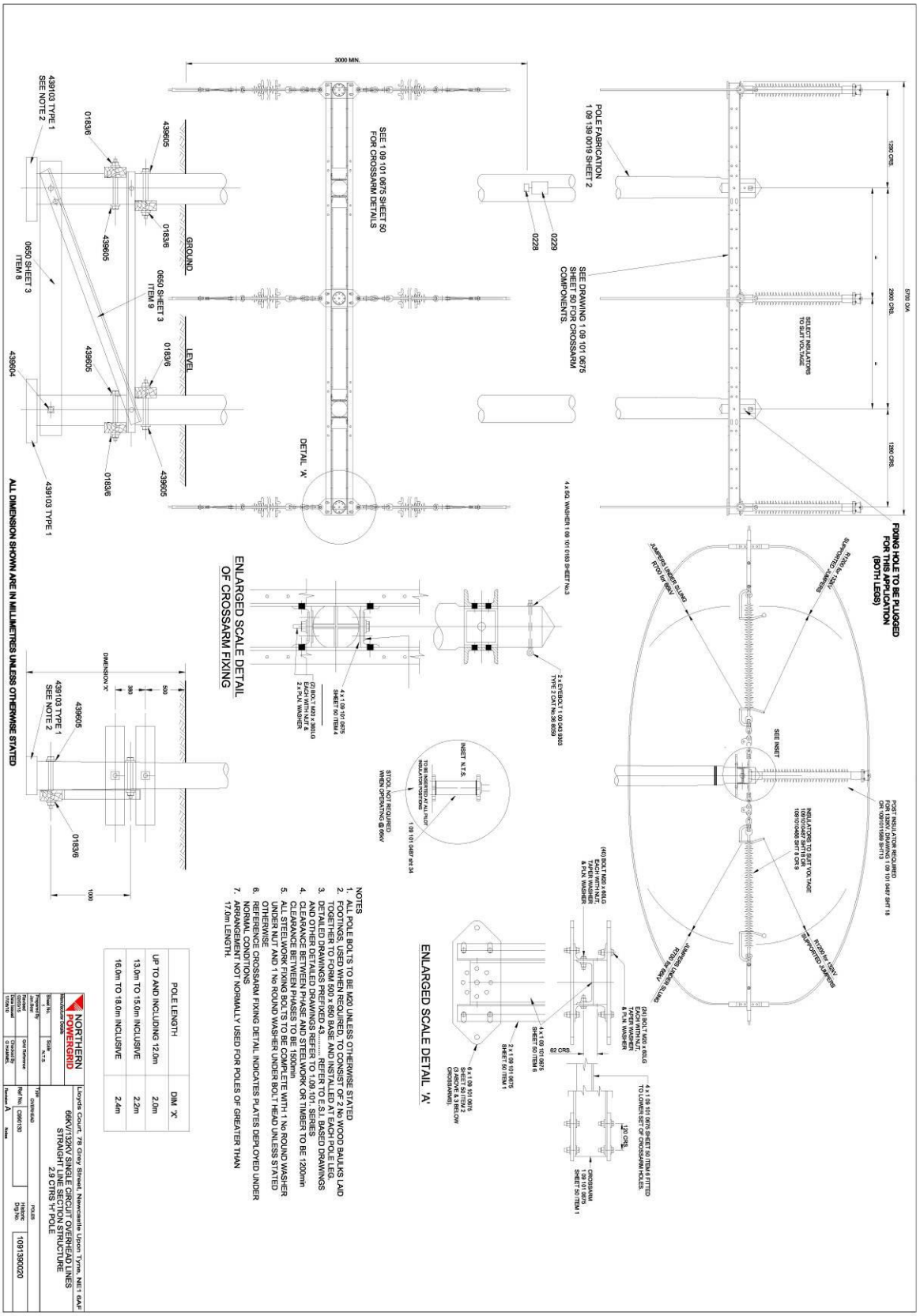
132KV SINGLE CIRUIT OVERHEAD LINES
DRILLING, SCARFING AND MARKING FOR
TERMINAL 'H' POLE STRUCTURE

Sheet No. 2	Scale 1:20	Type OVERHEAD	STANDARDS
Prepared By Joan.Oakley		Ref No. C949776	Historic Drg.No. 1091390019
Revised 13/12/13	Grid Reference	Revision G	Notes
Date Issued 03/07/07	Checked By G HAMMEL		

MATERIAL LIST FOR 1 09 139 0019 SHEET No.1(Terminal H)

DESCRIPTION	DRAWING NO	QUANTITY	CAT NO
Poles			
12m E Stout H Pole	1 09 139 0019 Sht2	1	234005
13m E Stout H Pole	1 09 139 0019 Sht2	1	234006
14m E Stout H Pole	1 09 139 0019 Sht2	1	234007
15m E Stout H Pole	1 09 139 0019 Sht2	1	234008
16m E Stout H Pole	1 09 139 0019 Sht2	1	234009
17m E Stout H Pole	1 09 139 0019 Sht2	1	234010
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	2	346507
Post Insulator & tension plates	1010675 sht50 item 2	6	346508
Pole Cheek plate	1010675 sht50 item 4	4	252670
Square plate for item 4 - Spacer Plates	1010675 sht50 item 5	8	240739
Crossarm Spacer Channels	1010675 sht50 item 6	4	346510
Bolts, M20 x 400, Galvd		2	372904
Washers, M20, Square Flat, Galvd	1091010183 sht 3 item 6	4	368063
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1	2	368059
Bolts, M20 x 60, Galvd		84	378703
Washers, M20, Tapered, Galvd	0183/4	88	374488
Nuts, M20, Galvd		86	378915
Washers, M20, Round, Galvd		88	375616
Earthing Bolt, M20 x 60, galv	1 09 101 0162 Sht1	4	370504
Conductor Terminations (to suit conductor type)			
Poplar Comp. dead end c/w straight lug	1 09 101 0653 sht 3	3	243240
Helical Deadends and socket Thimbles to suit		3	To suit
Insulator Assemblies			
132kV Operation			
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
66kV Operation			
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
33Kv Operation			
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			

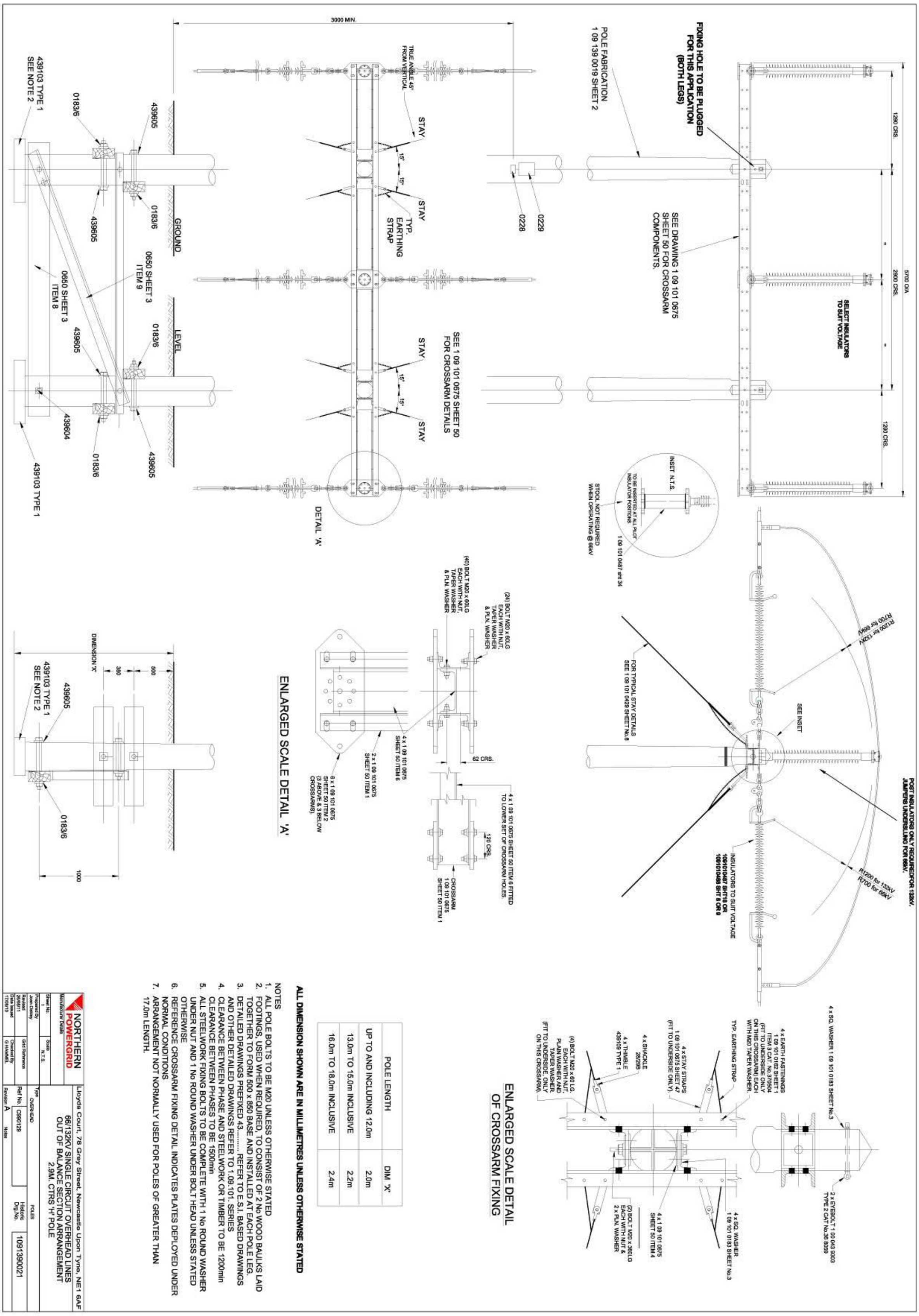
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
2 Stays per Leg			
45 Degree Stay Strap	1 09 101 0675 Sht 47	4	346504
Bolts, M20 x 60, Galvd		4	378703
Nuts, M20, Galvd		4	378915
Washers, M20, Round, Galvd		8	375616
7/4.00mm Grade 1150 Staywire	-	20	231481
Stay Dead End	1091010541 sht 1	16	255217
Stay thimble	1000439109	16	244922
Type 2 Stay Rod	1000439101	4	231477
Wood Stay Block	1000439103 item 2	4	235124
Barbed wire	-	2	366829
Stay Insulators			
Polymeric Stay Insulator - 132kV Unearthed Poles	1091010372 sht2 item 1	4	251547 or
Polymeric Stay Insulator - 66kV Unearthed Poles	1091010372 sht2 item 2	4	346596 or
Polymeric Stay Insulator - 33kV Unearthed Poles	1000439107 sht 1 item 2	8	253743 and
Stay Link Assembly - 33kV Unearthed poles Only	1000439107 sht 3	4	260183 or
Stay Insulator Earthed – all voltages	1000439107 sht1 item 1	8	248232
Earth Materials (Only where required)			
Comp Lug – M22 Hole (70mm PVC Cu)	1091010237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	1091010149/3	1	235548
Earth Rod	1091193143	As Req.	354249
Rod Coupling	1091193143	As Req.	354361
Driving Bolt	1091193143	As Req.	354408
Saddle Clamp	1091193143/2	As Req.	354338
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	2	251362


ALL DIMENSION SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
DETAIL 'A'
ENLARGED SCALE DETAIL OF CROSSARM FIXING
ENLARGED SCALE DETAIL 'A'
FIXING HOLE TO BE PLUGGED FOR THIS APPLICATION (BOTH LEGS)
NOTES
1. ALL POLE BOLTS TO BE M20 UNLESS OTHERWISE STATED
2. FOOTSTEPS SHALL NOT BE REQUIRED ON WOOD BAULKS LAID TOGETHER TO FORM 500 x 850 BASE AND INSTALLED AT EACH POLE LEG.
3. DETAILED DRAWINGS PREFIXED 43..... REFER TO E.S.L. BASED DRAWINGS AND OTHER DETAILED DRAWINGS REFER TO 1.09.101. SERIES
4. CLEARANCE BETWEEN PHASE AND STEELWORK OR TIMBER TO BE 1200mm CLEARANCE BETWEEN PHASES TO BE 1500mm
5. ALL STEELWORK FIXING BOLTS TO BE COMPLETE WITH 1 No ROUND WASHER UNDER BOLT AND 1 No ROUND WASHER UNDER BOLT HEAD UNLESS STATED OTHERWISE
6. REFERENCE CROSSARM FIXING DETAIL INDICATES PLATES DEPLOYED UNDER NORMAL CONDITIONS
7. ARRANGEMENT NOT NORMALLY USED FOR POLES OF GREATER THAN 17.0m LENGTH.
POLE LENGTH / DIM 'X'
UP TO AND INCLUDING 12.0m / 2.0m
13.0m TO 15.0m INCLUSIVE / 2.2m
16.0m TO 18.0m INCLUSIVE / 2.4m
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66KV/132KV SINGLE CIRCUIT OVERHEAD LINES
STRAIGHT LINE SECTION STRUCTURE
2.9 CTRS 'H' POLE
1091380020

MATERIAL LIST FOR 1 09 139 0020 SHEET No.1 (H – Line Section Structure)

	DRAWING NO	QUANTITY	CAT NO
Poles			
12m E Stout H Pole	1 09 139 0019 Sht2	1	234005
13m E Stout H Pole	1 09 139 0019 Sht2	1	234006
14m E Stout H Pole	1 09 139 0019 Sht2	1	234007
15m E Stout H Pole	1 09 139 0019 Sht2	1	234008
16m E Stout H Pole	1 09 139 0019 Sht2	1	234009
17m E Stout H Pole	1 09 139 0019 Sht2	1	234010
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	2	346507
Post Insulator & tension plates	1010675 sht50 item 2	6	346508
Pole Cheek plate	1010675 sht50 item 4	4	252670
Square plate for item 4 - Spacer Plates	1010675 sht50 item 5	8	240739
Crossarm Spacer Channels	1010675 sht50 item 6	4	346510
Bolts, M20 x 400, Galvd		2	372904
Washers, M20, Square Flat, Galvd	1091010183 sht 3 item 6	4	368063
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1	2	368059
Bolts, M20 x 60, Galvd		84	378703
Washers, M20, Tapered, Galvd	0183/4	88	374488
Nuts, M20, Galvd		86	378915
Washers, M20, Round, Galvd		88	375616
Earthing Bolt, M20 x 60, galv	1 09 101 0162 Sht1	4	370504
Insulator & Conductor Termination Assemblies			
132kV Operation			
Post Insulator with 127mm PCD + (Support Stool)	1091010487 sht18	1 or 2	251550
Post Insulator Support Stool (see above)	1091010487 sht34	1 or 2	Inc above
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 36	1 or 2	346402
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
Or			

66 kV - 70kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 8	6	251560
Or			
66 kV - 120kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 9	6	251536
33Kv Operation			
33kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 37	1 or 2	346405
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	2	363318
Fibre Washer, 14mm dia x 6mm thick		10	374581
Fibre Washer, 14mm dia x 2mm thick	-	10	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	10	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
Earth Materials **(Earthed or Approach Poles Only)**			
Comp Lug – M22 Hole (70mm PVC Cu)	1091010237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	1091010149/3	1	235548
Earth Rod	1091193143	As Req.	354249
Rod Coupling	1091193143	As Req.	354361
Driving Bolt	1091193143	As Req.	354408
Saddle Clamp	1091193143/2	As Req.	354338
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	2	251362


3000 MIN.
POLE FABRICATION 1 09 139 0019 SHEET 2
FIXING HOLE TO BE PLUGGED FOR THIS APPLICATION (BOTH LEGS)
SEE DRAWING 1 09 101 0675 SHEET 50 FOR CROSSARM COMPONENTS.
SEE 1 09 101 0675 SHEET 50 FOR CROSSARM DETAILS
SELECT INSULATORS TO SUIT VOLTAGE
STAY
TYP. EARTHING STRAP
DETAIL 'A'
GROUND
LEVEL
439103 TYPE 1 SEE NOTE 2
ENLARGED SCALE DETAIL 'A'
ENLARGED SCALE DETAIL OF CROSSARM FIXING
ALL DIMENSION SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
POLE LENGTH | DIM 'X'
UP TO AND INCLUDING 12.0m | 2.0m
13.0m TO 15.0m INCLUSIVE | 2.2m
16.0m TO 18.0m INCLUSIVE | 2.4m
NOTES
1. ALL POLE BOLTS TO BE M20 UNLESS OTHERWISE STATED
2. FOOTINGS, USED WHEN REQUIRED, TO CONSIST OF 2 No WOOD BAULKS LAID TOGETHER TO FORM 500 x 850 BASE AND INSTALLED AT EACH POLE LEG.
3. DETAILED DRAWINGS PREFIXED 43...... REFER TO E.S.I. BASED DRAWINGS AND OTHER DETAILED DRAWINGS REFER TO 1.09.101. SERIES
4. CLEARANCE BETWEEN PHASE AND STEELWORK OR TIMBER TO BE 1200min CLEARANCE BETWEEN PHASES TO BE 1500min
5. ALL STEELWORK FIXING BOLTS TO BE COMPLETE WITH 1 No ROUND WASHER UNDER NUT AND 1 No ROUND WASHER UNDER BOLT HEAD UNLESS STATED OTHERWISE
6. REFERENCE CROSSARM FIXING DETAIL INDICATES PLATES DEPLOYED UNDER NORMAL CONDITIONS
7. ARRANGEMENT NOT NORMALLY USED FOR POLES OF GREATER THAN 17.0m LENGTH.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV SINGLE CIRCUIT OVERHEAD LINES OUT OF BALANCE SECTION ARRANGEMENT 2.9M. CTRS 'H' POLE
1091390021

MATERIAL LIST FOR 1 09 139 0021 SHEET No.1 (Out of Balance Sect.Structure)

	DRAWING NO	QUANTITY	CAT NO
Poles			
12m E Stout H Pole	1 09 139 0019 Sht2	1	234005
13m E Stout H Pole	1 09 139 0019 Sht2	1	234006
14m E Stout H Pole	1 09 139 0019 Sht2	1	234007
15m E Stout H Pole	1 09 139 0019 Sht2	1	234008
16m E Stout H Pole	1 09 139 0019 Sht2	1	234009
17m E Stout H Pole	1 09 139 0019 Sht2	1	234010
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	2	346507
Post Insulator & tension plates	1010675 sht50 item 2	6	346508
Pole Cheek plate	1010675 sht50 item 4	4	252670
Square plate for item 4 - Spacer Plates	1010675 sht50 item 5	8	240739
Crossarm Spacer Channels	1010675 sht50 item 6	4	346510
Bolts, M20 x 400, Galvd		2	372904
Washers, M20, Square Flat, Galvd	1091010183 sht 3 item 6	4	368063
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1	2	368059
Bolts, M20 x 60, Galvd		84	378703
Washers, M20, Tapered, Galvd	0183/4	88	374488
Nuts, M20, Galvd		86	378915
Washers, M20, Round, Galvd		88	375616
Earthing Bolt, M20 x 60, galv	1 09 101 0162 Sht1	4	370504
Insulator & Conductor Termination Assemblies			
132kV Operation			
Post Insulator with 127mm PCD + (Support Stool)	1091010487 sht18	1 or 2	251550
Insulator Trunnion Clamp – to suit conductor diameter		3	To suit
Post Insulator Support Stool (see above)	1091010487 sht34	1 or 2	Inc above
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 sht 31 or	6	251553
Or			
120kn Ten. Ins. Assembly (132kV normal)	1 09 101 0487 sht 30	6	251552
66kV Operation			
66kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 36	1 or 2	346402
Insulator Trunnion Clamp – to suit conductor diameter		3	To suit
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	6	251559
Or			

66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	6	251539
Or			
66 kV - 70kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 8	6	251560
Or			
66 kV - 120kN Tension Insulator Assembly c/w arcing horns (Normal)	1091010488 sht 9	6	251536
33Kv Operation			
33kV Post Insulator with 127mm PCD Flange Base (all situations)	1091010487 sht 37	1 or 2	346405
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	6	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	6	251546
Signs & Numbers			
Safety Sign	1091010229	2	363318
Fibre Washer, 14mm dia x 6mm thick		10	374581
Fibre Washer, 14mm dia x 2mm thick	-	10	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	10	371738
Number Base plate	1091010228 sht 3	1	243258
Pole Numbers	1091010228 sht 3	To Suit	-
Stays			
40 Degree Stay Strap	1 09 101 0675 Sht 48	8	346506
Bolts, M20 x 60, Galvd		8	378703
Nuts, M20, Galvd		8	378915
Washers, M20, Round, Galvd		16	375616
7/4.00mm Grade 1150 Staywire	-	40	231481
Stay Dead End	1091010541 sht 1	32	255217
Stay thimble	1000439109	32	244922
Type 2 Stay Rod	1000439101	8	231477
Wood Stay Block	1000439103 item 2	8	235124
Barbed wire	-	4	366829
Stay Insulators			
Polymeric Stay Insulator - 132kV Unearthed Poles	1091010372 sht2 item 1	8	251547 or
Polymeric Stay Insulator - 66kV Unearthed Poles	1091010372 sht2 item 2	8	346596 or
Polymeric Stay Insulator - 33kV Unearthed Poles	1000439107 sht 1 item 2	16	253743 and
Stay Link Assembly - 33kV Unearthed poles Only	1000439107 sht 3	8	260183 or
Stay Insulator Earthed – all voltages	1000439107 sht1 item 1	8	248232
ACD where required			
Enhanced Anti-Climbing Device	1 09 101 0408 Sht 8	2	251362

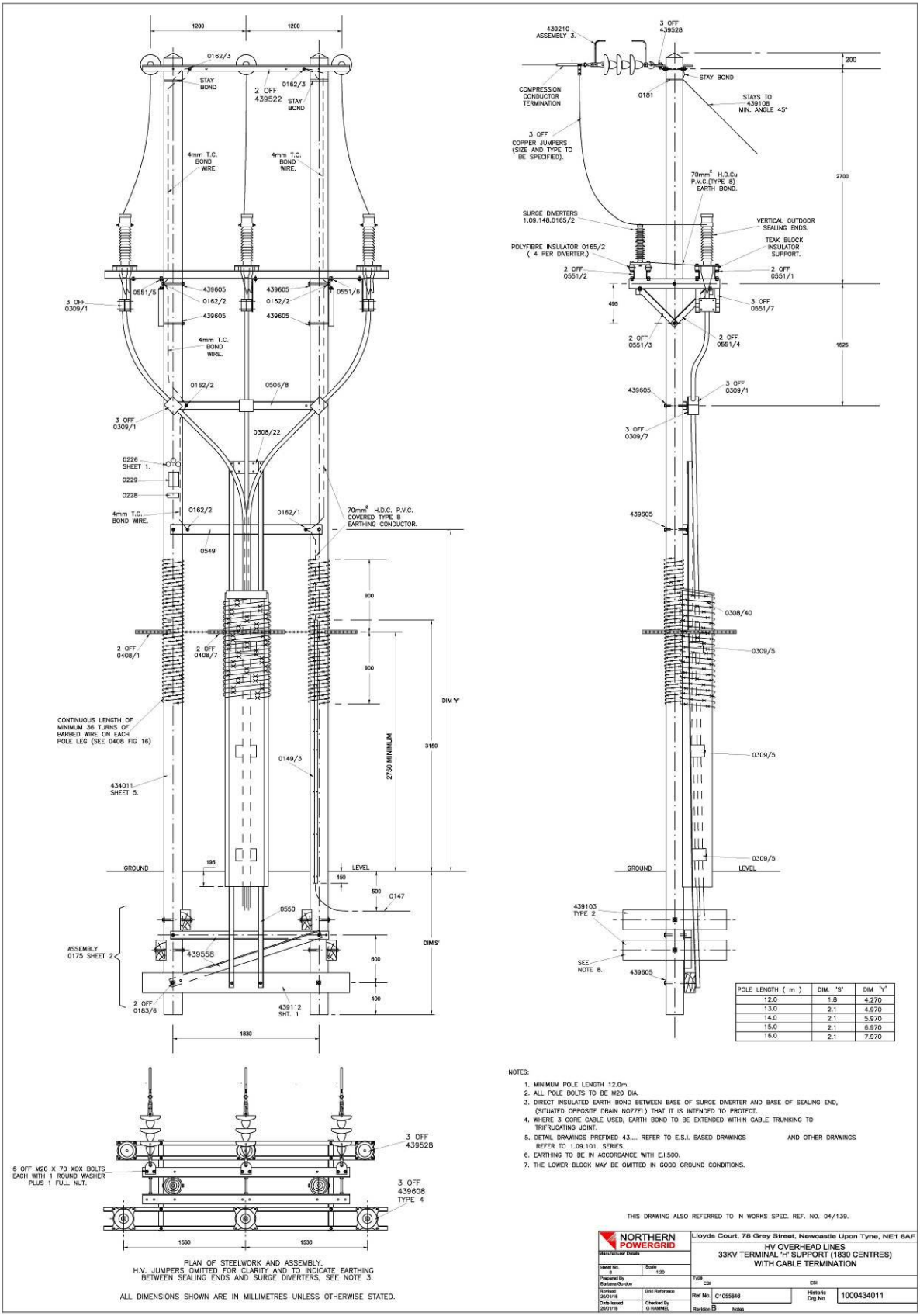
Cable Termination Structures

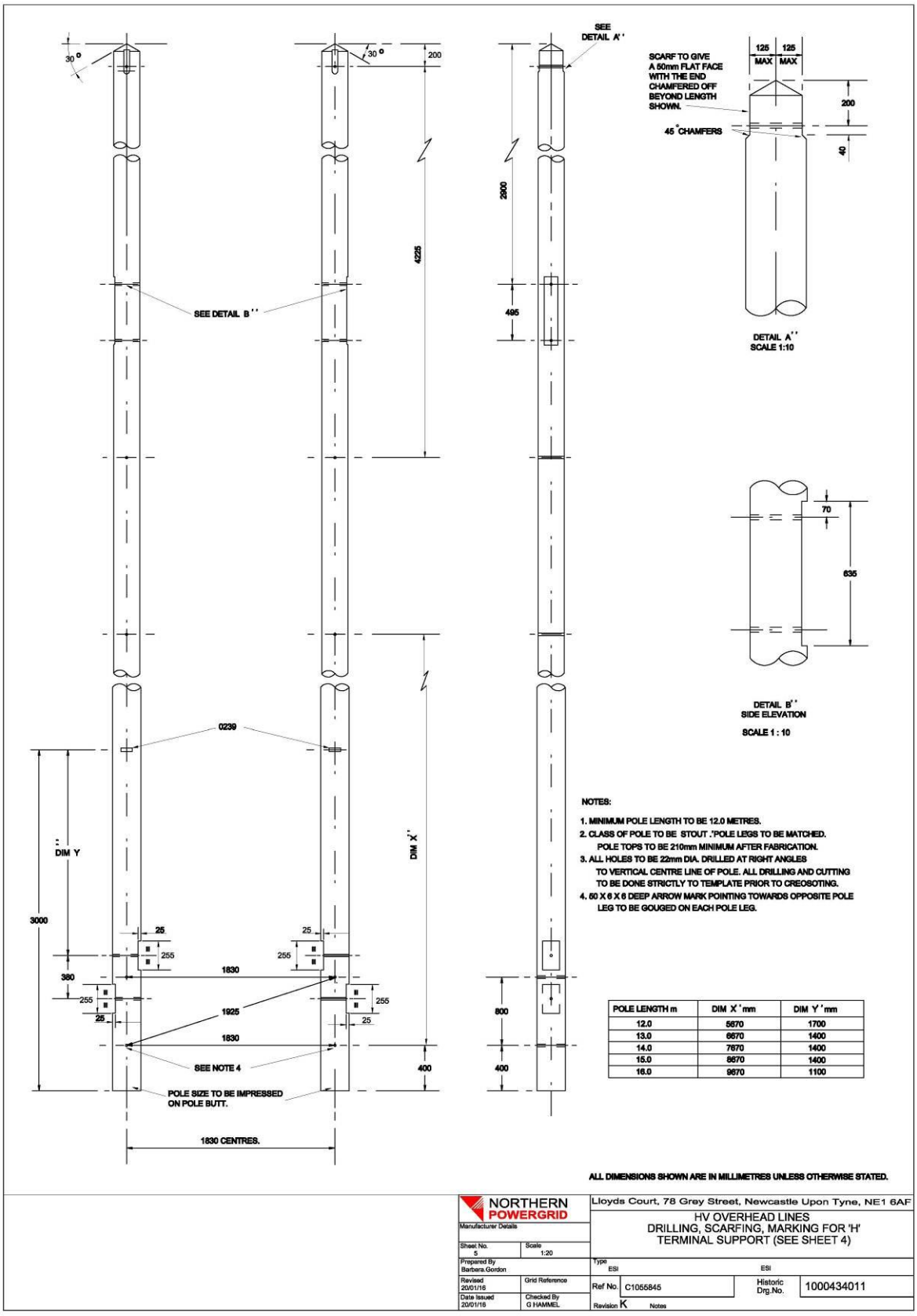
33kV Cable terminations may be provided using one of the following arrangement drawings with each arrangement increasing in capability and cost:-

- Drawing 1000434011 sht 8 – Spanning and tensions restrictions will apply due to the 1.2m phase spacing and 23kN tension Limit.
- Drawing 1091231173 sht 9 – No spanning or tension limitations apply but max cable CSA limited to 400mm2 Cu XLPE Single cores
  Drawing 1091231173 sht 4 - No restrictions apply.

66kV Cable Terminations shall be provided in accordance with 1091231173 sht 4, no restrictions apply

132kV Cable Terminations shall be provided in accordance with the drawing and material lists shown in ENA TS 43-50 fig 12 and the poles fabricated in accordance with figs 4 & 5, no restrictions apply.


1200
1200
0162/3
STAY BOND
2 OFF 439522
4mm T.C. BOND WIRE.
3 OFF 0309/1
0551/5
439605
0162/2
0551/6
0506/8
0308/22
0226 SHEET 1.
0229
0228
0162/1
70mm² H.D.C. P.V.C. COVERED TYPE B EARTHING CONDUCTOR.
0549
900
2 OFF 0408/1
2 OFF 0408/7
DIM 'Y'
CONTINUOUS LENGTH OF MINIMUM 36 TURNS OF BARBED WIRE ON EACH POLE LEG (SEE 0408 FIG 16)
2750 MINIMUM
3150
0149/3
434011 SHEET 5.
GROUND
LEVEL
195
150
500
0147
0550
DIMS'
ASSEMBLY 0175 SHEET 2
439558
600
400
2 OFF 0183/6
439112 SHT. 1
1830
439210 ASSEMBLY 3.
3 OFF 439528
200
COMPRESSION CONDUCTOR TERMINATION
0181
STAYS TO 439108 MIN. ANGLE 45°
3 OFF COPPER JUMPERS (SIZE AND TYPE TO BE SPECIFIED).
70mm² H.D.Cu P.V.C.(TYPE B) EARTH BOND.
2700
SURGE DIVERTERS 1.09.148.0165/2
VERTICAL OUTDOOR SEALING ENDS.
POLYFIBRE INSULATOR 0165/2 (4 PER DIVERTER)
TEAK BLOCK INSULATOR SUPPORT.
2 OFF 0551/2
2 OFF 0551/1
495
3 OFF 0551/7
2 OFF 0551/3
2 OFF 0551/4
1625
3 OFF 0309/1
3 OFF 0309/7
0308/40
0309/5
439103 TYPE 2
SEE NOTE 8.
6 OFF M20 X 70 XOX BOLTS EACH WITH 1 ROUND WASHER PLUS 1 FULL NUT.
3 OFF 439528
3 OFF 439608 TYPE 4
1530
1530
PLAN OF STEELWORK AND ASSEMBLY.
H.V. JUMPERS OMITTED FOR CLARITY AND TO INDICATE EARTHING BETWEEN SEALING ENDS AND SURGE DIVERTERS, SEE NOTE 3.
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
NOTES:
1. MINIMUM POLE LENGTH 12.0m.
2. ALL POLE BOLTS TO BE M20 DIA.
3. DIRECT INSULATED EARTH BOND BETWEEN BASE OF SURGE DIVERTER AND BASE OF SEALING END, (SITUATED OPPOSITE DRAIN NOZZEL) THAT IT IS INTENDED TO PROTECT.
4. WHERE 3 CORE CABLE USED, EARTH BOND TO BE EXTENDED WITHIN CABLE TRUNKING TO TRIFRUCATING JOINT.
5. DETAIL DRAWINGS PREFIXED 43.... REFER TO E.S.I. BASED DRAWINGS AND OTHER DRAWINGS REFER TO 1.09.101. SERIES.
6. EARTHING TO BE IN ACCORDANCE WITH E.I.500.
7. THE LOWER BLOCK MAY BE OMITTED IN GOOD GROUND CONDITIONS.
POLE LENGTH (m) | DIM. 'S' | DIM 'Y'
12.0 | 1.8 | 4.270
13.0 | 2.1 | 4.970
14.0 | 2.1 | 5.970
15.0 | 2.1 | 6.970
16.0 | 2.1 | 7.970
THIS DRAWING ALSO REFERRED TO IN WORKS SPEC. REF. NO. 04/139.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
HV OVERHEAD LINES
33KV TERMINAL 'H' SUPPORT (1830 CENTRES)
WITH CABLE TERMINATION
Ref No. C1055846
Historic Drg.No. 1000434011

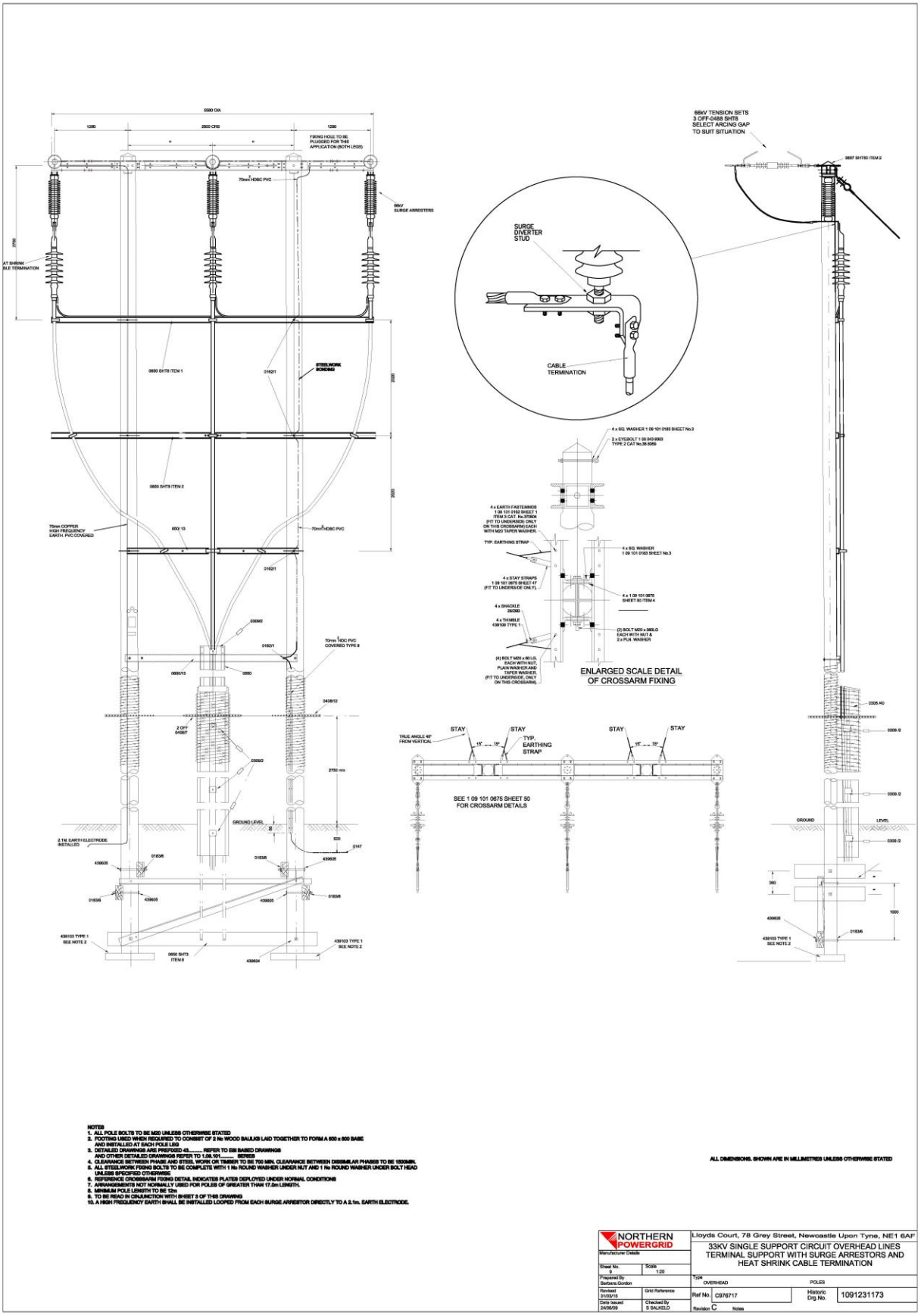


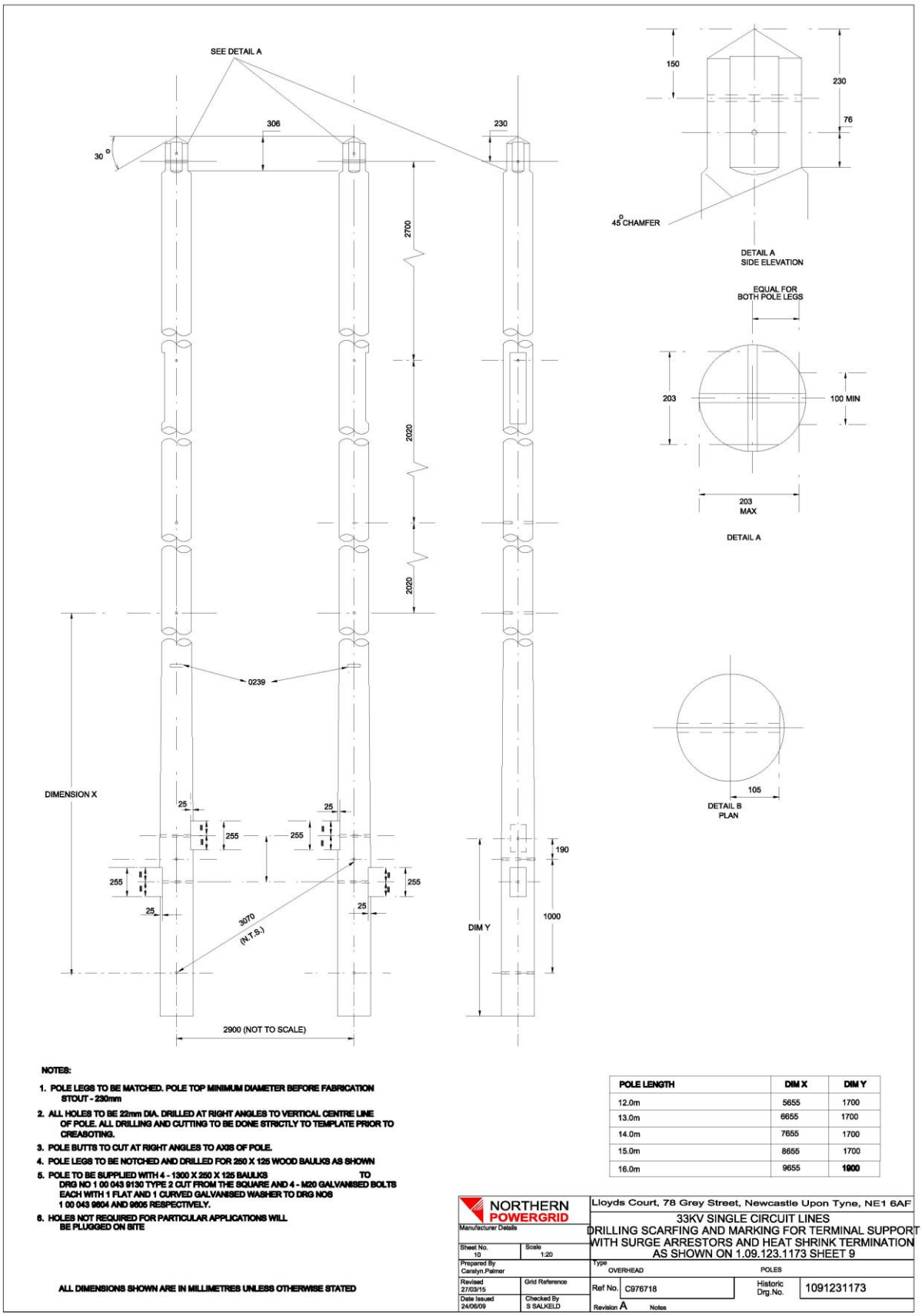
POLE LENGTH m	DIM X'' mm	DIM Y'' mm
12.0	5670	1700
13.0	6670	1400
14.0	7670	1400
15.0	8670	1400
16.0	9670	1100

Material List for 1000434011 sht 8

COMPONENT	DRAWING No.	QUANTITY	CAT NO
Wood 'H' Pole	434002 Sht 5	1	As rqd
Wood Blocks +	439103 Type 2	4	235124
Wood Brace Block	439112 Sht 1	1	234668
Foundation Braces	439558	2	254657
Bolts, M20 x 530, Galvd (Stout)	-	8	372815
Washers, M20, Square, Flat Galvd	0183/6	5	368063
Washers, M20, Square, Curved, Galvd	439605	8	368078
Steelwork			
Crossarm Members	439522	2	237577
Terminating Plate	439528	3	237596
Bolts, M20 x 60, Galvd, Earthing	0162/3	2	370504
Bolts, M20 x 70, Galvd	-	6	373911
Bolts, M20 x 300	-	6	378794
Tie Rods, M20 x 330, Galvd	439608/3	4	375828
Nuts, M20, Galvd	-	6	378915
Washers, M20, Round, Galvd	-	16	375616
Washers, M20, Square, Curved, Galvd	439605	8	368078
Insulators			
90kV rating Pin Insulator (33kV)	0486/4	3	253423
Pilot Pin Ø	0619/1	3	261909
Distribution Ties (see Work Spec 04/043)	0660	3	As rqd
Tension Set Assemblies comprising:		**33 kV**	
70kN - 33kV Composite Tension Insulator 420mm spacing 16mm, ball/skt fittings	0487/23	3	216150
Assembly 1091010488 sht8 arrangement 2		3	
70kN socket Tongue	0449	3	250779
70kN ball ended clevis	0456	3	248586
Ball Ended Hook	0454	3	253071
Preformed Termination *	0425	3	As rqd
Socket Thimble *	0426/1 or 3	3	264682
OR			
70kN - 33kV Composite Tension Insulator 420mm spacing 16mm, ball/skt fittings	0487/23	3	216150
Assembly 1091010488 sht8 arrangement 1			
Ball Ended Hook	0454	3	253071
70kN socket Tongue	0449	3	250779
70kN ball ended clevis	0456	3	248586
Socket ended compression dead end	0102 sht 9	3	As rqd
Jumper Lug *	0102/9	3	As rqd
OR			
125kN - 33kV Composite Tension Insulator 534mm spacing, 20mm Ball/Skt fittings	tba	3	251546
Assembly 1091010488 sht 9			

COMPONENT	DRAWING No.	QUANTITY	CAT NO
125kN Ball Ended Eyelink	0462	3	224253
125kN shackle (ye special)	0443 sht3	3	264216
125kN socket Tongue	0465	3	241002
Clevis ended Compression Termination	0102/9	3	As rqd
Jumper Lug *	0102/9	3	As rqd
Signs & Notices			
Notices (see Work Specs 04/055 & 04/056)	-	As spec'd	-
Safety Sign	-	1	363318
Fibre Washer 9/16 in dia x 1/4 thick		6	374581
Fibre Washer 9/16 in dia x 1/16 thick		6	374577
Screws 1 in x No 8 brass		6	375777
OR			
Screw Nails, Hardened			
B2P 2 in x 10 G		2	371738
Stays			
40 Degree Stay Strap	1 09 101 0675 Sht 48	4	346506
Bolts, M20 x 60, Galvd		4	378703
Nuts, M20, Galvd		4	378915
Washers, M20, Round, Galvd		8	375616
7/4.00mm Grade 1150 Staywire	-	20	231481
Stay Dead End	1091010541 sht 1	16	255217
Stay thimble	1000439109	16	244922
Type 2 Stay Rod	1000439101	4	231477
Wood Stay Block	1000439103 item 2	4	235124
Barbed wire	-	2	366829
Stay Insulators			
Stay Insulator Earthed	1000439107 sht 1 item 1	4	248232
Wood Plugs 24 mm x 75 mm Long	0247/3	8	263073


SURGE DIVERTER STUD
CABLE TERMINATION
ENLARGED SCALE DETAIL OF CROSSARM FIXING
STAY
TYP. EARTHING STRAP
SEE 1 09 101 0675 SHEET 50 FOR CROSSARM DETAILS
NOTES
1. ALL POLE BOLTS TO BE M20 UNLESS OTHERWISE STATED
2. FOOTING USED WHEN REQUIRED TO CONSIST OF 2 No WOOD BAULKS LAID TOGETHER TO FORM A 600 x 600 BASE AND INSTALLED AT EACH POLE LEG
3. DETAILED DRAWINGS ARE PREFIXED 43..... REFER TO ESI BASED DRAWINGS AND OTHER DETAILED DRAWINGS REFER TO 1.09.101..... SERIES
4. CLEARANCE BETWEEN PHASE AND STEEL WORK OR TIMBER TO BE 700 MIN. CLEARANCE BETWEEN DISSIMILAR PHASES TO BE 1800MM.
5. ALL STEELWORK FIXING BOLTS TO BE COMPLETE WITH 1 No ROUND WASHER UNDER NUT AND 1 No ROUND WASHER UNDER BOLT HEAD UNLESS SPECIFIED OTHERWISE
6. REFERENCE CROSSARM FIXING DETAIL INDICATES PLATES DEPLOYED UNDER NORMAL CONDITIONS
7. ARRANGEMENTS NOT NORMALLY USED FOR POLES OF GREATER THAN 17.0m LENGTH.
8. MINIMUM POLE LENGTH TO BE 12m
9. TO BE READ IN CONJUNCTION WITH SHEET 3 OF THIS DRAWING
10. A HIGH FREQUENCY EARTH SHALL BE INSTALLED LOOPED FROM EACH SURGE ARRESTOR DIRECTLY TO A 2.1m. EARTH ELECTRODE.
ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33KV SINGLE SUPPORT CIRCUIT OVERHEAD LINES TERMINAL SUPPORT WITH SURGE ARRESTORS AND HEAT SHRINK CABLE TERMINATION
Ref No. C976717
Drg.No. 1091231173
Revision C



NOTES:

1. POLE LEGS TO BE MATCHED. POLE TOP MINIMUM DIAMETER BEFORE FABRICATION STOUT - 230mm
2. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREASOTING.
3. POLE BUTTS TO CUT AT RIGHT ANGLES TO AXIS OF POLE.
4. POLE LEGS TO BE NOTCHED AND DRILLED FOR 250 X 125 WOOD BAULKS AS SHOWN
5. POLE TO BE SUPPLIED WITH 4 - 1300 X 250 X 125 BAULKS TO DRG NO 1 00 043 9130 TYPE 2 CUT FROM THE SQUARE AND 4 - M20 GALVANISED BOLTS EACH WITH 1 FLAT AND 1 CURVED GALVANISED WASHER TO DRG NOS 1 00 043 9604 AND 9605 RESPECTIVELY.
6. HOLES NOT REQUIRED FOR PARTICULAR APPLICATIONS WILL BE PLUGGED ON SITE

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

POLE LENGTH	DIM X	DIM Y
12.0m	5655	1700
13.0m	6655	1700
14.0m	7655	1700
15.0m	8655	1700
16.0m	9655	1900

NORTHERN POWERGRID
Manufacturer Details

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

33KV SINGLE CIRCUIT LINES
DRILLING SCARFING AND MARKING FOR TERMINAL SUPPORT WITH SURGE ARRESTORS AND HEAT SHRINK TERMINATION AS SHOWN ON 1.09.123.1173 SHEET 9

Sheet No. 10 | Scale 1:20
Prepared By Carolyn.Palmer
Type OVERHEAD POLES
Revised 27/03/15 | Grid Reference
Date Issued 24/06/09 | Checked By S SALKELD
Ref No. C976718 | Historic Drg.No. 1091231173
Revision A Notes

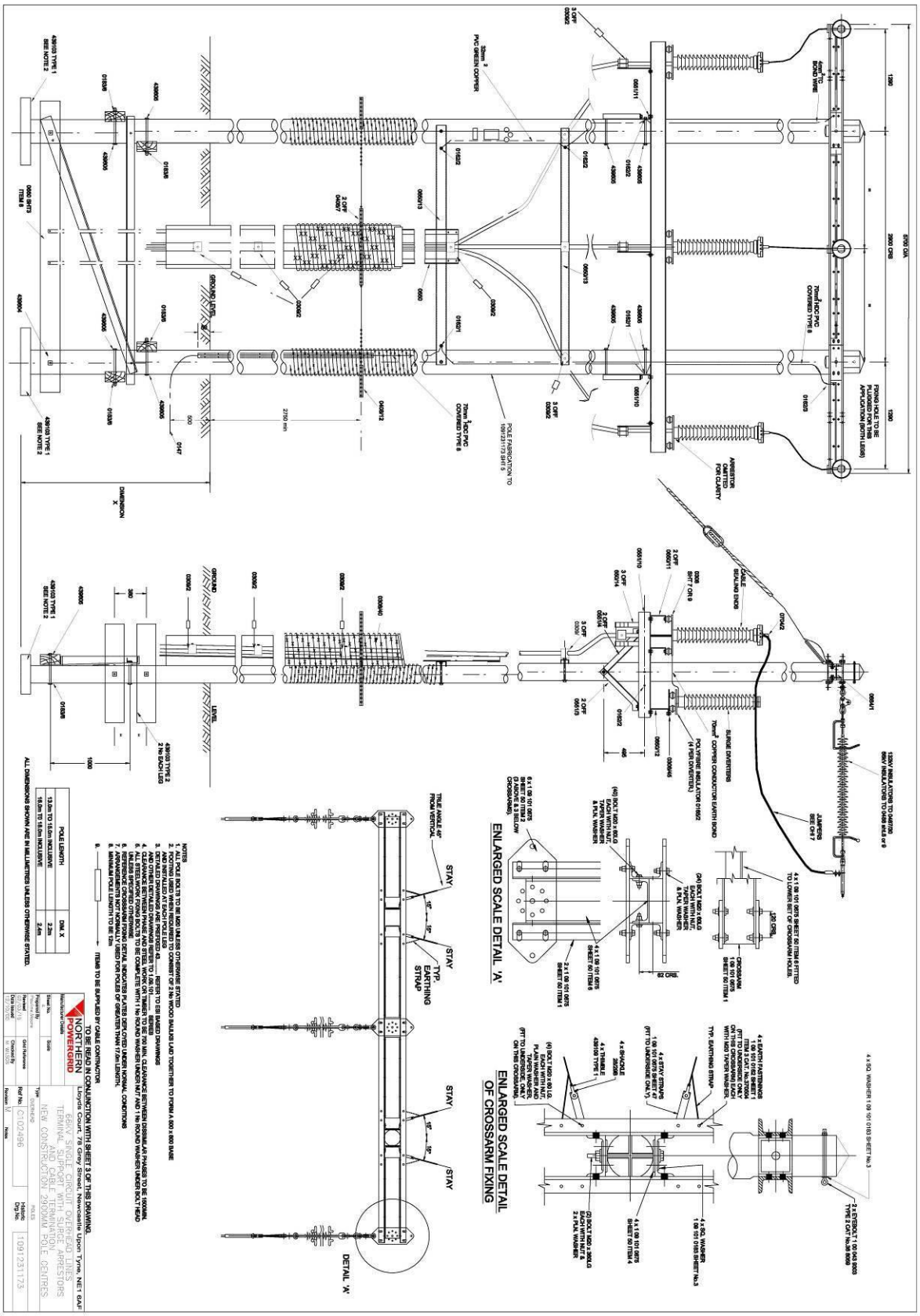
Material List for 1091231173 sht 9

33kV Terminal Pole with Heat Shrink Cable based on 2.9m Ctrs H Pole

	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Stout H Pole	1 09 1123 1173 sht10	1	233896
13m Stout H Pole	1 09 1123 1173 sht10	1	233909
14m Stout H Pole	1 09 1123 1173 sht10	1	233913
15m Stout H Pole	1 09 1123 1173 sht10	1	233947
16m Stout H Pole	1 09 1123 1173 sht10	1	233932
17m Stout H Pole	1 09 1123 1173 sht10	1	233951
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	439605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	439103 type2	4	235124
Steelwork			
Crossarms	1010675 sht50 item1	2	346507
Post Insulator & tension plates	1010675 sht50 item 2	6	346508
Pole Cheek plate	1010675 sht50 item 4	4	252670
Square plate for item 4 - Spacer Plates	1010675 sht50 item 5	8	240739
Crossarm Spacer Channels	1010675 sht50 item 6	4	346510
Bolts, M20 x 400, Galvd		2	372904
Washers, M20, Square Flat, Galvd	1091010183 sht 3 item 6	4	368063
Washers, M20, Square curved, Galvd	100043950 sht 1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1	2	368059
Bolts, M20 x 60, Galvd		84	378703
Washers, M20, Tapered, Galvd	0183/4	88	374488
Nuts, M20, Galvd		86	378915
Washers, M20, Round, Galvd		88	375616
Earthing Bolt, M20 x 60, galv	1 09 101 0162 Sht1	4	370504
Insulator & Conductor Termination Assemblies			
33kV Operation			
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	3	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	3	251546
Signs & Numbers			
Safety Sign	1091010229	2	363318
Fibre Washer, 14mm dia x 6mm thick		10	374581
Fibre Washer, 14mm dia x 2mm thick	-	10	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	10	371738
Number Base plate	1091010228 sht 3	1	243258

Pole Numbers	1091010228 sht 3	To Suit	-
Stays			
40 Degree Stay Strap	1 09 101 0675 Sht 48	4	346506
Bolts, M20 x 60, Galvd		4	378703
Nuts, M20, Galvd		4	378915
Washers, M20, Round, Galvd		8	375616
7/4.00mm Grade 1150 Staywire	-	20	231481
Stay Dead End	1091010541 sht 1	16	255217
Stay thimble	1000439109	16	244922
Type 2 Stay Rod	1000439101	4	231477
Wood Stay Block	1000439103 item 2	4	235124
Barbed wire	-	2	366829
Stay Insulators			
Stay Insulator Earthed	1000439107 sht 1 item 1	4	248232
Cable and Diverter Support			
Ironwork Support Channel	1091010650 sht 8 item 1	1	240280
Ironwork Support Channel	1091010650 sht 8 item 2	1	240281
Ironwork Support Channel	1091010650 sht 4 item 13	2	240298
Cable Cleat		9	291583
Bolt, M20 x 400		8	372904
Washer, M20 Round		8	375616
Washer Sq Curved	9605	8	368078
33 KV Surge Arrester		3	TBA
Cable Termination Plate (Copper)	Y204L0808	3	tba
Bolt, M12 x 40 Earthing	0162/2	12	370491
Earthing Bolt, M20 x 60, galv	1 09 101 0162 Sht1	4	370504
Cable Ladder			
Ladder Assy. To suit Pole Height	0550 sheet 2	1	To suit
Bolts, M16 x 50		2	378544
Coach Screws 12 x 75		2	297770
Baulk Type 2	439103	1	235124
Bolts, M20 x 530		1	372815
Washer, Flat Sq	1091010183/3	2	368063
Washer, M20 Round		2	375616
Flat Cleat Support	1091010308/22	5	242895
Flat Cleat Support	1091010309/37	1	245272
Bolts, M12 x 40		38	378421
Washer, M12 Round		38	375601
Protection			
Cable Casing	1091010308/40	1	243084
Bolts, M16 x 50		18	378544
Bolts, M12 x 40		6	378421
Washer, M12 Round		6	375601
ACG	1091010408/12	1 pair	251362
ACG	1091010408/7	1 pair	243192

Bolt, M16 x 400		2	378671
Washer, M16 Round		20	378987
Barbed Wire		50m	366829
Staples, ¼ x 9G Galvanised		20	375599
Earth Materials **(Earthed or Approach Poles Only)**			
Comp Lug – M22 Hole (70mm PVC Cu)	1091010237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m Approx.	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	1091010149/3	1	235548
Earth Rod	1091193143	As Req.	354249
Rod Coupling	1091193143	As Req.	354361
Driving Bolt	1091193143	As Req.	354408
Saddle Clamp	1091193143/2	As Req.	354338



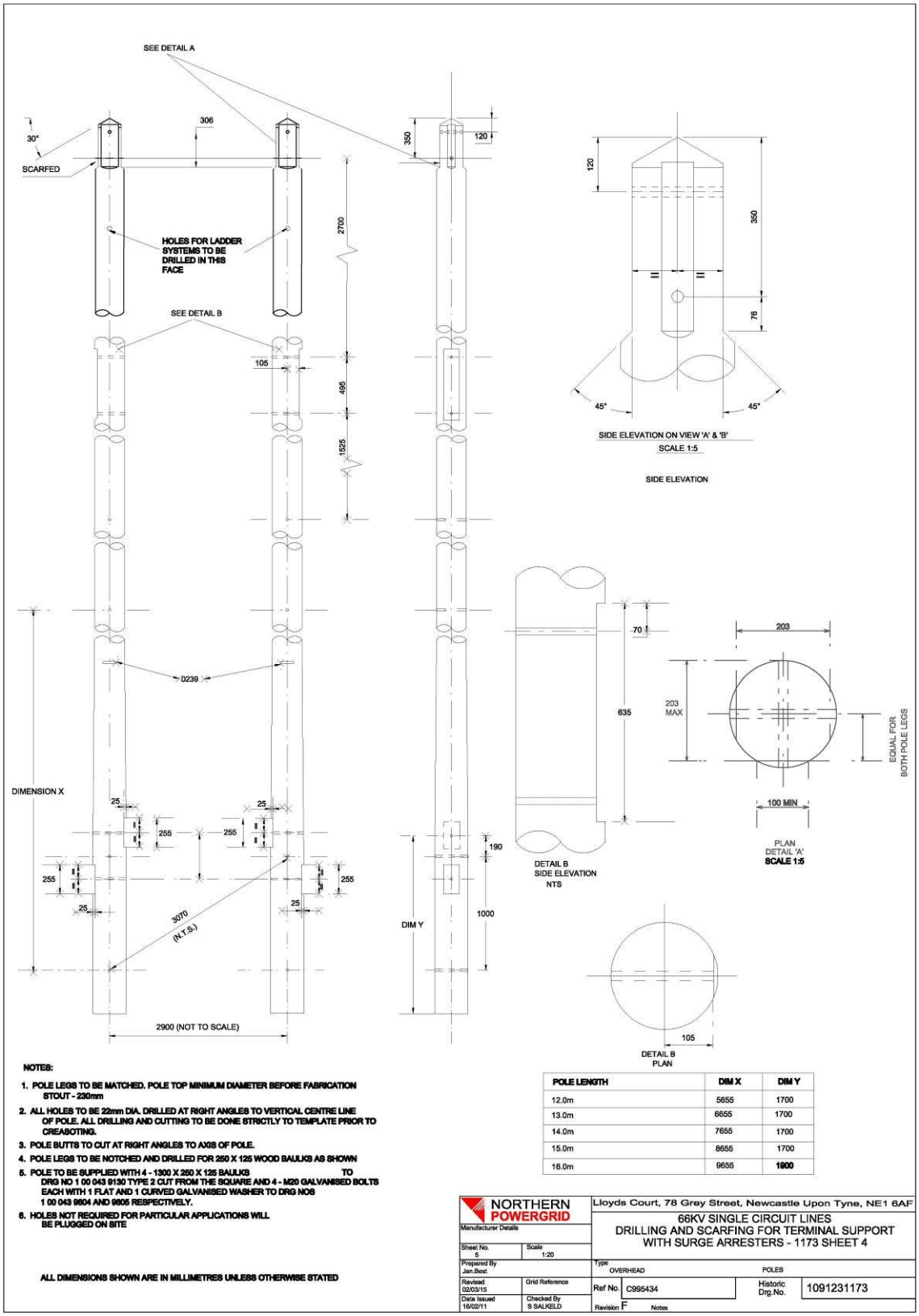
33 - 66 KV 'H' TERMINAL

Based on Drg Nos 1.09.123.1173 Sheet 4

	DRAWING NO	QUANTITY	CAT NO
Poles			
12m Stout H Pole	1.09.123.1173 sht5	1	233896
13m Stout H Pole	1.09.123.1173 sht5	1	233909
14m E Stout H Pole	1.09.123.1173 sht5	1	233913
15m E Stout H Pole	1.09.123.1173 sht5	1	233947
16m E Stout H Pole	1.09.123.1173 sht5	1	233932
17m E Stout H Pole	1.09.123.1173 sht5	1	233951
Foundation Components			
Bolt Ms Hex Galv M20 X 530 Long	-	8	372815
Plain Washer Ms Galv M20	-	2	375616
Square Curved Washer	1 00 043 9605 Sht1	5	368078
Square Flat washers	1091010183 sht 3 item 6	5	368063
Foundation Braces	1091010650 sht 3 item 9	2	240315
Wood Block (3600 x 250 x 125mm)	1091010650 sht3 item 8	1	234507
Wood Blocks 439103 type 2	1000439103 type2	4	235124
Insulators			
132Kv Operation			
120kn Ten. Ins. Assembly (132kV Approach)	1 09 101 0487 Sht 31 **or**	3	251553
66kV Operation			
66kV - 70kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 8	3	251559
Or			
66kV - 120kN Tension Insulator Assembly c/w arcing horns (Approach)	1091010488 sht 9	3	251539
33kV Operation			
33 kV - 70kN Tension Insulator Assembly (All situations)	1091010488 sht 8	3	216150
Or			
33 kV - 120kN Tension Insulator Assembly (All Situations)	1091010488 sht 9	3	251546
Conductor Terminations			
Poplar Comp. Dead End C/W Straight Lug	1 09 101 0653 sht 3	3	243240
Conductor Terminations to suit	To suit	3	To suit
Steelwork & Fixings			
Crossarm	1 09 101 0675 Sht 50 item 1	2	346507
Post Insulator & Tension Plate	1 09 101 0675 Sht 50 item 2	6	346508
Pole Cheek Plate	1 09 101 0675 Sht 50 item 4	4	252670
Bolt Ms Hex Galv M20 X 400 Long		2	372904
Square Flat Washer	1 09 101 0183 Sht 3 item 6		368078
Square Plate For Item 4	1 09 101 0675 Sht 50 item 5	4	240739
Crossarm Spacer Channel	1 09 101 0675 Sht 50 item 6	4	346510
Square Curved Washer	1 00 043 9605 Sht1	4	368078
Eyebolt Type 2	1 00 043 9303 Sht 1		368059
Bolt Ms Hex Galv M20 X 60 Long		84	378703
Taper Washer Galv M20	1 09 101 0183 item4	88	374488
Nut Ms Hex Galv M20		86	378915
Plain Washer Galv M20		88	375616
Earthing Fastenings	1 09 101 0162 Sht1	4	370504

Signs & Notices			
Pole Number Plate	1 09 101 0228 sht 3	1	243258
Pole Numbers (number to suit)	1 09 101 0228 sht 3	1	To suit
Pole Safety Sign	1 09 101 0229 Sht1	2	363318
Brass Slotted Head screws 1" No8	-	4	375777
Fibre washers (Thin)	-	4	374581
Fibre washers (Thick)	-	4	374577
Stays (2 per leg)			
40 Degree Stay Strap	1 09 101 0675 Sht 48	4	346504
Pole Top Stay Dead End	1091010541 sht 2	4	250209
7/4.00mm Grade 1150 Staywire	-	10	231481
Stay Dead End	1091010541/1	12	255217
Stay thimble	439109	12	244922
Type 2 Stay Rod	439101	4	231477
Wood Stay Block	439103/2	4	235124
Barbed wire	-	2	366829
66/132kv Stay Insulator Arcing Horn	1091010490 item9	8	238014
66/132kv Stay Insulator Earthed	439107 item 2	1	248232
Cable and Diverter Support			
Channel	0650 sht4 item 11	2	240508
Channel	0650 sht4 item 12	1	240512
Channel	0650 sht4 item 13	2	240289
Channel	0551 sht 4 item 10	1	243421
Channel	0551 sht 4 item 11	1	243493
Angle	0551 sht1 item 3	2	243578
Angle	0551 sht1 item 4	2	243582
SB Support Plates	0308 sheet 7 or 8	3	To Suit
Arrester Plates	0308/45	3	243987
Cleat Support	0309/7	3	245268
Bolt, M20 x 360		8	374609
Bolt, M16 x 50		46	378544
Bolt, M12 x 55 Earthing	0162/1	1	370487
Bolt, M12 x 40 Earthing	0162/2	3	370491
Washer Sq Curved	9605	8	368078
Washer, M16 Round		46	378987
Washer, M20 Round		8	375616
Washer, M16 Galvanised Tap		22	379852
Surge Arrester to suit Voltage		3	
Cable Support Cleat	0650 item 14	3	244640
Cable Sealing Bell Support Bars	0208 item 47	6	232732
Cable Sealing Bell Support Bars	0308 item 49	6	232747
Bolt, M12 x 40		24	378421
Cable Ladder			
Ladder Assy. To suit Pole Height	0550 sheet 2	1	To suit
Bolts, M16 x 50		2	378544

Coach Screws ½ x 3”		2	372891
Baulk Type 2	9103	1	235124
Bolts, M20 x 530		1	372815
Washer, Flat Sq	0183/3	2	368063
Washer, M20 Round		2	375616
Flat Cleat Support	0308/22	5	242895
Flat Cleat Support	0309/37	1	245272
Bolts, M12 x 40		38	378421
Washer, M12 Round		38	375601
Cable Protection			
Cable Casing	0308/40	1	243084
Bolts, M16 x 40		18	378525
Bolts, M12 x 40		6	378421
Washer, M12 Round		6	375601
ACG	0408/12	1 pair	251362
ACG	0408/7	1 pair	243192
Bolt, M16 x 400		2	378671
Washer, M16 Round		20	378987
Steel Wire Galvanised		2m	330013
Barbed Wire		50m	366829
Staples, ¼ x 9G Galvanised		20	375599
Earth Materials			
Comp Lug – M22 Hole (70mm PVC Cu)	0237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m Approx.	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	0149/3	1	235548
Earth Rod	3143	As Req.	354249
Rod Coupling	3143	As Req.	354361
Driving Bolt	3143	As Req.	354408
Saddle Clamp	3143/2	As Req.	354338



NOTES:

1. POLE LEGS TO BE MATCHED. POLE TOP MINIMUM DIAMETER BEFORE FABRICATION STOUT - 230mm
2. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE OF POLE. ALL DRILLING AND CUTTING TO BE DONE STRICTLY TO TEMPLATE PRIOR TO CREASOTING.
3. POLE BUTTS TO CUT AT RIGHT ANGLES TO AXIS OF POLE.
4. POLE LEGS TO BE NOTCHED AND DRILLED FOR 250 X 125 WOOD BAULKS AS SHOWN
5. POLE TO BE SUPPLIED WITH 4 - 1300 X 250 X 125 BAULKS TO DRG NO 1 00 043 9130 TYPE 2 CUT FROM THE SQUARE AND 4 - M20 GALVANISED BOLTS EACH WITH 1 FLAT AND 1 CURVED GALVANISED WASHER TO DRG NOS 1 00 043 9804 AND 9805 RESPECTIVELY.
6. HOLES NOT REQUIRED FOR PARTICULAR APPLICATIONS WILL BE PLUGGED ON SITE

ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED

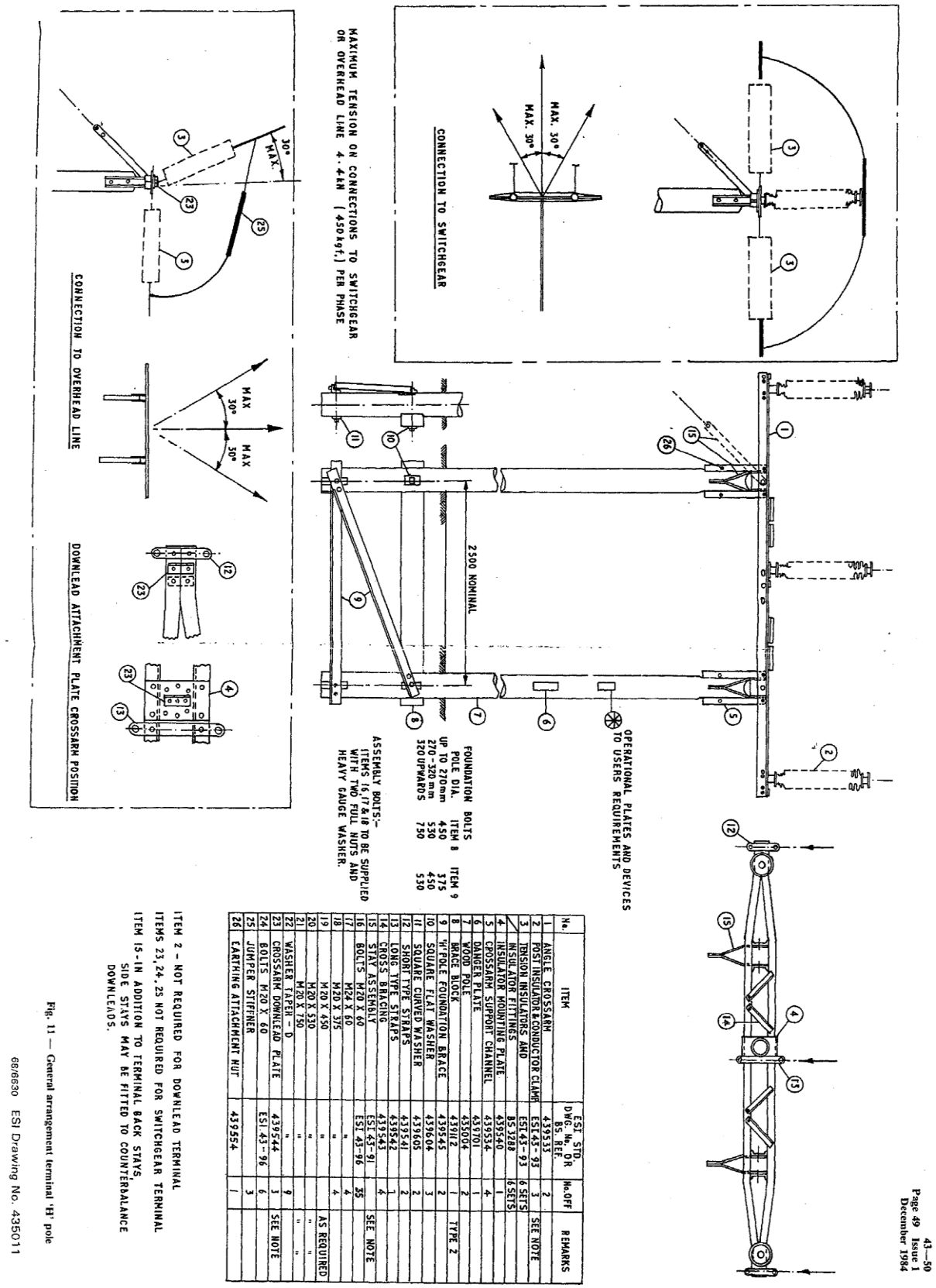
POLE LENGTH	DIM X	DIM Y
12.0m	5655	1700
13.0m	6655	1700
14.0m	7655	1700
15.0m	8655	1700
16.0m	9655	1900

NORTHERN POWERGRID
Manufacturer Details

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

66KV SINGLE CIRCUIT LINES
DRILLING AND SCARFING FOR TERMINAL SUPPORT
WITH SURGE ARRESTERS - 1173 SHEET 4

Sheet No. 5	Scale 1:20		
Prepared By Jan Best		Type OVERHEAD	POLES
Revised 02/03/15	Grid Reference	Ref No. C995434	Historic Drg.No. 1091231173
Date Issued 16/02/11	Checked By S SALKELD	Revision F	Notes



No.	ITEM	EST. STD. DWG. No. OR BS. REF.	No. OFF	REMARKS
1	ANGLE CROSSARM	439533	2	SEE NOTE
2	POST INSULATOR & CONDUCTOR CLAMP	EST 43-93	3	
3	TENSION INSULATORS AND	EST 43-93	6 SETS	
	INSULATOR FITTINGS	BS 3288	6 SETS	
4	INSULATOR MOUNTING PLATE	439540	1	
5	CROSSARM SUPPORT CHANNEL	439534	4	
6	DANGER PLATE	439701	1	
7	WOOD POLE	435004	2	
8	BRACE BLOCK	439112	1	TYPE 2
9	'H' POLE FOUNDATION BRACE	439545	2	
10	SQUARE FLAT WASHER	439604	3	
11	SQUARE CURVED WASHER	439605	2	
12	SHORT TYPE STRAPS	439541	2	
13	LONG TYPE STRAPS	439542	1	
14	CROSS BRACING	439543	4	
15	STAY ASSEMBLY	EST 43-91		SEE NOTE
16	BOLTS M20 X 60	EST 43-96	35	
17	M24 X 60	"	4	
18	M20 X 375	"	4	
19	M20 X 450	"	4	
20	M20 X 530	"		AS REQUIRED
21	M20 X 780	"		"
22	WASHER TAPER - D	"		"
23	CROSSARM DOWNLEAD PLATE	439544	9	
24	BOLTS M20 X 60	EST 43-96	3	SEE NOTE
25	JUMPER STIFFENER		6	
26	EARTHING ATTACHMENT NUT	439554	3	

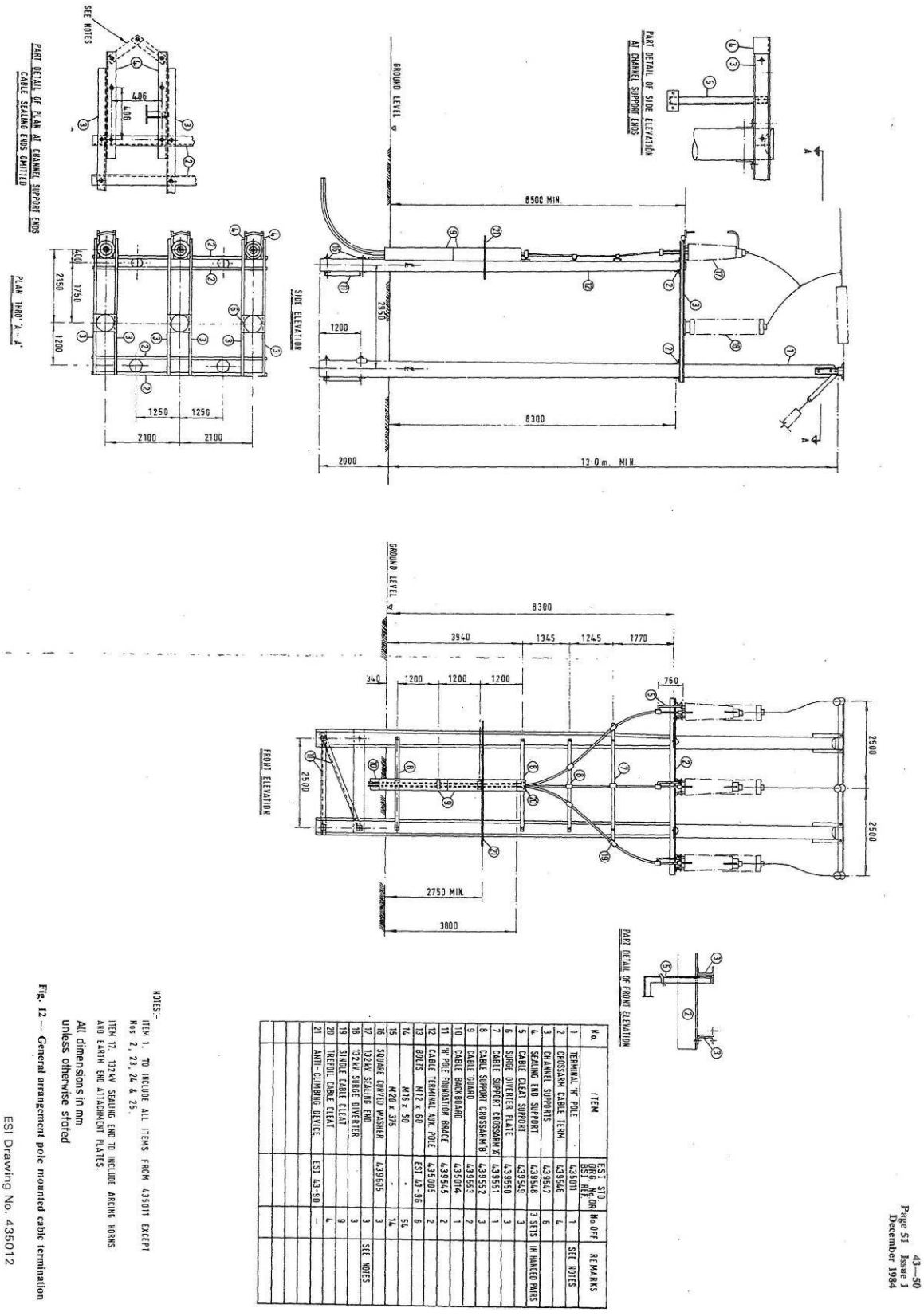
ITEM 2 - NOT REQUIRED FOR DOWNLEAD TERMINAL

ITEMS 23, 24, 25 NOT REQUIRED FOR SWITCHGEAR TERMINAL

ITEM 15 - IN ADDITION TO TERMINAL BACK STAYS, SIDE STAYS MAY BE FITTED TO COUNTERBALANCE DOWNLEADS.

Fig. 11 — General arrangement terminal 'H' pole

68/6630 ESI Drawing No. 435011



No.	ITEM	EST. STD. DRG. REF.	No. OFF	REMARKS
1	TERMINAL 'H' POLE	435011	1	SEE NOTES
2	CROSSARM CABLE TERM.	439566	1	
3	CHANNEL SUPPORTS	439567	6	
4	SEALING END SUPPORT	439568	3 SETS	IN HANGED PAIRS
5	CABLE CLEAT SUPPORT	439549	3	
6	SURGE DIVERTER PLATE	439550	3	
7	CABLE SUPPORT CROSSARM 'A'	439551	1	
8	CABLE SUPPORT CROSSARM 'B'	439552	3	
9	CABLE GUARD	439553	2	
10	CABLE BACKBOARD	439014	1	
11	'H' POLE FOUNDATION BRACE	439545	2	
12	CABLE TERMINAL AUX. POLE	435005	2	
13	BOLTS M12 x 60	EST 43-96	6	
14	M16 x 50	-	54	
15	M20 x 375		14	
16	SQUARE CURVED WASHER	439605	3	
17	132kV SEALING END		3	SEE NOTES
18	132kV SURGE DIVERTER		3	
19	SINGLE CABLE CLEAT		9	
20	TREFOIL CABLE CLEAT		4	
21	ANTI-CLIMBING DEVICE.	EST 43-90	—	

NOTES:-

ITEM 1, TO INCLUDE ALL ITEMS FROM 435011 EXCEPT Nos 2, 23, 24 & 25.

ITEM 17, 132kV SEALING END TO INCLUDE ARCING HORNS AND EARTH END ATTACHMENT PLATES.

All dimensions in mm unless otherwise stated

Fig. 12 — General arrangement pole mounted cable termination

ESI Drawing No. 435012

ENA TS 43-50 Fig 4

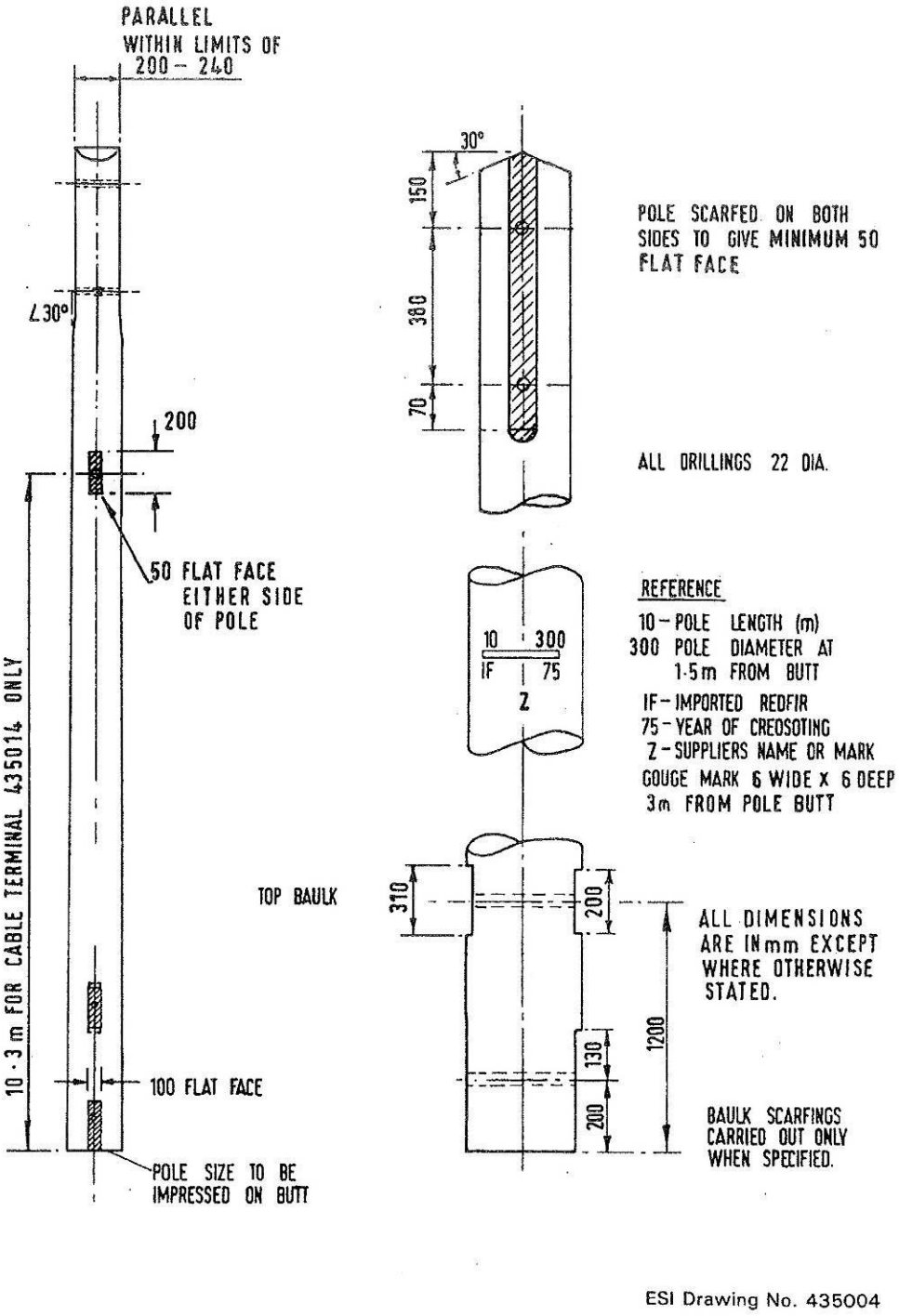


Fig. 4 — Scarfing and drilling for terminal and section angle 'H' type supports

68/6623

ENA TS 43-50 Fig 5

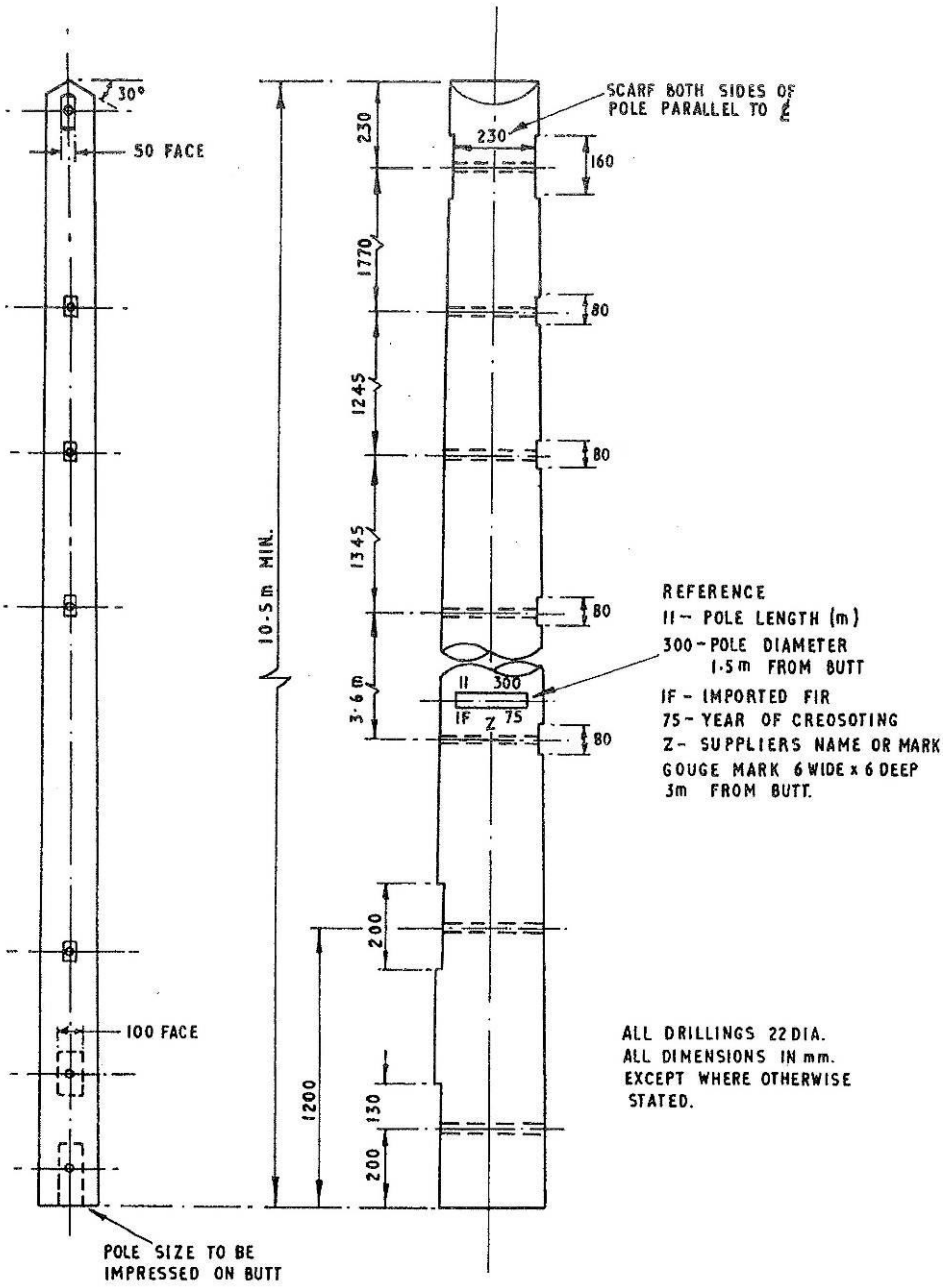


Fig. 5 — Scarfing and drilling — cable terminal structure auxiliary pole

132 KV 'H' Cable Terminal

Based on Drg Nos ENA TS 43-50 sht 12

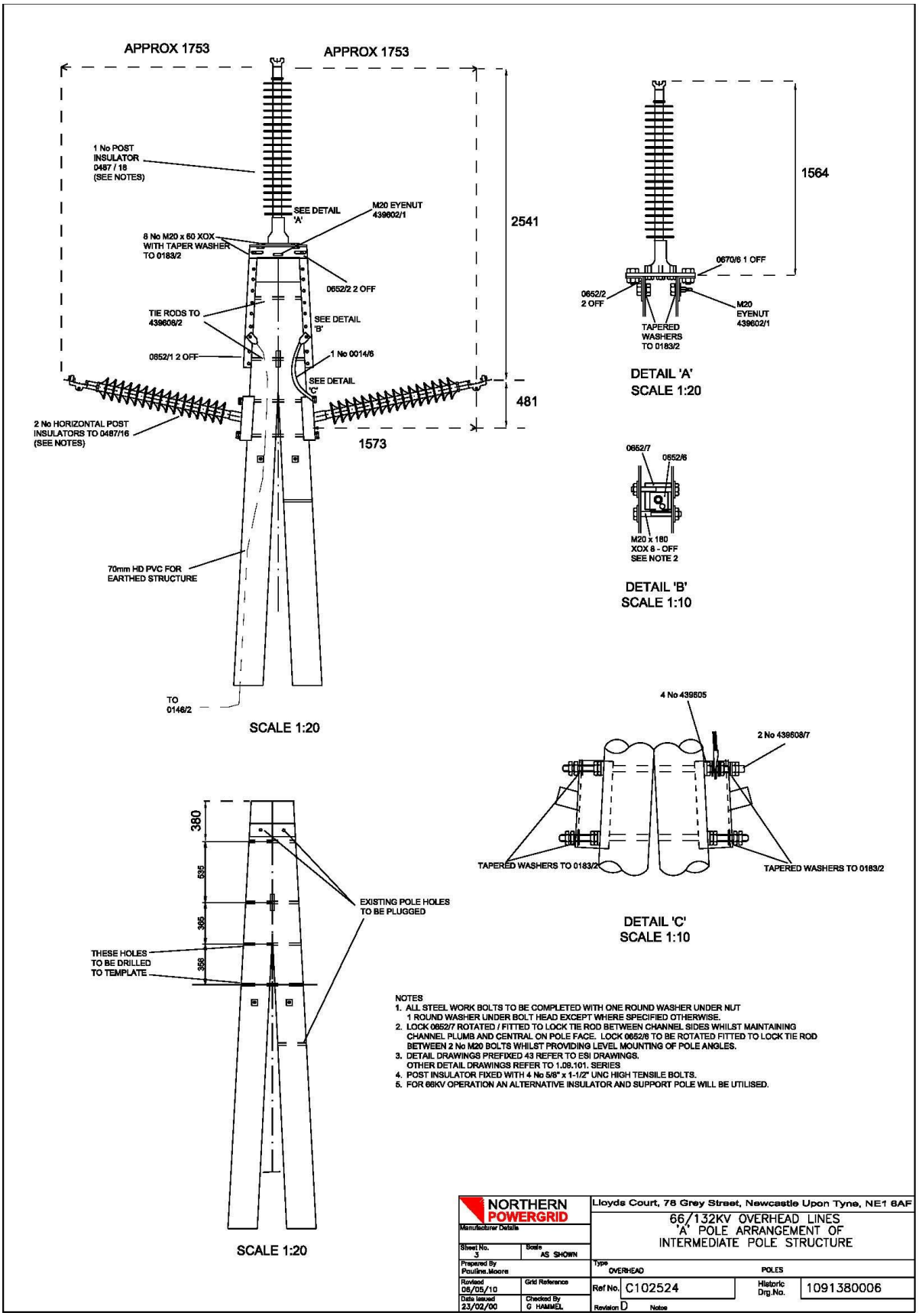
Item Description	Item Ref	Drawing No	Quantity	Cat No
Materials for Terminal Support leg				
Wood pole	435011/7	ENA TS 435004		To Suit
Foundation Components				
Bolt Ms Hex Galv M20 X 530 Long	435011/18 – 435011/20	ENA TS 43-96	8	372815
Square Curved Washer	435011/11	1 00 043 9605 Sht1	5	368078
Square Flat washers	435011/10	1091010183 sht 3 item 6	5	368063
Foundation Braces	435011/9	ENA TS 439545	2	TBA
Wood Block (3600 x 250 x 125mm)	435011/8	ENA TS 439112 (Type 2)	1	TBA
Pole, Insulator and Conductor Fittings				
Angle Crossarm	435011/1	ENA TS 439533	2	TBA
Short Type Straps	435011/12	ENA TS 439541	2	TBA
Long Type Straps	435011/13	ENA TS 439542	1	TBA
Cross bracing	435011/14	ENA TS 439543	4	TBA
Insulator Mounting Plate	435011/4	ENA TS 439540	1	TBA
Crossarm Support Channel	435011/5	ENA TS 439534	4	TBA
Crossarm Downlead Plate	435011/23	ENA TS 439544	3	TBA
120kn Ten. Ins. Assembly (132kV Approach)	435011/3	1 09 101 0487 Sht 31	6	251553
Poplar Comp. Dead End C/W Straight Lug	435011/3	1 09 101 0653 sht 3	6	243240
Bolt Ms Hex Galv M20 X 60 Long	435011/16	ENA TS 43-96	36	378703
Bolt Ms Hex Galv M24 X 60 Long	435011/17	ENA TS 43-96	4	TBA
Washer Taper - D	435011/22	ENA TS 43-96	9	TBA
Bolt Ms Hex Galv M20 X 60 Long	435011/24	ENA TS 43-96	6	378703
Earthing & Bonding				
Earthing Fastenings	435011/26	1 09 101 0162 Sht1	4	370504
70mm HD Green PVC Insulated earthing Conductor –	-	-	20m	220146
70mm compression Lug (m20 clearance hole)	-	1091010237	1	075234
Signs and Notices				
Pole Safety Sign	435011/6	1 09 101 0229 Sht1	2	363318
Pole Number Plate	435011/6	1 09 101 0228 sht 3	1	243258
Pole Numbers	435011/6	1 09 101 0228 sht 3	1	to suit)
Brass Slotted Head screws 1" No8	435011/6	-	4	375777
Fibre washers (Thin)	435011/6	-	4	374581
Fibre washers (Thick)	435011/6	-	4	374577
Enhanced Anti-Climbing Device		1 09 101 0408 Sht 8	1	251362

Item Description	Item Ref	Drawing No	Quantity	Cat No
Stays (2 per leg)	435011/15			
190kN Heavy Duty Stay Straps (pair)	435011/15	1000439113	2	252647
Cranked Links (190kN) - 1091010469 sht 2	435011/15	BS 3288 ref 42/87	3	

Bolt Ms Hex Galv M24 X 60 Long Thread length 36mm with two round washers	435011/15	ENA TS 43-96	4	TBA
Bolt Ms Hex Galv M20 X 45 Long Thread length 36mm with two round washers	435011/15	ENA TS 43-96	2	378703
190KN Shackle	435011/15	BS 3288 ref 42/103	4	250938
190kN Yoke Plate	435011/15	BS 3288 ref 42/42	2	TBA
120kN Insulator Stay Assembly	435011/15	1 09 123 0372 Sht2	4	251547
Stay thimble	435011/15	1000439109 type 1	8	244922
7/4.00mm Grade 1150 Staywire	435011/15	-	20	231481
Stay Dead End	435011/15	0541/1	8	255217
Type 2 Stay Rod	435011/15	9101	4	231477
Wood Stay Block	435011/15	9103/2	4	235124
notes items 16, 17 & 18 to be supplied with two full nuts and a washer				
item 2 not required for downlead terminal				
items 23,24 and 25 not req for switchgear terminals				
item 15 - in addition to terminal back stays, side stays may be fitted to counterbalance downleads				
Cable Support Pole				
Cable Terminal Aux Pole Fabrication Drawing	435012/12	ENA TS 435005	2	TBA
Materials for Cable Support leg				
Crossarm - cable termination	435012/2	ENA TS 439546	4	TBA
Channel Supports	435012/3	ENA TS 439547	6	TBA
Sealing End Support	435012/4	ENA TS 439548	3 sets	TBA
Cable Cleat Support	435012/5	ENA TS 439549	3	TBA
Surge Diverter plate	435012/6	ENA TS 439550	3	TBA
Cable support Crossarm (a)	435012/7	ENA TS 439551	1	TBA
Cable support crossarm (b)	435012/8	ENA TS 439552	3	TBA
Cable Guard	435012/9	ENA TS 439553	1	TBA
Cable backboard	435012/10	ENA TS 435014	1	TBA
H Pole Foundation Brace	435012/11	ENA TS 439545	2	TBA
Bolt Ms Hex Galv M12 X 60 Long	435012/13	ENA TS 43-96	6	TBA
Bolt Ms Hex Galv M16 X 50 Long	435012/14	ENA TS 43-96	54	TBA
Bolt Ms Hex Galv M20 X 375 Long	435012/15	ENA TS 43-96	14	TBA
Square Curved Washer	435012/16	1 00 043 9605 Sht1	3	TBA

Item Description	Item Ref	Drawing No	Quantity	Cat No
132kV sealing End	435012/17		3	TBA
132kV Surge Diverter	435012/18		3	368078
Single cable Cleat	435012/19	1091010309 item 1	9	TBA
Trfoil cable cleat	435012/20	1091010309 item 5	4	TBA
Earth Materials				
Comp Lug – M22 Hole (70mm PVC Cu)		1091010237	1	075234
70mm (7/3.55)HD CU Cond. PVC Covered type 8		-	20m Approx.	220146

Polyprop cleats		-	As Req.	248815
Earthing Lead casing		1091190149/3	1	235548
Earth Rod		3143	As Req.	354249
Rod Coupling		3143	As Req.	354361
Driving Bolt		3143	As Req.	354408
Saddle Clamp		1091193143/2	As Req.	354338
Item 17 . 132kV sealing end to include arcing horns and earth end attachment plates				
Protection				
Anti-Climbing Device - cable trunking	435012/21	1091010408 sht 11 item 7	2	243192
Anti-Climbing Device - Cable Pole leg	435012/21	1090100408 sht 8	2	251362
Barbed Wire			50m	366829
Signs and Notices				
Pole Safety Sign		1 09 101 0229 Sht1	2	363318
Brass Slotted Head screws 1” No8		-	4	375777
Fibre washers (Thin)		-	4	374581
Fibre washers (Thick)		-	4	374577

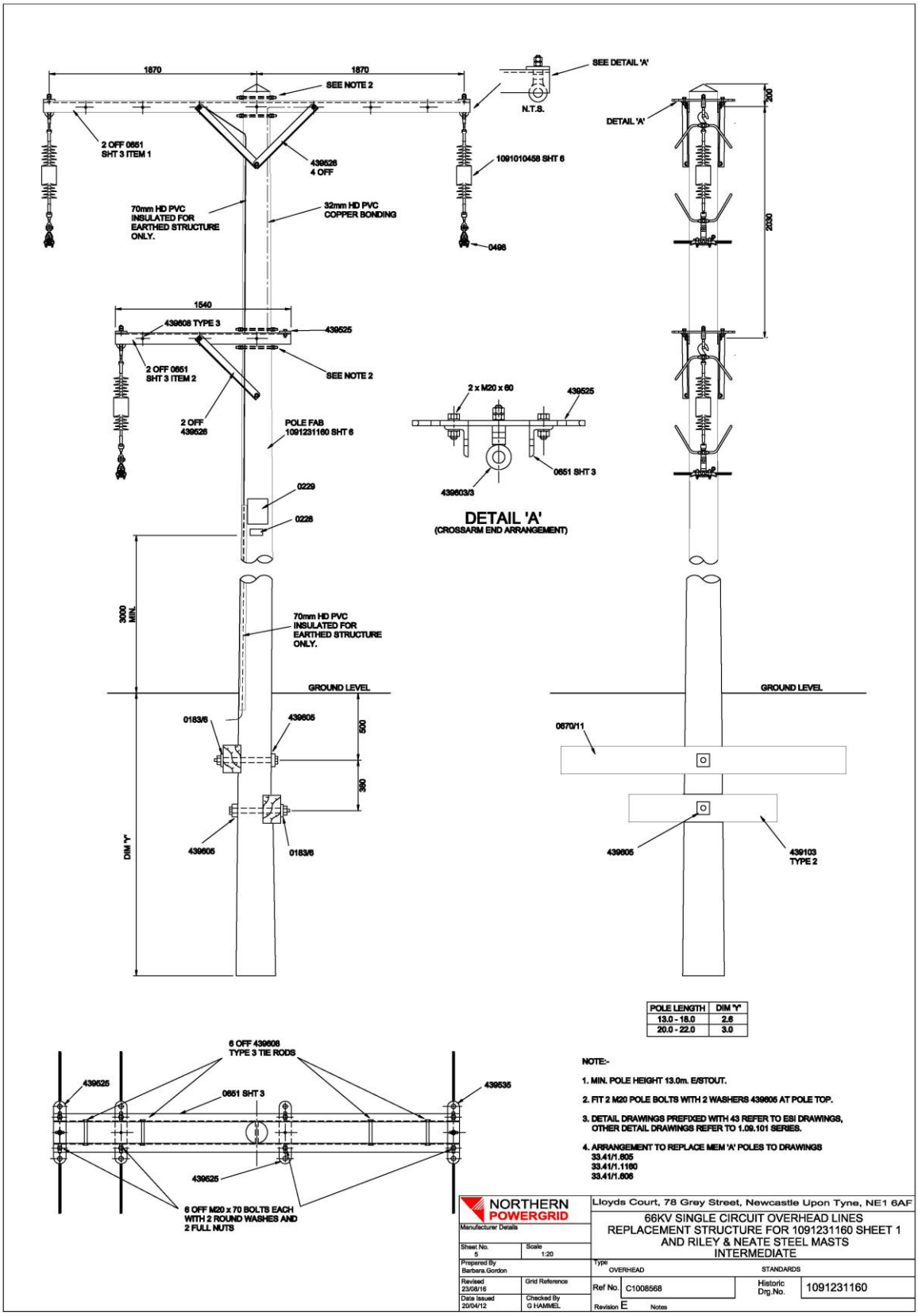

APPROX 1753
APPROX 1753
1 No POST INSULATOR 0487 / 18 (SEE NOTES)
SEE DETAIL 'A'
M20 EYENUT 439602/1
8 No M20 x 60 XOX WITH TAPER WASHER TO 0183/2
0652/2 2 OFF
TIE RODS TO 439608/2
SEE DETAIL 'B'
0652/1 2 OFF
1 No 0014/6
SEE DETAIL 'C'
2 No HORIZONTAL POST INSULATORS TO 0487/16 (SEE NOTES)
2541
481
1573
70mm HD PVC FOR EARTHED STRUCTURE
TO 0146/2
SCALE 1:20
1564
0670/6 1 OFF
0652/2 2 OFF
M20 EYENUT 439602/1
TAPERED WASHERS TO 0183/2
DETAIL 'A'
SCALE 1:20
0652/7
0652/6
M20 x 180 XOX 8 - OFF SEE NOTE 2
DETAIL 'B'
SCALE 1:10
4 No 439605
2 No 439608/7
TAPERED WASHERS TO 0183/2
TAPERED WASHERS TO 0183/2
DETAIL 'C'
SCALE 1:10
380
635
395
368
EXISTING POLE HOLES TO BE PLUGGED
THESE HOLES TO BE DRILLED TO TEMPLATE
SCALE 1:20
NOTES
1. ALL STEEL WORK BOLTS TO BE COMPLETED WITH ONE ROUND WASHER UNDER NUT 1 ROUND WASHER UNDER BOLT HEAD EXCEPT WHERE SPECIFIED OTHERWISE.
2. LOCK 0652/7 ROTATED / FITTED TO LOCK TIE ROD BETWEEN CHANNEL SIDES WHILST MAINTAINING CHANNEL PLUMB AND CENTRAL ON POLE FACE. LOCK 0652/6 TO BE ROTATED FITTED TO LOCK TIE ROD BETWEEN 2 No M20 BOLTS WHILST PROVIDING LEVEL MOUNTING OF POLE ANGLES.
3. DETAIL DRAWINGS PREFIXED 43 REFER TO ESI DRAWINGS. OTHER DETAIL DRAWINGS REFER TO 1.08.101. SERIES
4. POST INSULATOR FIXED WITH 4 No 5/8" x 1-1/2" UNC HIGH TENSILE BOLTS.
5. FOR 66KV OPERATION AN ALTERNATIVE INSULATOR AND SUPPORT POLE WILL BE UTILISED.
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66/132KV OVERHEAD LINES 'A' POLE ARRANGEMENT OF INTERMEDIATE POLE STRUCTURE
Sheet No. 3
Scale AS SHOWN
Prepared By Pauline.Moore
Type OVERHEAD POLES
Revised 06/05/10
Grid Reference
Ref No. C102524
Historic Drg.No. 1091380006
Date Issued 23/02/00
Checked By G HAMMEL
Revision D
Notes

RENOVATION OF EXISTING 'A' POLE INTERMEDIATE STRUCTURES

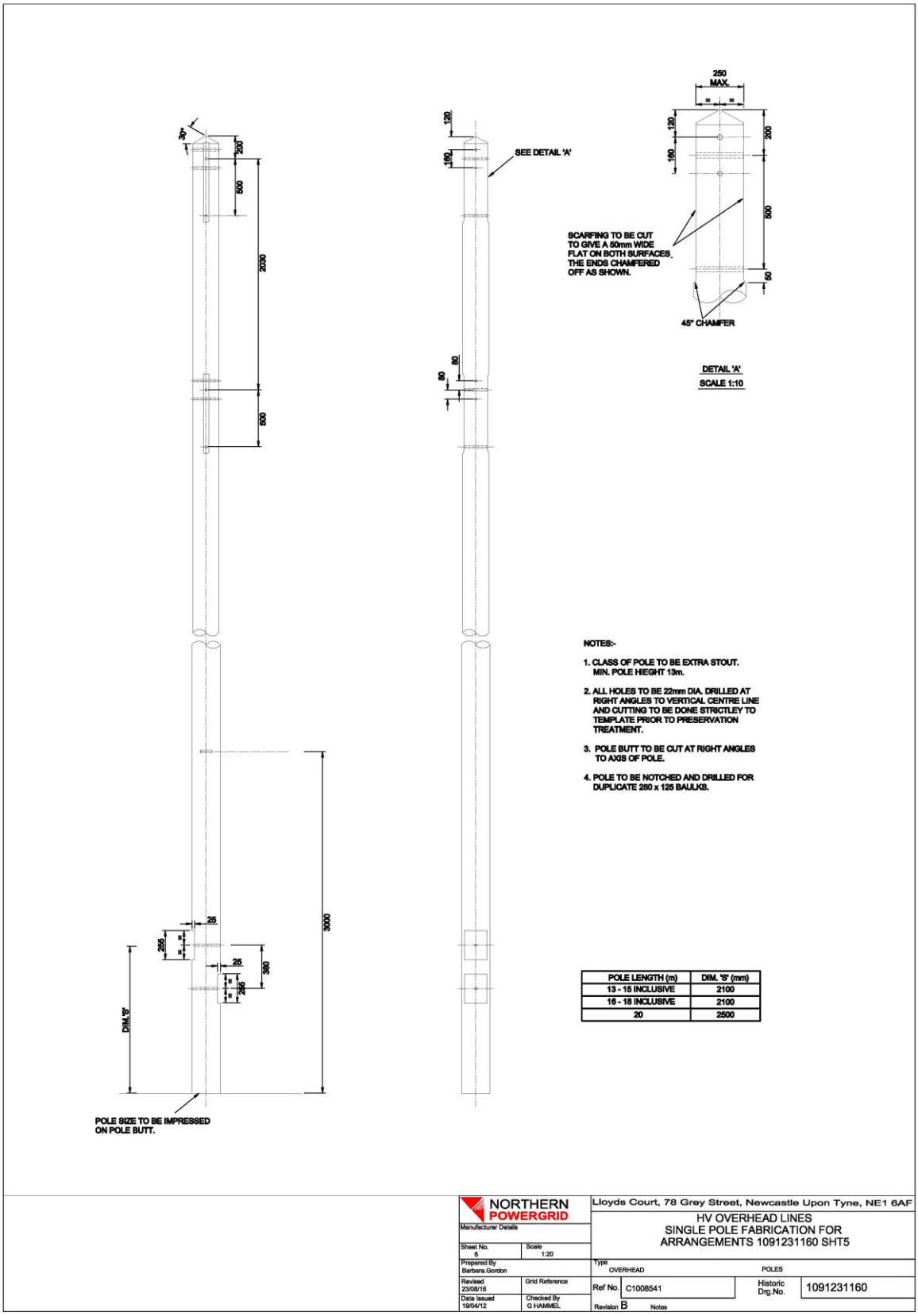
Based on Drg Nos 1.09.138.0006/3

COMPONENT	DRAWING NO	QUANTITY	CAT NO
Anti Split Bolts / Climbing Attachment Point			
Eyebolts, M20 x 300, Galvd	439603/2	1	368059
Washers, Square Curved	439605	2	368078
Vertical Insulators			
132kv Polymeric Post Insulator -	0487/18	1	251551
or			
66kV Polymeric Post Insulator – 930mm long c/w bolts	0487/36	1	346402
66kV – 646mm Long Stool for Vertical Post Insulator c/w bolts	0487/38	1	346403
or			
33kV Polymeric Post Insulator -	0487/37	1	346405
33kV – 976mm Long Stool for Vertical Post Insulator c/w bolts	0487/40	1	346406
Post insulator fixing bolts – 5/8" Unc, **Grade 8.8**	0487/6	4	239892
Post Insulator Base Plate	0670/6	1	346539
Bolts, M20 x 60, Galvd	-	8	378703
Square M20 Tapered Washer, Galvd	0183/2	8	374473
Angles (Post)	0652/2	2	252702
Channels (Post)	0652/1	2	252685
Tie Rod, M20 x 450, Galvd	439608/2	2	375832
Earthing Bolts, M20 x 60	0162/3	2	370504
Bolts, M20 x 180, Galvd	-	8	374098
Washers, M20, Round, Galvd	-	8	375616
Horizontal Lock	0652/7	4	252755
Vertical Locks	0652/6	4	252740
Earthing Strap –22mm lugs 750mm long	0014/6	1	251786
Horizontal Insulators			
132kv Horizontal Post Insulator c/w with bendable base	0487/16	2	251549
or			
66kV Horizontal Polymeric Post Insulator – 930mm c/w bolts	0487/36	2	346402
66kV – 670mm Long Stool for Horizontal Post Insulator c/w bolts	0487/39	2	346404
or			
33kV Horizontal Polymeric Post Insulator -	0487/37	2	346405
33kV – 1000mm Long Stool for Horizontal Post Insulator c/w bolts	0487/41	2	346407
Tie Rod, M20 x 600, Galvd	439608/6	4	371225
Washers, Square Curved	439605	4	368078
Washers, M20, Round, Galvd	-	6	375616
Nuts M20	-	8	378915
Notices			
Safety Sign	0229	1	363318
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick	-	6	374577
Screw Nails, Hardened, B2p, 2in x 10G	-	6	371738

Number Base plate	0028	1	243258
Pole Numbers	0028	To Suit	-
Eathed Structures Only			
Comp Lug – M22 Hole (70mm PVC Cu)	0237	1	268819
70mm (7/3.55)HD CU Cond. PVC Covered type 8	-	20m Approx.	224774
Staples Copper 1½ x 8G	-	As Req.	374399
Earthing Lead casing	0149/3	1	235548
Earth Rod	3143	As Req.	354249
Rod Coupling	3143	As Req.	354361
Saddle Clamp	3143/2	As Req.	354338

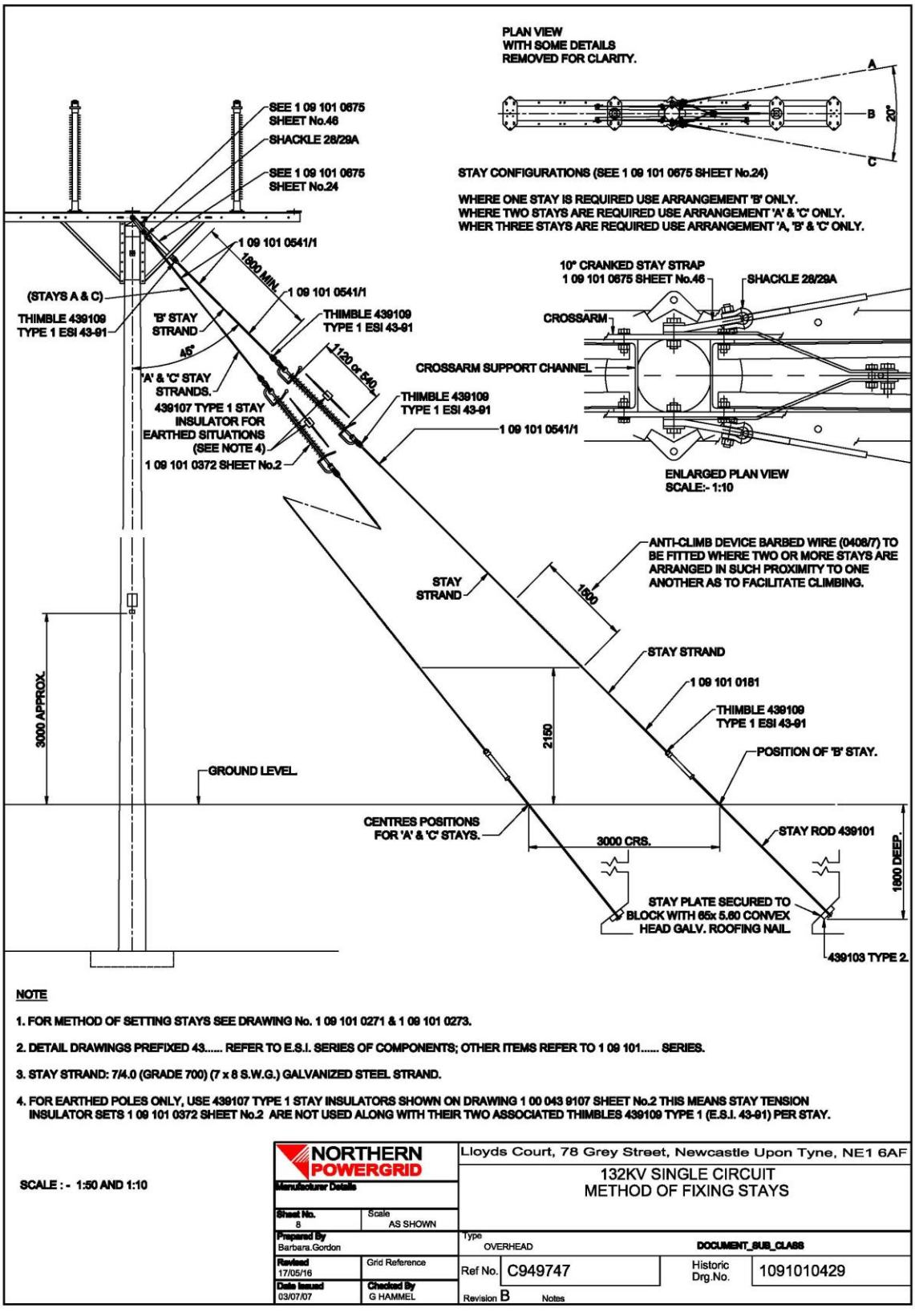


POLE LENGTH	DIM 'Y'
13.0 - 18.0	2.6
20.0 - 22.0	3.0


30°
200
500
2030
600
SEE DETAIL 'A'
120
180
80
60
250
MAX.
120
160
200
600
50
SCARFING TO BE CUT TO GIVE A 50mm WIDE FLAT ON BOTH SURFACES, THE ENDS CHAMFERED OFF AS SHOWN.
45° CHAMFER
DETAIL 'A'
SCALE 1:10
25
255
25
360
295
DIM 'S'
3000
POLE SIZE TO BE IMPRESSED ON POLE BUTT.
NOTES:-
1. CLASS OF POLE TO BE EXTRA STOUT. MIN. POLE HIEGHT 13m.
2. ALL HOLES TO BE 22mm DIA. DRILLED AT RIGHT ANGLES TO VERTICAL CENTRE LINE AND CUTTING TO BE DONE STRICTLEY TO TEMPLATE PRIOR TO PRESERVATION TREATMENT.
3. POLE BUTT TO BE CUT AT RIGHT ANGLES TO AXIS OF POLE.
4. POLE TO BE NOTCHED AND DRILLED FOR DUPLICATE 250 x 125 BAULKS.
POLE LENGTH (m) | DIM. 'S' (mm)
13 - 15 INCLUSIVE | 2100
16 - 18 INCLUSIVE | 2100
20 | 2500
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 6
Scale 1:20
Prepared By Barbara.Gordon
Revised 23/08/16
Grid Reference
Date Issued 19/04/12
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
HV OVERHEAD LINES
SINGLE POLE FABRICATION FOR
ARRANGEMENTS 1091231160 SHT5
Type OVERHEAD POLES
Ref No. C1008541
Historic Drg.No. 1091231160
Revision B
Notes

Material List for 1091231160 sht 5 – Replacement for R &N 'A' Suspension Support

Description	Drawing number	Quantity	Cat number
Extra stout Wood Pole to pole fabrication no.	1091231160 sht6	1	Height to suit
Foundations			
Foundation Baulk 2500x225x125	0670/11	1	346581
Foundation Baulk 1300x225x125	439103/2	1	235124
Washer, Square Flat	0183/3	2	368063
Washers, Square Curved	439605	2	368078
Bolts, M20 x 530 Galvd		2	372815
Anti Split Bolts			
Bolts, M20 x 300 (Stout)		4	378794
Washers, Square Curved	439605	4	368078
Crossarms			
Crossarm Member (large) 100 x 75 x 12 x 2840mm long	1091010651 sht3 item 1	2	237725
Crossarm Member (small)	1091010651 sht3 item 2	2	237728
Crossarm Strut	439526	6	237581
Bolts, M20 x 300 (Stout)		4	378794
Bolts, M20 x 60		14	378703
Washers, Round, M20		14	375616
Washers, Square, Curved	439605	8	368078
Section plate	439525	4	237609
Tie Rod, M20 x 330 each with 4 Standard Nuts	439608 Type 3	4	375828
Washers, Round, M20		8	375616
Insulator assemblies			
M20 Eyenut	439603/3	3	368025
Nuts, M20		15	378915
Insulator : 66kV Suspension assembly 70kN for OHL4 construction 5 x 140mm spacing - 16mm ball hook fitting and socket clevis - Unearthed construction (540mm arc gap).	1091010428 sht. 7	3	251541
Suspension Clamp (Tongue Ended)	1091010498	3	246010
Plates and signs			
Pole Safety Sign	1 09 101 0229 Sht1	1	363318
Pole Number Plate	1 09 101 0228 sht3	1	243258
Fibre Washer, 14mm dia x 6mm thick		6	374581
Fibre Washer, 14mm dia x 2mm thick		6	374577



NOTE

1. FOR METHOD OF SETTING STAYS SEE DRAWING No. 1 09 101 0271 & 1 09 101 0273.
2. DETAIL DRAWINGS PREFIXED 43..... REFER TO E.S.I. SERIES OF COMPONENTS; OTHER ITEMS REFER TO 1 09 101..... SERIES.
3. STAY STRAND: 7/4.0 (GRADE 700) (7 x 8 S.W.G.) GALVANIZED STEEL STRAND.
4. FOR EARTHED POLES ONLY, USE 439107 TYPE 1 STAY INSULATORS SHOWN ON DRAWING 1 00 043 9107 SHEET No.2 THIS MEANS STAY TENSION INSULATOR SETS 1 09 101 0372 SHEET No.2 ARE NOT USED ALONG WITH THEIR TWO ASSOCIATED THIMBLES 439109 TYPE 1 (E.S.I. 43-91) PER STAY.

SCALE : - 1:50 AND 1:10

NORTHERN POWERGRID
Manufacturer Details

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

132KV SINGLE CIRCUIT
METHOD OF FIXING STAYS

Sheet No.	Scale
8	AS SHOWN
Prepared By: Barbara.Gordon	Type: OVERHEAD
Revised: 17/05/16	Grid Reference
Date Issued: 03/07/07	Checked By: G HAMMEL

DOCUMENT_SUB_CLASS

Ref No. C949747 Historic Drg.No. 1091010429

Revision B Notes

MATERIAL LIST FOR 1 09 101 0429 SHEET No.8 REV 1

IF ONE STAY IS USED THE FOLLOWING ITEMS ARE REQUIRED: -

QTY	CAT. No.	DESCRIPTION		DETAIL DRG.	
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 Link Assembly	33kV Unearthed poles Only	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 gald.			
Notes for more details See		STAY YOKE ARRAY (SEE DRAWING)		1 09 101 0675 SHT24	
2	346483	Stay Yoke leg		1091010675 sht 16	
1	235124	Stay Block 439103 type 2		1000439103 type 2	

IF TWO STAYS ARE USED THE FOLLOWING ITEMS ARE REQUIRED: -

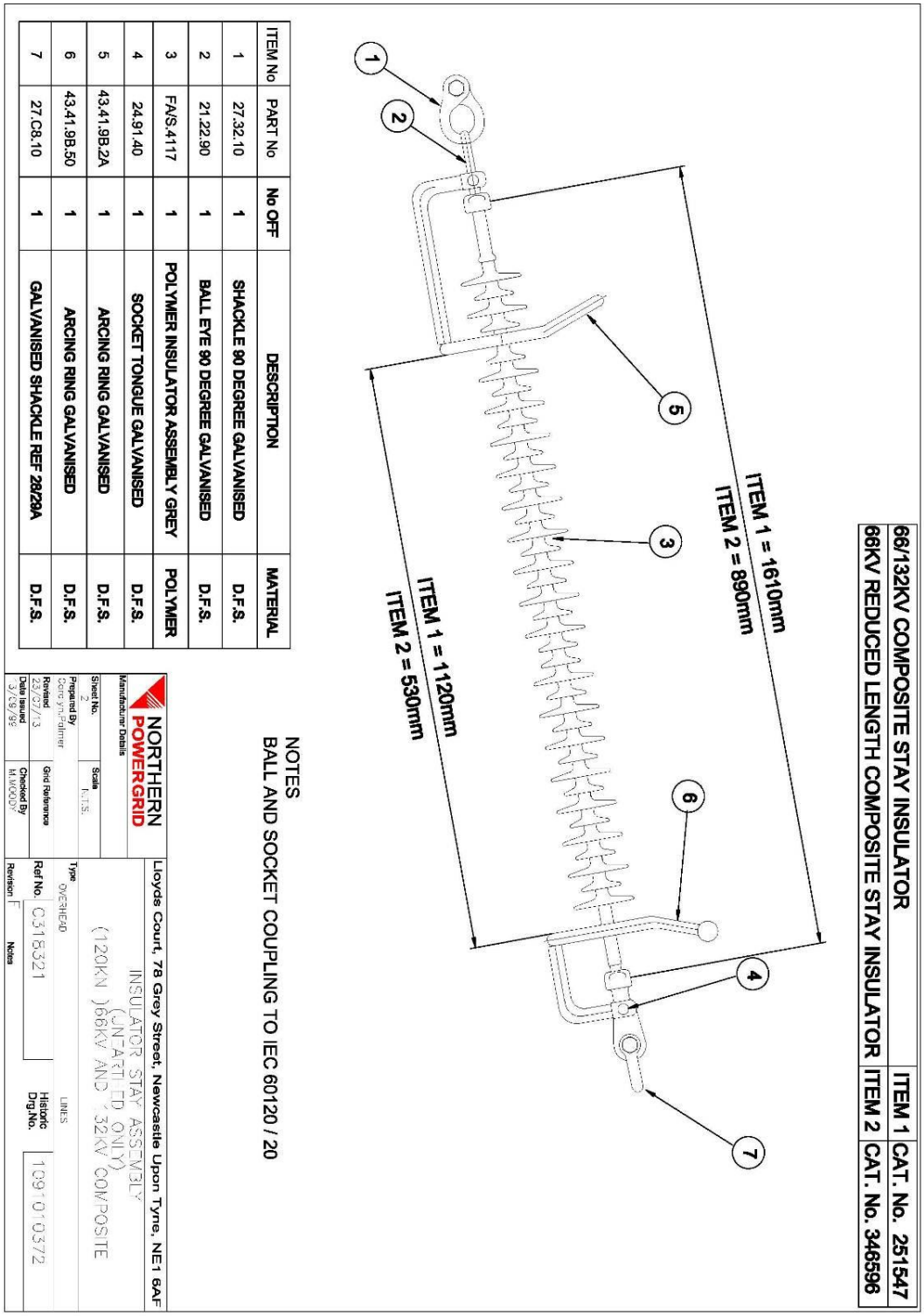
QTY	CAT. No.	DESCRIPTION		DETAIL DRG.	
2	346503	10˚ Cranked Stay Strap		1091010675 Sht46	
2	226365	Shackle BS3288 28/29a		1091010461 sht1	
2	248232	Single Stay Insulator Type 1	Earthed Poles	1 00 043 9107 Sht1	item1 **Or**
2	251547	Stay Insulator Assembly	132kV Unearthed Poles	1 09 123 0372 Sht2 item1 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 Only	1 00 043 9107 sht 3	
8	244922	Thimble		1000439109 Type 1	
8	255217	Helical Stay Dead End		1091010541	
2	231477	Stay Rod		1000439101 Type 2 Item 3	
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	

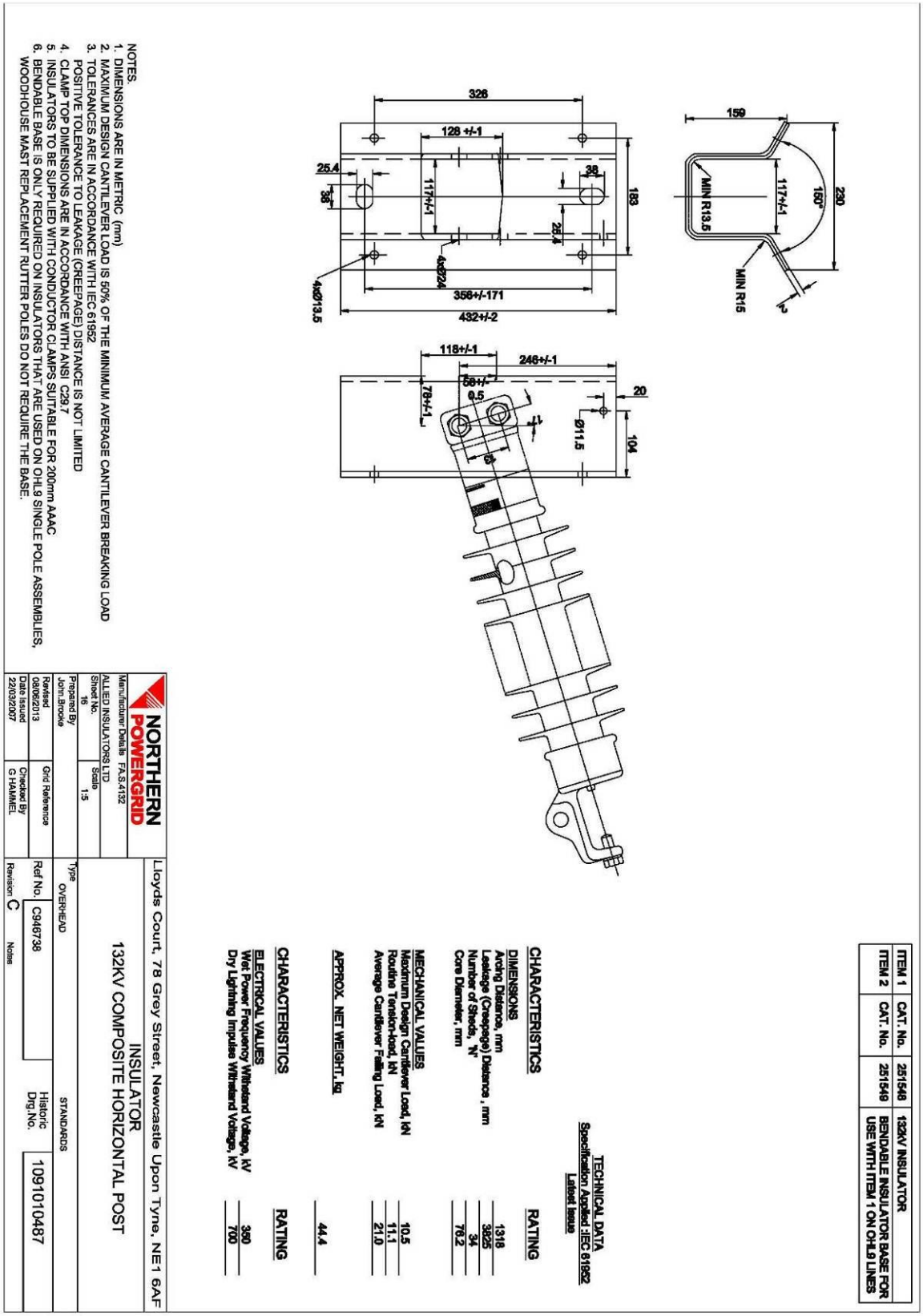
IF THREE STAYS ARE USED THE FOLLOWING ITEMS ARE REQUIRED: -

QTY	CAT. No.	DESCRIPTION		DETAIL DRG.	
3	248232	Single Stay Insulator Type 1	Earthed Poles	1 00 043 9107 Sht1	item1 **Or**
3	251547	Stay Insulator Assembly	132kV Unearthed Poles	1 09 123 0372 Sht2	item 1 Or
3	346596	Stay Insulator Assembly	66kV Unearthed Poles	1 09 123 0372 Sht2	item 2 Or
6	253743	Stay Insulator	33kV Unearthed Poles	1 00 043 9107 Sht1	Item 2 and
3	260183	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 gald.	
1	235124	Stay Block 439103 type 2	1000439103 type 2

APPENDIX C – COMPONENT DETAIL DRAWINGS




NOTES.
1. DIMENSIONS ARE IN METRIC (mm)
2. MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MINIMUM AVERAGE CANTILEVER BREAKING LOAD
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61952
POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED
4. CLAMP TOP DIMENSIONS ARE IN ACCORDANCE WITH ANSI C29.7
5. INSULATORS TO BE SUPPLIED WITH CONDUCTOR CLAMPS SUITABLE FOR 200mm AAAC
6. BENDABLE BASE IS ONLY REQUIRED ON INSULATORS THAT ARE USED ON OHL9 SINGLE POLE ASSEMBLIES. WOODHOUSE MAST REPLACEMENT RUTTER POLES DO NOT REQUIRE THE BASE.
326
128 +/-1
25.4
38
117+/-1
183
4xØ24
4xØ13.5
356+/-171
432+/-2
159
MIN R13.5
117+/-1
160°
230
MIN R15
118+/-1
246+/-1
58+/-1
78+/-1
9.5
20
Ø11.5
104
ITEM 1 CAT. No. 251548 132kV INSULATOR
ITEM 2 CAT. No. 251549 BENDABLE INSULATOR BASE FOR USE WITH ITEM 1 ON OHL9 LINES
TECHNICAL DATA
Specification Applied :IEC 61952
Latest Issue
CHARACTERISTICS RATING
DIMENSIONS
Arcing Distance, mm 1318
Leakage (Creepage) Distance , mm 3825
Number of Sheds, 'N' 34
Core Diameter, mm 76.2
MECHANICAL VALUES
Maximum Design Cantilever Load, kN 10.5
Routine Tension-load, kN 11.1
Average Cantilever Failing Load, kN 21.0
APPROX. NET WEIGHT, kg 44.4
CHARACTERISTICS RATING
ELECTRICAL VALUES
Wet Power Frequency Withstand Voltage, kV 360
Dry Lightning Impulse Withstand Voltage, kV 700
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR
132KV COMPOSITE HORIZONTAL POST
Manufacturer Details FAS.4132
ALLIED INSULATORS LTD
Sheet No. 16
Scale 1:5
Prepared By John.Brooke
Revised 08/06/2013
Date Issued 22/03/2007
Checked By G HAMMEL
Grid Reference
Type OVERHEAD
STANDARDS
Ref No. C946738
Historic Drg.No. 1091010487
Revision C
Notes

CAT. No 251551 SUPPLIED WITHOUT STOOL
CAT. No 251650 SUPPLIED WITH SUPPORT STOOL AND ARMOUR GRIP CLAMPS

TECHNICAL DATA
Specification Applied :IEC 61952
Latest Issue

ITEM	COMPONENT	MATERIAL
1	FLANGE END	DUCTILE IRON, HDG
2	WEATHERSHEDS	SILICONE RUBBER
3	FLANGE END	DUCTILE IRON, HDG
4	LABEL	POLYESTER
5	CORE	HIGH QUALITY PULTRUDED FRP ROD
6	VERTICAL CLAMP ADAPTOR (LINDSEY#2121)	DUCTILE IRON, HDG
7	TRUNNION BOLT SET	STEEL, HDG
8	BOLT SET (LE328-P1-1,2,3)	STAINLESS STEEL OR STEEL, HDG

CHARACTERISTICS

DIMENSIONS	RATING
Arcing Distance, mm	1168
Leakage (Creepage) Distance , mm	3378
Number of Sheds, 'N'	30
Core Diameter, mm	76.2

MECHANICAL VALUES	RATING
Maximum Design Cantilever Load, kN (Without Vertical Clamp Adaptor)	10.5
Routine Tension-load, kN (Without Vertical Clamp Adaptor)	33.4
Average Cantilever Failing Load, kN (Without Vertical Clamp Adaptor)	21.0

APPROX. NET WEIGHT, kg	RATING
	36.74

CHARACTERISTICS

ELECTRICAL VALUES	RATING
Wet Power Frequency Withstand Voltage, kV	350
Dry Lightning Impulse Withstand Voltage, kV	650

NOTES.

1. DIMENSIONS ARE IN METRIC (mm)
2. MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MINIMUM AVERAGE CANTILEVER BREAKING LOAD
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61952
   POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE)DISTANCE IS NOT LIMITED
4. ELECTRICAL TEST : IEC 61952 - 2002
5. BOTTOM FLANGE SHOULD BE INSTALLED BY 4 BOLTS OF THE FOLLOWING MATERIAL IN ORDER TO WITHSTAND AVERAGE CANTILEVER FAILING LOAD
6. WHERE USED AS A PILOT INSULATOR, THIS UNIT MUST BE USED WITH A SUPPORT STOOL SEE DRAWING 1091010487 SHEET 34
7. TO BE SUPPLIED COMPLETE WITH CONDUCTOR TRUNNION CLAMPS SUITABLE FOR 200mm AAAC

MATERIAL : SAE GRADE 9 (ISO 898 - 1:1999, CLASS 12.9) OR EQUIVALENT, GALVANISED

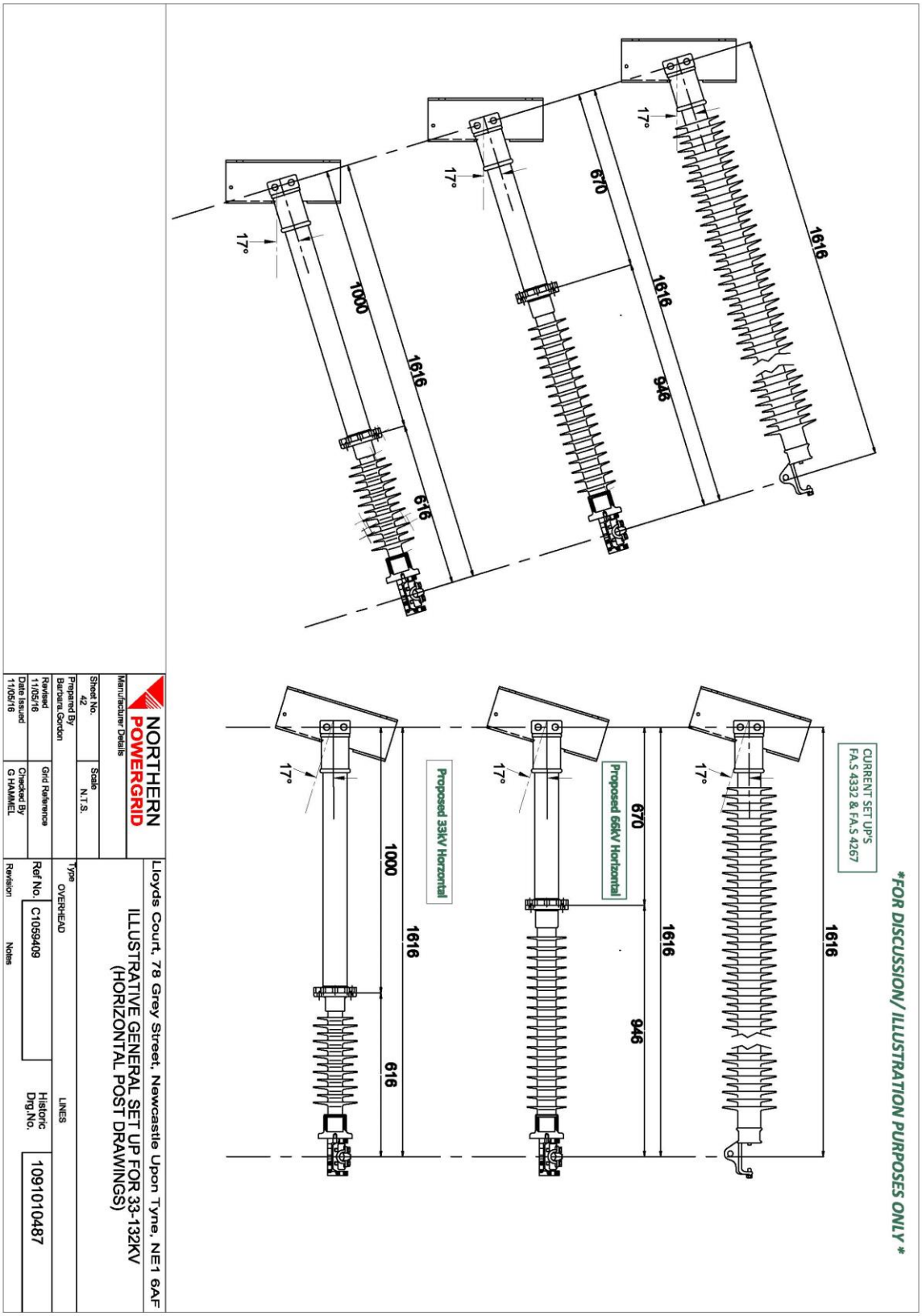
NORTHERN POWERGRID

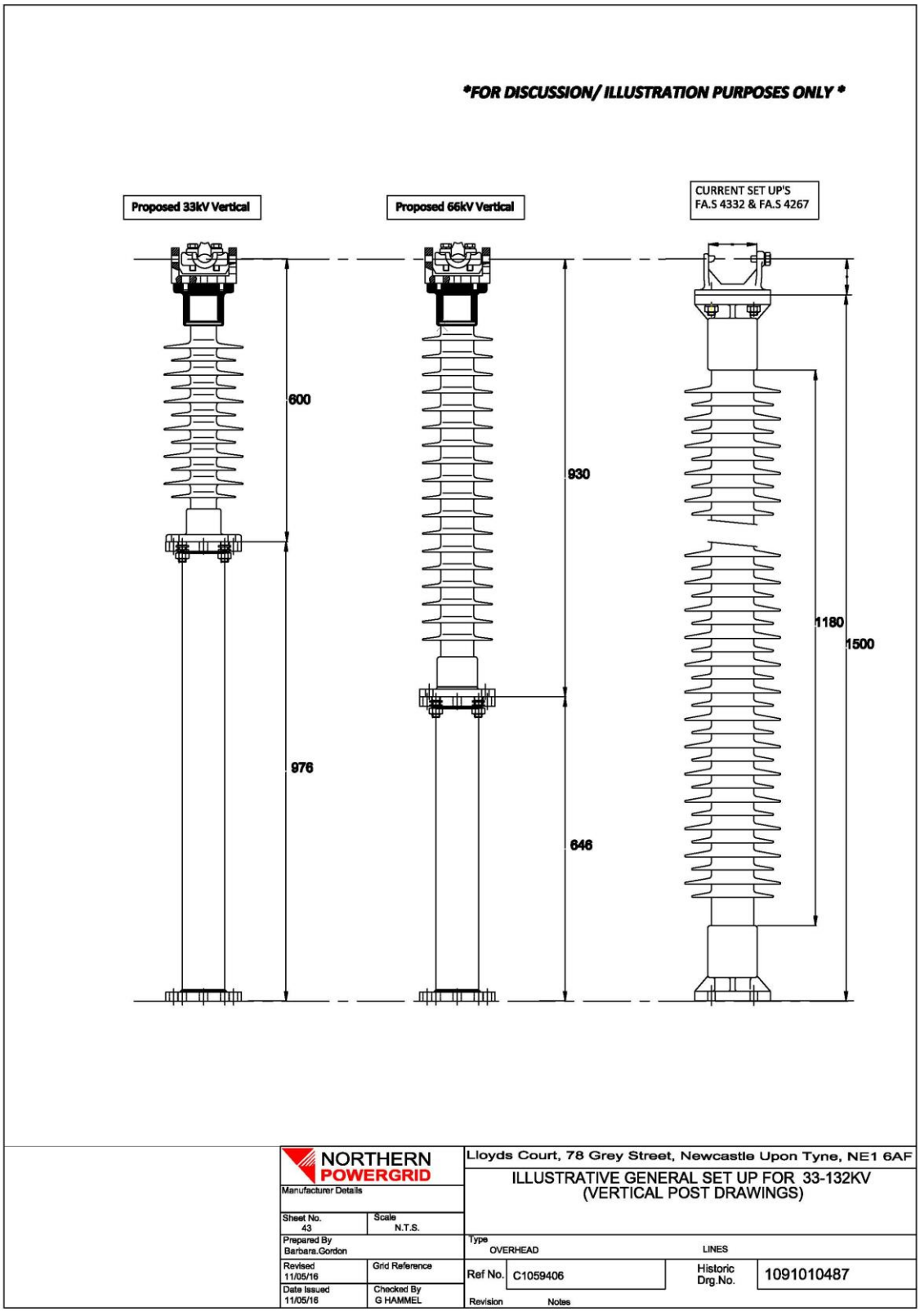
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF

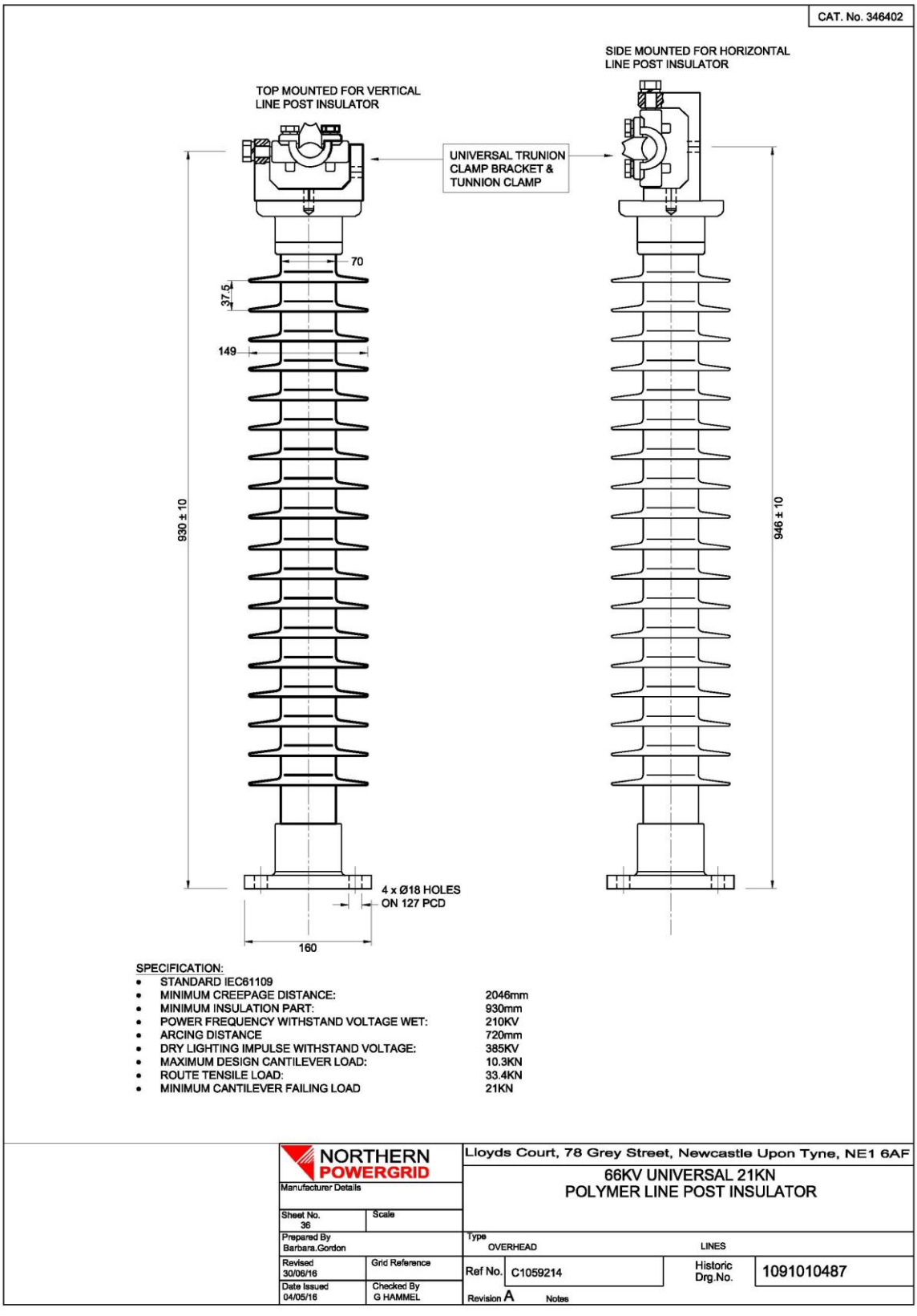
Manufacturer Details FA.S.4134
ALLIED INSULATORS LTD.
Sheet No. 1B
Scale 1:5
Prepared By Barbara.Gordon
Revised 21/12/2011
Date Issued 23/03/2007
Checked By G HAMMEL
Grid Reference

INSULATOR
132KV COMPOSITE VERTICAL POST / PILOT
(127MM PCD PEDASTEL BASE)

Type OVERHEAD
Ref No. C9467/68
Revision C
Notes
STANDARDS
Historic Drg.No. 1091010487

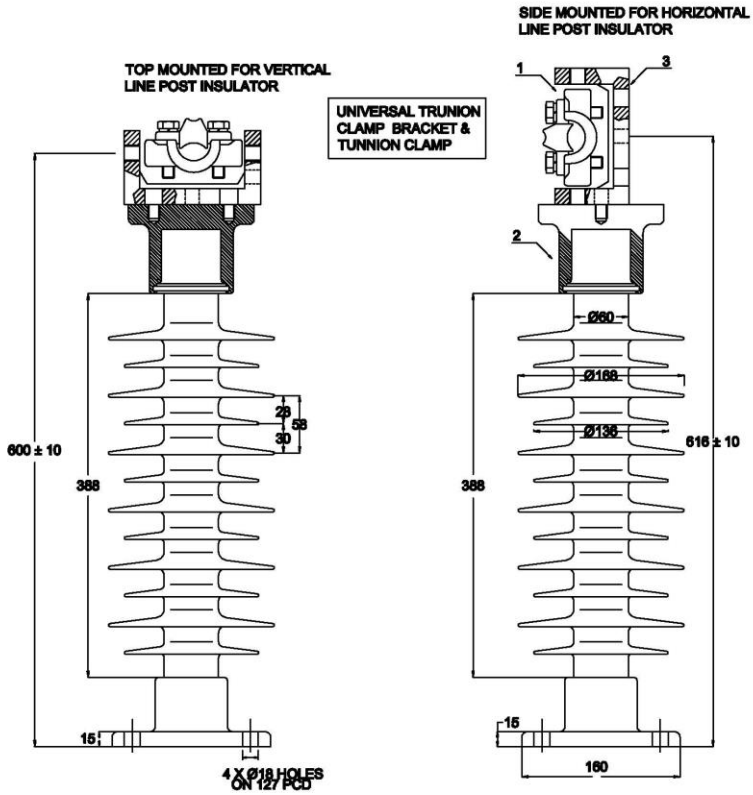

*FOR DISCUSSION/ ILLUSTRATION PURPOSES ONLY *
CURRENT SET UP'S FA.S 4332 & FA.S 4267
Proposed 66kV Horizontal
Proposed 33kV Horzontal
17°
1616
670
946
1000
616
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 42
Scale N.T.S.
Prepared By Barbara Gordon
Grid Reference
Revised 11/05/16
Checked By G HAMMEL
Date Issued 11/05/16
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ILLUSTRATIVE GENERAL SET UP FOR 33-132KV (HORIZONTAL POST DRAWINGS)
Type OVERHEAD LINES
Ref No. C1059409
Historic Drg.No. 1091010487
Revision
Notes


*FOR DISCUSSION/ ILLUSTRATION PURPOSES ONLY *
Proposed 33kV Vertical
Proposed 66kV Vertical
CURRENT SET UP'S
FA.S 4332 & FA.S 4267
600
976
930
646
1180
1500
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 43
Scale N.T.S.
Prepared By Barbara.Gordon
Revised 11/05/16
Grid Reference
Date Issued 11/05/16
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
ILLUSTRATIVE GENERAL SET UP FOR 33-132KV
(VERTICAL POST DRAWINGS)
Type OVERHEAD LINES
Ref No. C1059406
Historic Drg.No. 1091010487
Revision
Notes


CAT. No. 346402
SIDE MOUNTED FOR HORIZONTAL LINE POST INSULATOR
TOP MOUNTED FOR VERTICAL LINE POST INSULATOR
UNIVERSAL TRUNION CLAMP BRACKET & TUNNION CLAMP
70
37.5
149
930 ± 10
946 ± 10
4 x Ø18 HOLES ON 127 PCD
160
SPECIFICATION:
STANDARD IEC61109
MINIMUM CREEPAGE DISTANCE: 2046mm
MINIMUM INSULATION PART: 930mm
POWER FREQUENCY WITHSTAND VOLTAGE WET: 210KV
ARCING DISTANCE 720mm
DRY LIGHTING IMPULSE WITHSTAND VOLTAGE: 385KV
MAXIMUM DESIGN CANTILEVER LOAD: 10.3KN
ROUTE TENSILE LOAD: 33.4KN
MINIMUM CANTILEVER FAILING LOAD 21KN
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
66KV UNIVERSAL 21KN
POLYMER LINE POST INSULATOR
Sheet No. 36
Scale
Prepared By Barbara.Gordon
Type OVERHEAD LINES
Revised 30/06/16
Grid Reference
Ref No. C1059214
Historic Drg.No. 1091010487
Date Issued 04/05/16
Checked By G HAMMEL
Revision A
Notes

CAT.No. 346405

No:	Part Number	Part Description	Qty	Wt
1	FA. 6174	TRUNION CLAMP	1	
2	FA. 6175	UNIVERSAL END FITTING	1	
3	FA. 6176	UNIVERSAL TRUNION CLAMP BRACKET	1	



SPECIFICATION:

- STANDARD IEC61109
- MINIMUM CREEPAGE DISTANCE: 1400MM
- DRY ARCING DISTANCE: 400MM
- POWER FREQUENCY WITHSTAND VOLTAGE DRY: 100KV
- POWER FREQUENCY WITHSTAND VOLTAGE WET: 90KV
- LIGHTNING IMPULSE WITHSTAND VOLTAGE: 200KV
- MINIMUM CANTILEVER FAILING LOAD: 21KN
- MAXIMUM DESIGN CANTILEVER LOAD: 10KN

NORTHERN POWERGRID
Manufacturer Details

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

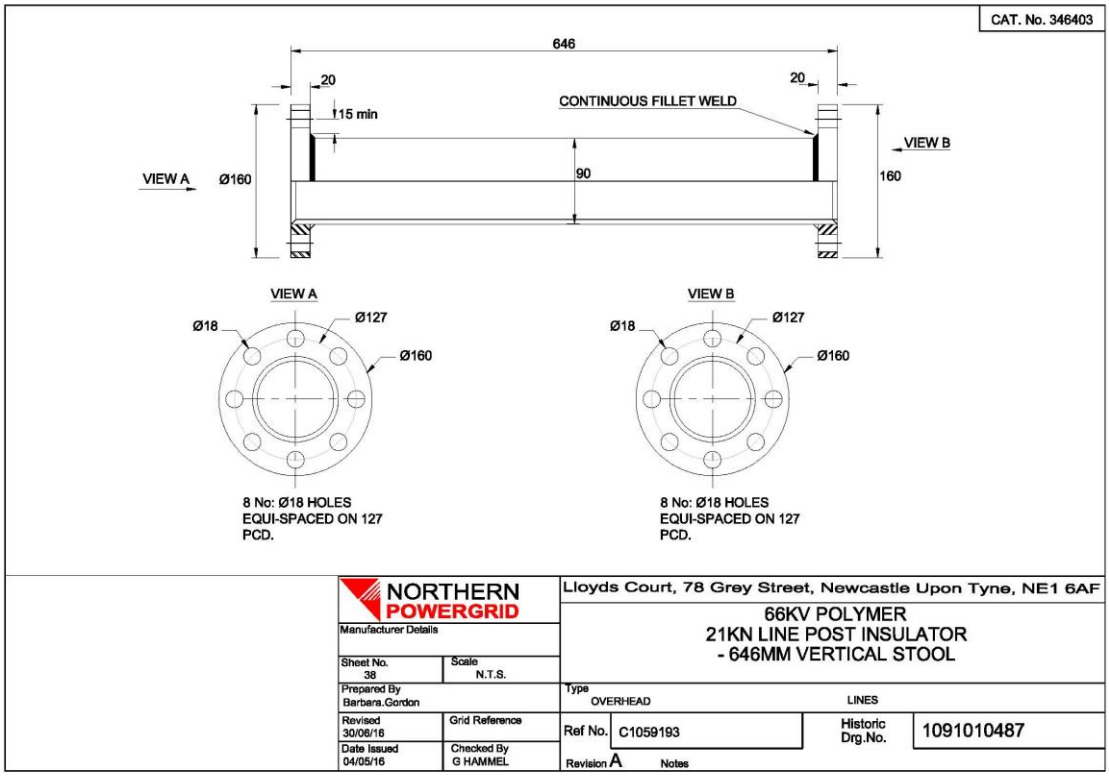
33KV UNIVERSAL 21KN POLYMER LINE POST INSULATOR

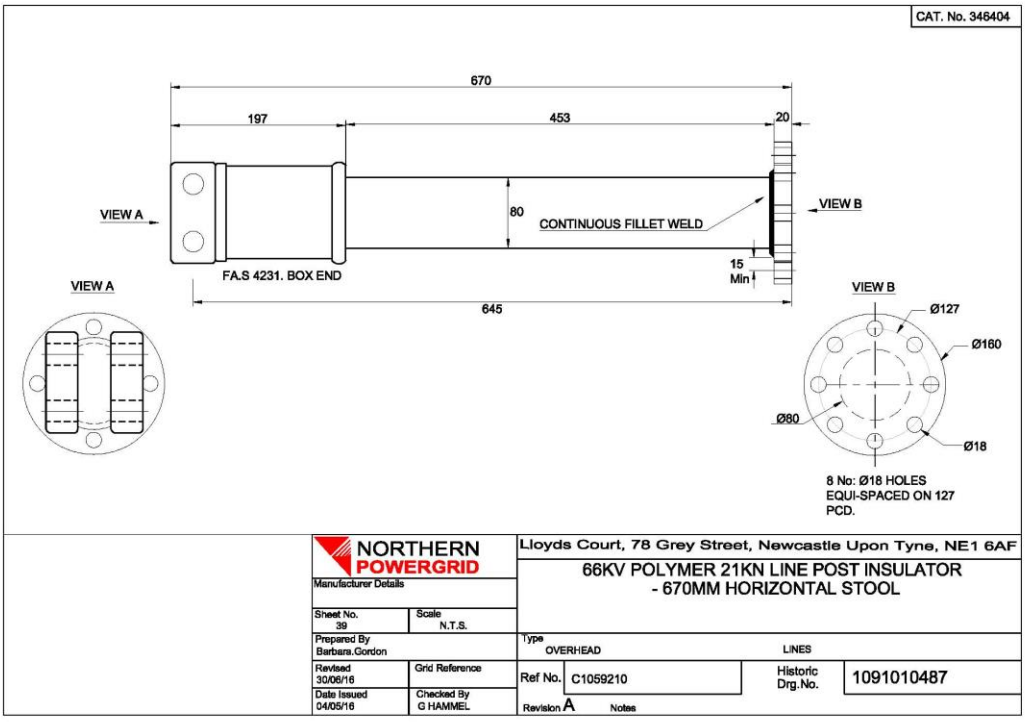
Sheet No. 37	Scale N.T.S.
Prepared By Barbara.Gordon	
Revised 30/06/16	Grid Reference
Date Issued 11/05/16	Checked By G HAMMEL

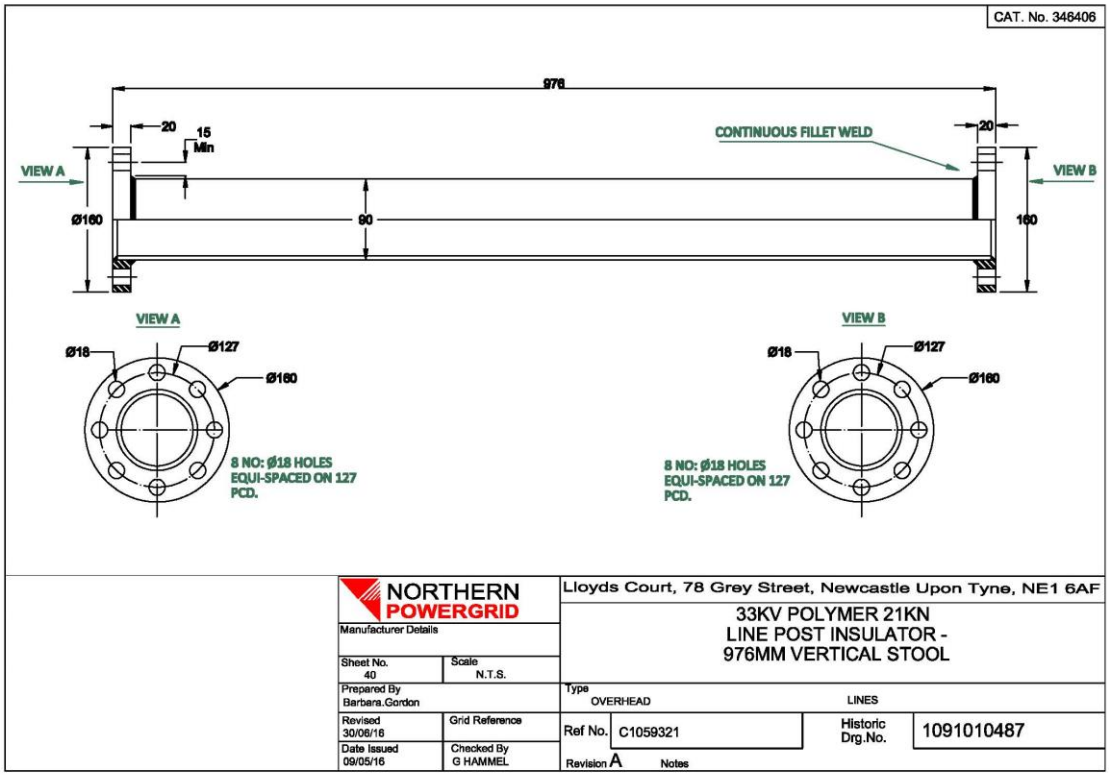
Type OVERHEAD LINES

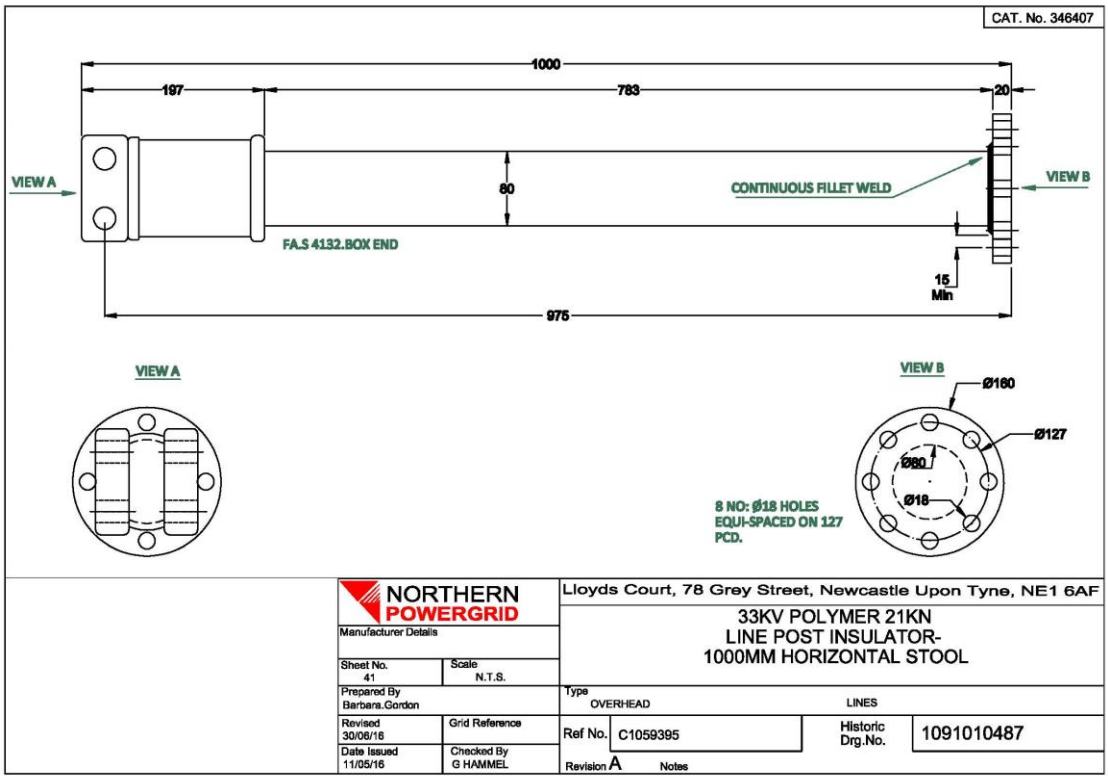
Ref No. C1059404 Historic Drg.No. 1091010487

Revision A Notes


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


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


CAT. No. 346406
976
20
15
Min
CONTINUOUS FILLET WELD
20
VIEW A
VIEW B
Ø160
90
160
VIEW A
Ø18
Ø127
Ø160
8 NO: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
VIEW B
Ø18
Ø127
Ø160
8 NO: Ø18 HOLES
EQUI-SPACED ON 127
PCD.
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33KV POLYMER 21KN
LINE POST INSULATOR -
976MM VERTICAL STOOL
Sheet No. 40
Scale N.T.S.
Prepared By Barbara.Gordon
Type OVERHEAD LINES
Revised 30/06/16
Grid Reference
Date Issued 09/05/16
Checked By G HAMMEL
Ref No. C1059321
Historic Drg.No. 1091010487
Revision A
Notes


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

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

TECHNICAL DATA

SPECIFICATION APPLIED : IEC61109. LATEST ISSUE

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

NOTES

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

NORTHERN POWERGRID

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

Manufacturer Details FAS.4117
ALLIED INSULATORS LTD

Sheet No. 28

Scale 1:5

Prepared By John.Brooke

Type OVERHEAD LINES

Grid Reference

Ref No. C947326

Historic Drg.No. 10910104487

Revised 08/06/13

Date Issued 11/04/07

Checked By G HAMMEL

Revision A

Notes

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

SCHEDULE OF PARTS

ITEM No	PART No	No OFF	DESCRIPTION
1		1	FLANGE END GALVANISED
2	FA.8016.MOD	1	ARCING RING GALVANISED
3	FA / S. 4134	1	POLYMER INSULATOR UNIT GREY
4		1	FLANGE END GALVANISED
5		1	CONDUCTOR CLAMP
6	FA.8016.MOD	1	ARCING RING GALVANISED
7	FA . 6021	1	POKER DEVICE TO DOWN GRADE GAP 12 DIA ROD

NOTES

1. NOTES AND CHARACTERISTICS AS DRAWING FA.S.4134
2. ITEM 7 POKER DEVICE USED WHEN 66kV GAP REQUIRED

NORTHERN POWERGRID

Manufacturer Details FA/S.4134.A
ALLIED INSULATORS LTD

Drawn No. 32
Scale N.T.S.

Prepared By John Brooks

Revised 09/08/13
Date Issued 11/04/07

Grid Reference

Checked By G HAMMEL

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

INSULATOR ASSEMBLY
66/132KV COMPOSITE VERTICAL POST/PILOT ASSEMBLY
(APPROACH / EARTHED SITUATIONS)
FOR USE WITH 1 09 101 0487 SHEET 18

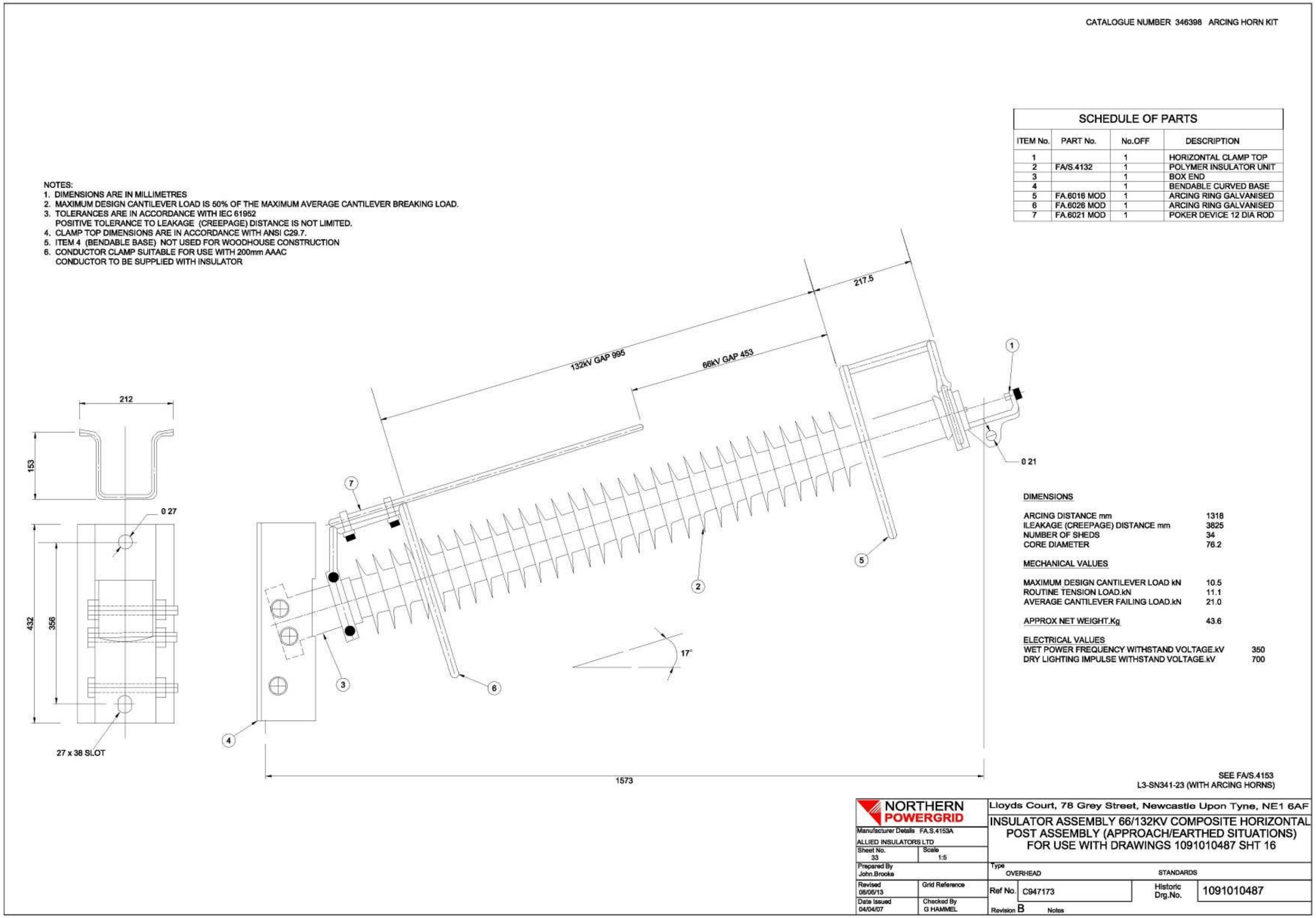
Type OVERHEAD LINES

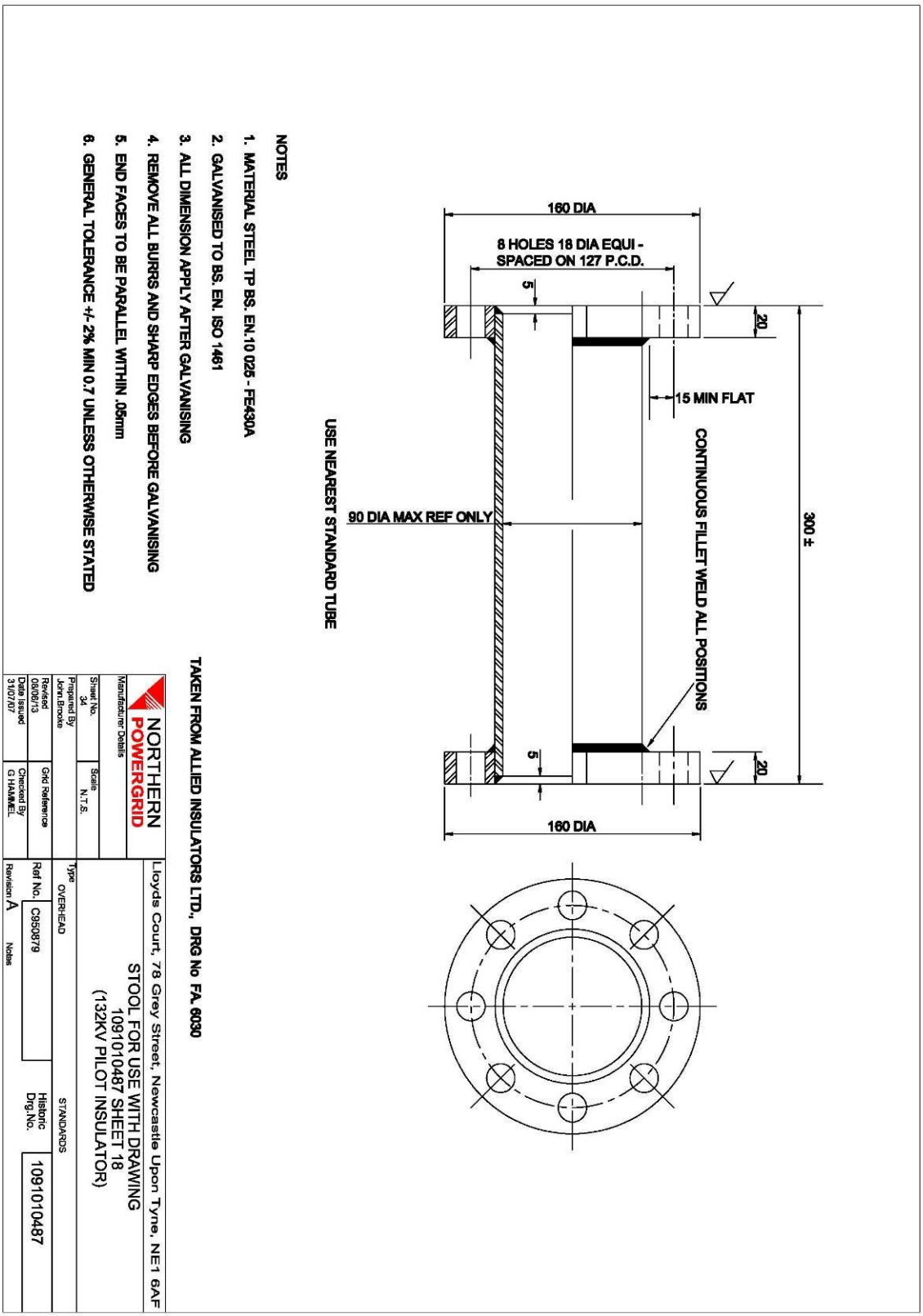
Ref No. C947338

Historic Drg.No. 1091010487

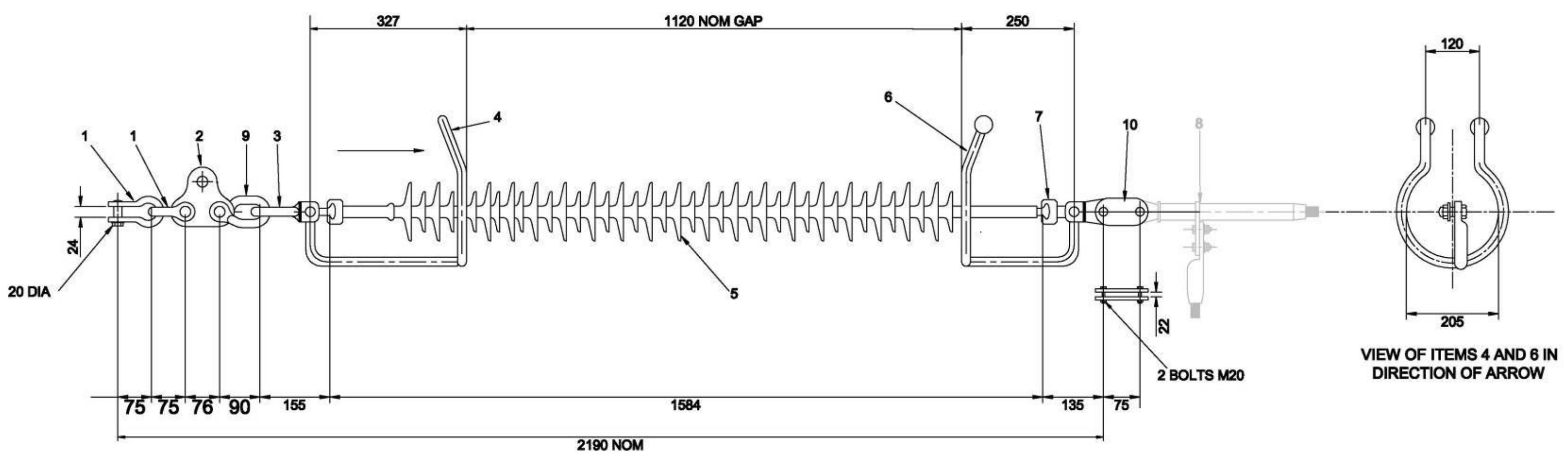
Revision A

Notes


CATALOGUE NUMBER 346398 ARCING HORN KIT
SCHEDULE OF PARTS
ITEM No. | PART No. | No.OFF | DESCRIPTION
1 | | 1 | HORIZONTAL CLAMP TOP
2 | FA/S.4132 | 1 | POLYMER INSULATOR UNIT
3 | | 1 | BOX END
4 | | 1 | BENDABLE CURVED BASE
5 | FA.6016 MOD | 1 | ARCING RING GALVANISED
6 | FA.6026 MOD | 1 | ARCING RING GALVANISED
7 | FA.6021 MOD | 1 | POKER DEVICE 12 DIA ROD
NOTES:
1. DIMENSIONS ARE IN MILLIMETRES
2. MAXIMUM DESIGN CANTILEVER LOAD IS 50% OF THE MAXIMUM AVERAGE CANTILEVER BREAKING LOAD.
3. TOLERANCES ARE IN ACCORDANCE WITH IEC 61952
POSITIVE TOLERANCE TO LEAKAGE (CREEPAGE) DISTANCE IS NOT LIMITED.
4. CLAMP TOP DIMENSIONS ARE IN ACCORDANCE WITH ANSI C29.7.
5. ITEM 4 (BENDABLE BASE) NOT USED FOR WOODHOUSE CONSTRUCTION
6. CONDUCTOR CLAMP SUITABLE FOR USE WITH 200mm AAAC
CONDUCTOR TO BE SUPPLIED WITH INSULATOR
217.5
132kV GAP 995
66kV GAP 453
212
153
0 27
432
356
27 x 38 SLOT
0 21
17°
1573
DIMENSIONS
ARCING DISTANCE mm 1318
ILEAKAGE (CREEPAGE) DISTANCE mm 3825
NUMBER OF SHEDS 34
CORE DIAMETER 76.2
MECHANICAL VALUES
MAXIMUM DESIGN CANTILEVER LOAD kN 10.5
ROUTINE TENSION LOAD.kN 11.1
AVERAGE CANTILEVER FAILING LOAD.kN 21.0
APPROX NET WEIGHT.Kg 43.6
ELECTRICAL VALUES
WET POWER FREQUENCY WITHSTAND VOLTAGE.kV 350
DRY LIGHTING IMPULSE WITHSTAND VOLTAGE.kV 700
SEE FA/S.4153
L3-SN341-23 (WITH ARCING HORNS)
NORTHERN POWERGRID
Manufacturer Details FA.S.4153A
ALLIED INSULATORS LTD
Sheet No. 33
Scale 1:5
Prepared By John.Brooke
Revised 08/06/13
Grid Reference
Date Issued 04/04/07
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
INSULATOR ASSEMBLY 66/132KV COMPOSITE HORIZONTAL POST ASSEMBLY (APPROACH/EARTHED SITUATIONS) FOR USE WITH DRAWINGS 1091010487 SHT 16
Type OVERHEAD
STANDARDS
Ref No. C947173
Historic Drg.No. 1091010487
Revision B
Notes


160 DIA
8 HOLES 18 DIA EQUI - SPACED ON 127 P.C.D.
5
20
15 MIN FLAT
CONTINUOUS FILLET WELD ALL POSITIONS
300 ±
90 DIA MAX REF ONLY
USE NEAREST STANDARD TUBE
5
20
160 DIA
NOTES
1. MATERIAL STEEL TP BS. EN.10 025 - FE430A
2. GALVANISED TO BS. EN. ISO 1461
3. ALL DIMENSION APPLY AFTER GALVANISING
4. REMOVE ALL BURRS AND SHARP EDGES BEFORE GALVANISING
5. END FACES TO BE PARALLEL WITHIN .05mm
6. GENERAL TOLERANCE +/- 2% MIN 0.7 UNLESS OTHERWISE STATED
TAKEN FROM ALLIED INSULATORS LTD., DRG No FA. 6030
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 34
Scale N.T.S.
Prepared By John Brooke
Revised 08/08/13
Date Issued 31/07/07
Grid Reference
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
STOOL FOR USE WITH DRAWING 1091010487 SHEET 18 (132KV PILOT INSULATOR)
Type OVERHEAD
STANDARDS
Ref No. C9508/79
Historic Drg.No. 1091010487
Revision A
Notes

CATALOGUE NUMBER 251552



SCHEDULE OF PARTS

ITEM No	PART No	No OFF	DESCRIPTION	MATERIAL
1	27.10.10	2	SHACKLE GALVANISED	D.F.S.
2	28 / 21	1	LANDING PLATE GALVANISED	STEEL
3	21.22.90.60X	1	BALL EYE 90° GALVANISED	D.F.S.
4	43.41.98.28 TYPE	1	ARCING RING GALVANISED	D.F.S.
5	FA / S. 4117	1	POLYMER INSULATOR ASSEMBLY GREY	POLYMER
6	43.43.98.80	1	ARCING RING GALVANISED	D.F.S.
7	24.92.40.20	1	SOCKET TONGUE GALVANISED	D.F.S.
8	400281	1	COMPRESSION DEAD END CLAMP FOR POPLAR(NOT SUPPLIED BY A.I)	AL ALLOY
9	27.32.10X	1	SHACKLE 90° GALVANISED	D.F.S.
10	28.28.88	1	EXTENSION LINK ASSEMBLY GALVANISED	STEEL

NOTES

MINIMUM BREAKING STRENGTH OF SET (LESS CLAMP) 125kN

THE CLAMP WILL DEVELOP 95% OF THE U.T.S. OF THE CONDUCTOR

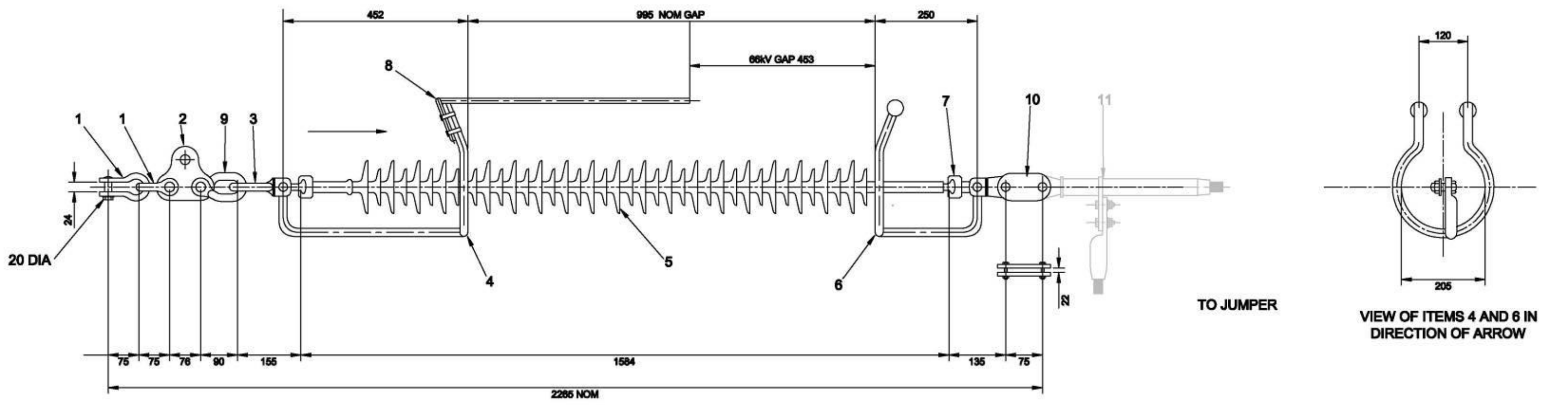
LINE VOLTAGE 132kV

CONDUCTOR AAAC POPLAR DIA 20.09mm

BALL AND SOCKET COUPLING TO IEC 60120 / 20

NORTHERN POWERGRID	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details FA / S.4115 ALLIED INSULATORS LTD	INSULATOR ASSEMBLY 66 / 132KV TENSION SET (NORMAL UNEARTHED SITUATIONS) FOR USE WITH DRAWING 1091010487 SHEET 29
Sheet No. 30 / Scale N.T.S.	
Prepared By John.Brooke	Type OVERHEAD LINES
Revised 08/06/13 / Grid Reference	Ref No. C947434 / Historic Drg.No. 1091010487
Date Issued 13/04/07 / Checked By G HAMMEL	Revision B / Notes

CATALOGUE No. 251553 132kV OPERATION
251554 66/33kV OPERATION



NOTES

ITE M 10 POKER DEVICE USED WHEN 66kV GAP IS REQUIRED

MINIMUM BREAKING STRENGTH OF SET (LESS CLAMP) 125kN

THE CLAMP WILL DEVELOP 95% OF THE U.T.S. OF THE CONDUCTOR

LINE VOLTAGE 132kV

CONDUCTOR AAAC POPLAR DIA 20.09mm

BALL AND SOCKET COUPLING TO IEC 60120 / 20

SCHEDULE OF PARTS

ITEM No	PART No	No OFF	DESCRIPTION	MATERIAL
1	27.10.10	2	SHACKLE GALVANISED	D.F.S.
2	28 / 21	1	LANDING PLATE GALVANISED	STEEL
3	21.22.90.60X	1	BALL EYE 90° GALVANISED	D.F.S.
4	43.41.98.28 TYPE	1	ARCING RING GALVANISED	D.F.S.
5	FA / S. 4117	1	POLYMER INSULATOR ASSEMBLY GREY	POLYMER
6	43.43.98.50	1	ARCING RING GALVANISED	D.F.S.
7	24.92.40.20	1	SOCKET TONGUE GALVANISED	D.F.S.
8	FA6022	1	POKER DEVICE FOR 66kV GAP X = 562	12 DIA STEEL ROD
9	27.32.10X	1	SHACKLE 90° GALVANISED	D.F.S.
10	26.26.66	1	EXTENSION LINK ASSEMBLY GALVANISED	STEEL
11	400261	1	COMPRESSION DEAD END FOR POPLAR (NOT SUPPLIED BY A.I.)	AL ALLOY

NORTHERN POWERGRID

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

Manufacturer Details FA / S.4115.A
ALLIED INSULATORS LTD

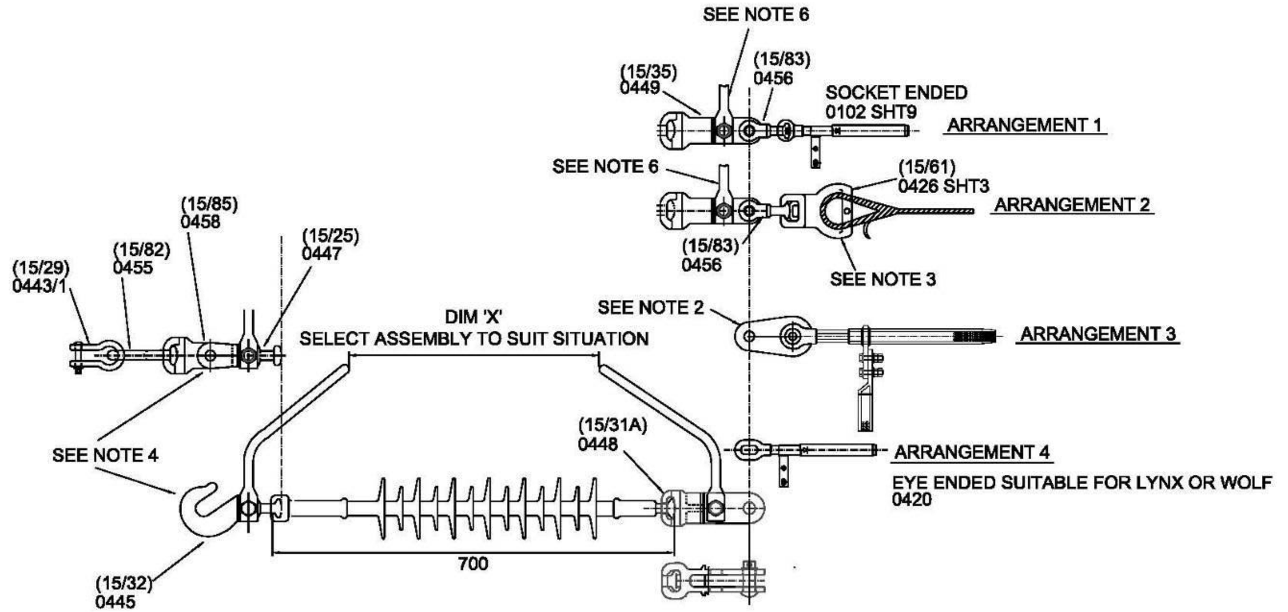
INSULATOR ASSEMBLY
66 / 132KV TENSION SET
(APPROACH / EARTHED SITUATIONS)
FOR USE WITH DRAWING 1 09 101 0487 SHEET 29

Sheet No. 31 | Scale N.T.S.

Prepared By John.Brooke | Type OVERHEAD | LINES

Revised 08/06/13 | Grid Reference | Ref No. C947374 | Historic Drg.No. 1091010487

Date Issued 11/04/07 | Checked By G HAMMEL | Revision B | Notes

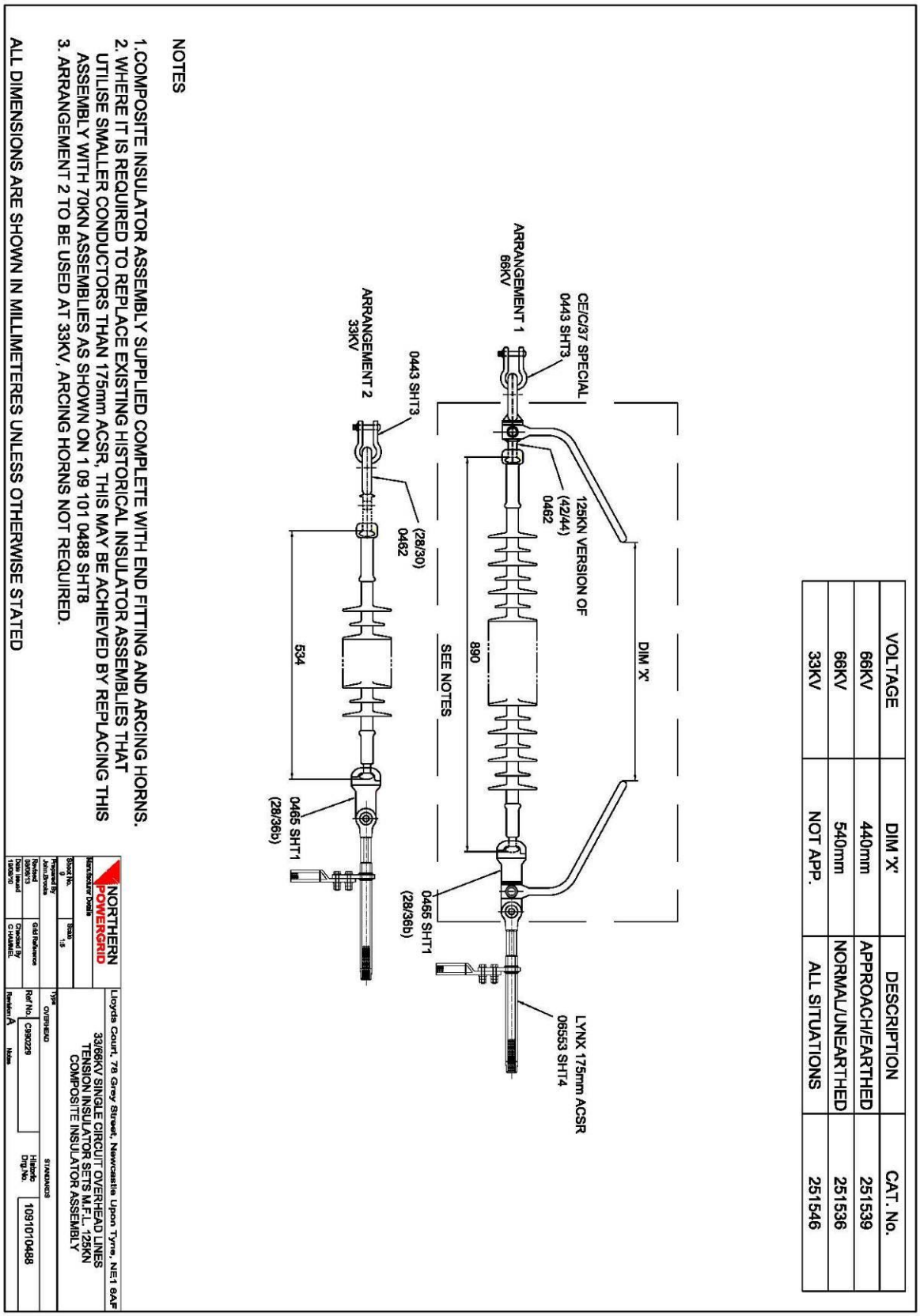


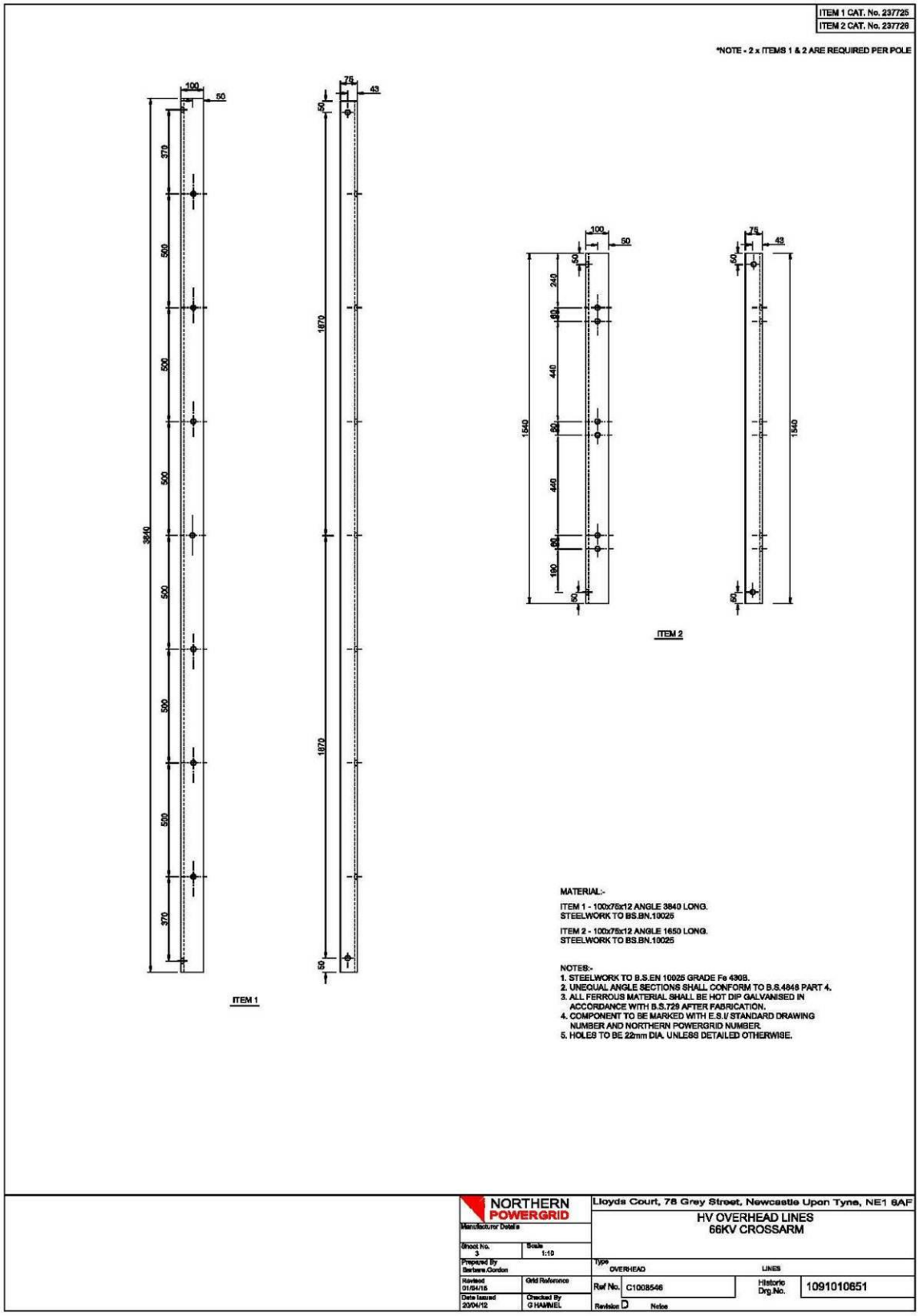
NOTES:-
1. ITEM Nos REFER TO 1 09 1 1 DRAWING SERIES FOR COMPONENTS.
2. USE CLAMP ADAPTOR FOR CLEVIS ENDED CLAMP
   (eg. ALCANGRIP PATTERN 450 FOR 150mm sq (37/2.59) ASCR
   175mm sq (37/2.79) ASCR)
   NOT REQUIRED FOR TONGUE OR EYE ENDED ANCHOR CLAMPS
   eg. CCL HEXPRESS DESIGN.
3. LARGE RADIUS SOCKET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

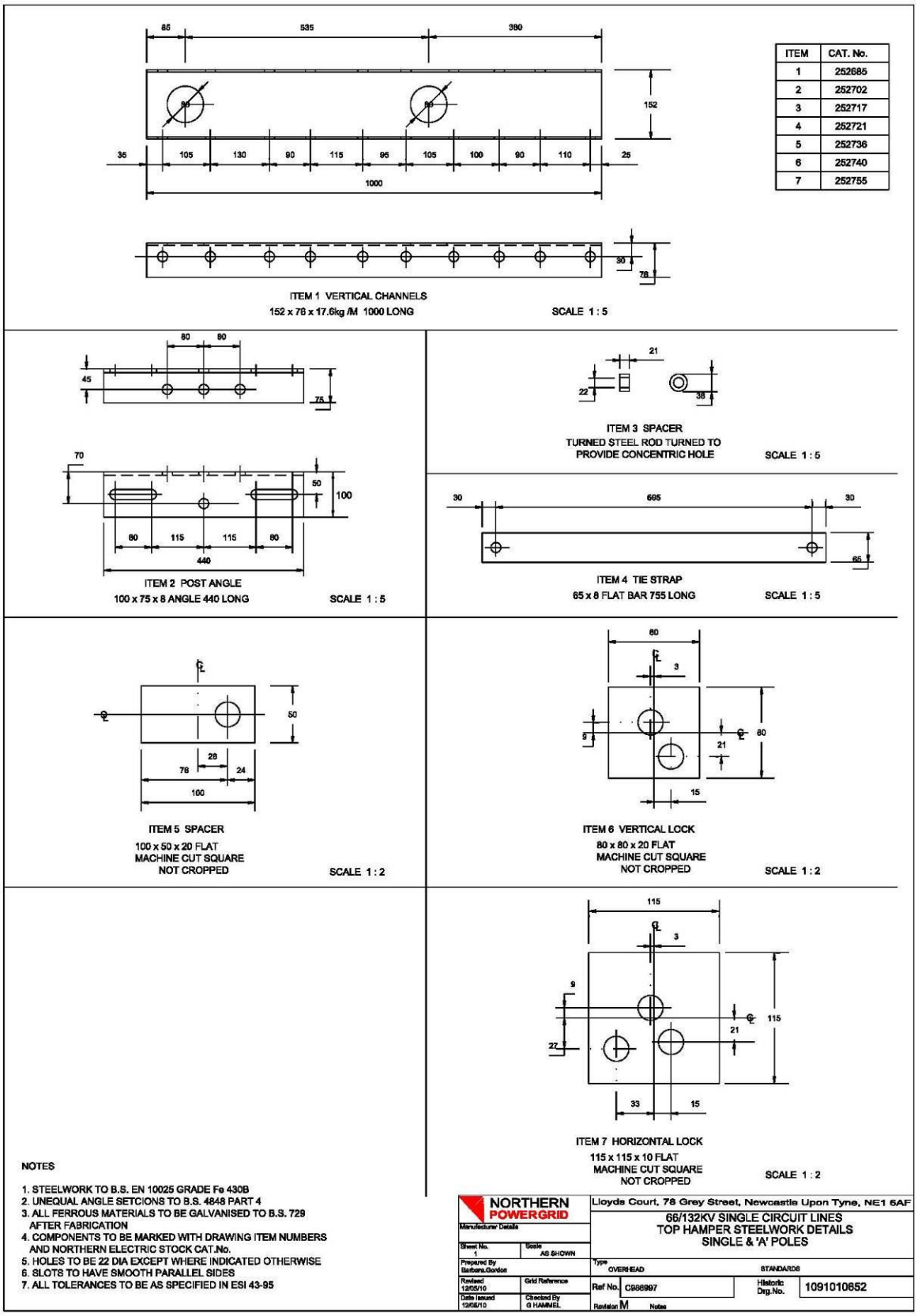
VOLTAGE	DIM 'X'	DESCRIPTION	CAT. No.
66KV	440mm	APPROACH/EARTHED	251559
66KV	540mm	NORMAL/UNEARTHED	251560
33KV	NOT APP.	ALL SITUATIONS	216150

ALL DIMENSIONS ARE SHOWN IN MILLIMETERES UNLESS OTHERWISE STATED

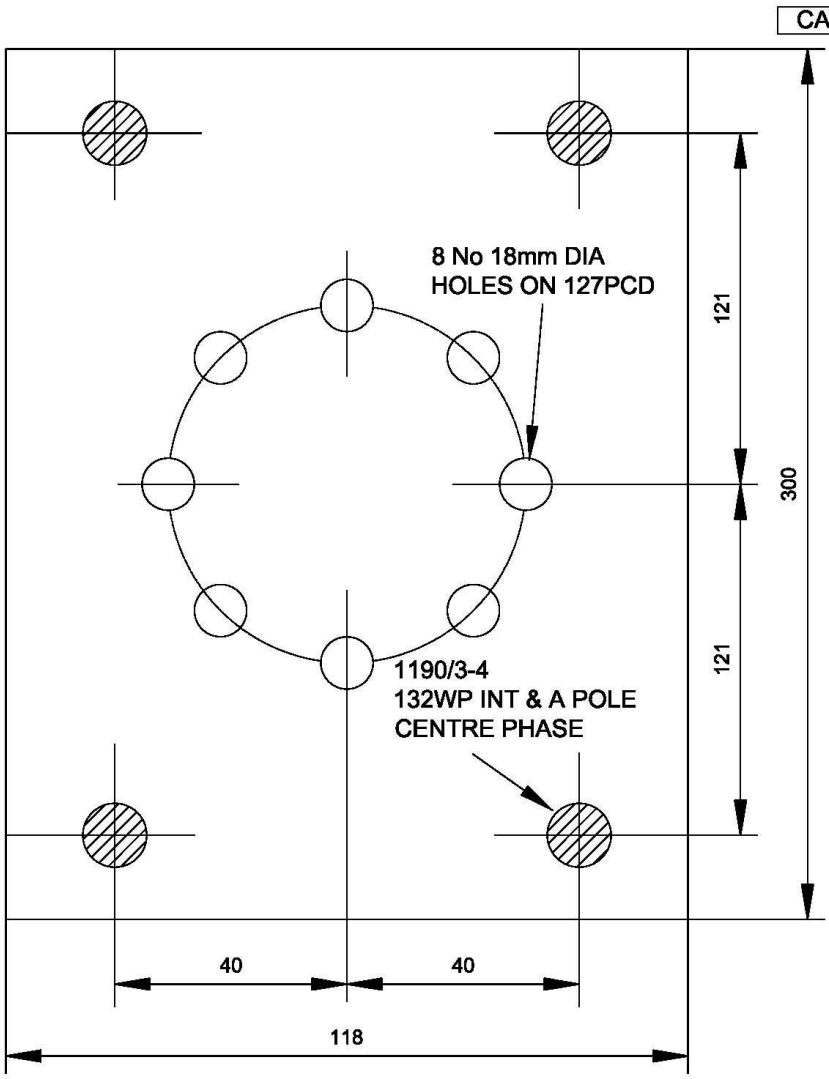
NORTHERN POWERGRID Manufacturer Details	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Sheet No. 6 / Scale 1:5	66KV SINGLE CIRCUIT OVERHEAD LINES TENSION INSULATOR SETS M.F.L. 70KN COMPOSITE INSULATOR ASSEMBLY
Prepared By John.Brooke	Type OVERHEAD STANDARDS
Revised 08/08/13 / Grid Reference	Ref No. C990199 / Historic Drg.No. 1091010488
Date Issued 18/08/10 / Checked By G HAMMEL	Revision A Notes


VOLTAGE
DIM 'X'
DESCRIPTION
CAT. No.
66KV
440mm
APPROACH/EARTHED
251539
66KV
540mm
NORMAL/UNEARTHED
251536
33KV
NOT APP.
ALL SITUATIONS
251546
CE/C/37 SPECIAL
0443 SHT3
ARRANGEMENT 1
66KV
125KN VERSION OF
(42/44)
0462
DIM 'X'
890
SEE NOTES
LYNX 175mm ACSR
06553 SHT4
0455 SHT1
(28/36b)
0443 SHT3
ARRANGEMENT 2
33KV
(28/30)
0462
534
0465 SHT1
(28/36b)
NOTES
1.COMPOSITE INSULATOR ASSEMBLY SUPPLIED COMPLETE WITH END FITTING AND ARCING HORNS.
2. WHERE IT IS REQUIRED TO REPLACE EXISTING HISTORICAL INSULATOR ASSEMBLIES THAT UTILISE SMALLER CONDUCTORS THAN 175mm ACSR, THIS MAY BE ACHIEVED BY REPLACING THIS ASSEMBLY WITH 70KN ASSEMBLIES AS SHOWN ON 1 09 101 0488 SHT8
3. ARRANGEMENT 2 TO BE USED AT 33KV, ARCING HORNS NOT REQUIRED.
ALL DIMENSIONS ARE SHOWN IN MILLIMETERES UNLESS OTHERWISE STATED
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
33/66KV SINGLE CIRCUIT OVERHEAD LINES
TENSION INSULATOR SETS M.F.L. 125KN
COMPOSITE INSULATOR ASSEMBLY
1091010488


ITEM 1 CAT. No. 237725
ITEM 2 CAT. No. 237726
*NOTE - 2 x ITEMS 1 & 2 ARE REQUIRED PER POLE
ITEM 1
ITEM 2
MATERIAL:-
ITEM 1 - 100x76x12 ANGLE 3840 LONG. STEELWORK TO BS.EN.10025
ITEM 2 - 100x76x12 ANGLE 1650 LONG. STEELWORK TO BS.EN.10025
NOTES:-
1. STEELWORK TO B.S.EN 10025 GRADE Fe 430B.
2. UNEQUAL ANGLE SECTIONS SHALL CONFORM TO B.S.4848 PART 4.
3. ALL FERROUS MATERIAL SHALL BE HOT DIP GALVANISED IN ACCORDANCE WITH B.S.729 AFTER FABRICATION.
4. COMPONENT TO BE MARKED WITH E.S.I/ STANDARD DRAWING NUMBER AND NORTHERN POWERGRID NUMBER.
5. HOLES TO BE 22mm DIA. UNLESS DETAILED OTHERWISE.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
HV OVERHEAD LINES
66KV CROSSARM
Ref No. C1008546
Historic Drg.No. 1091010651
Revision D



ITEM	CAT. No.
1	252685
2	252702
3	252717
4	252721
5	252736
6	252740
7	252755

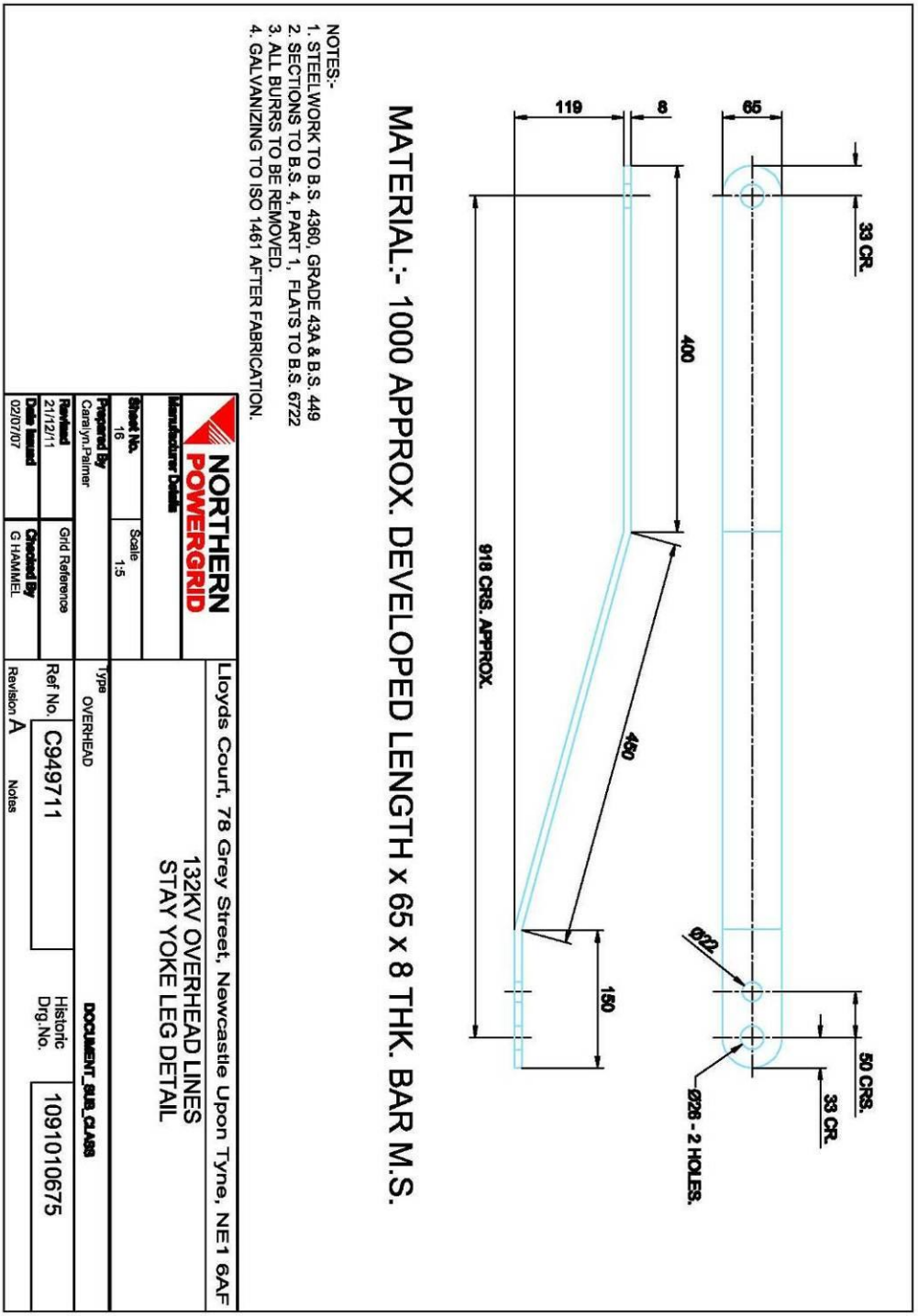


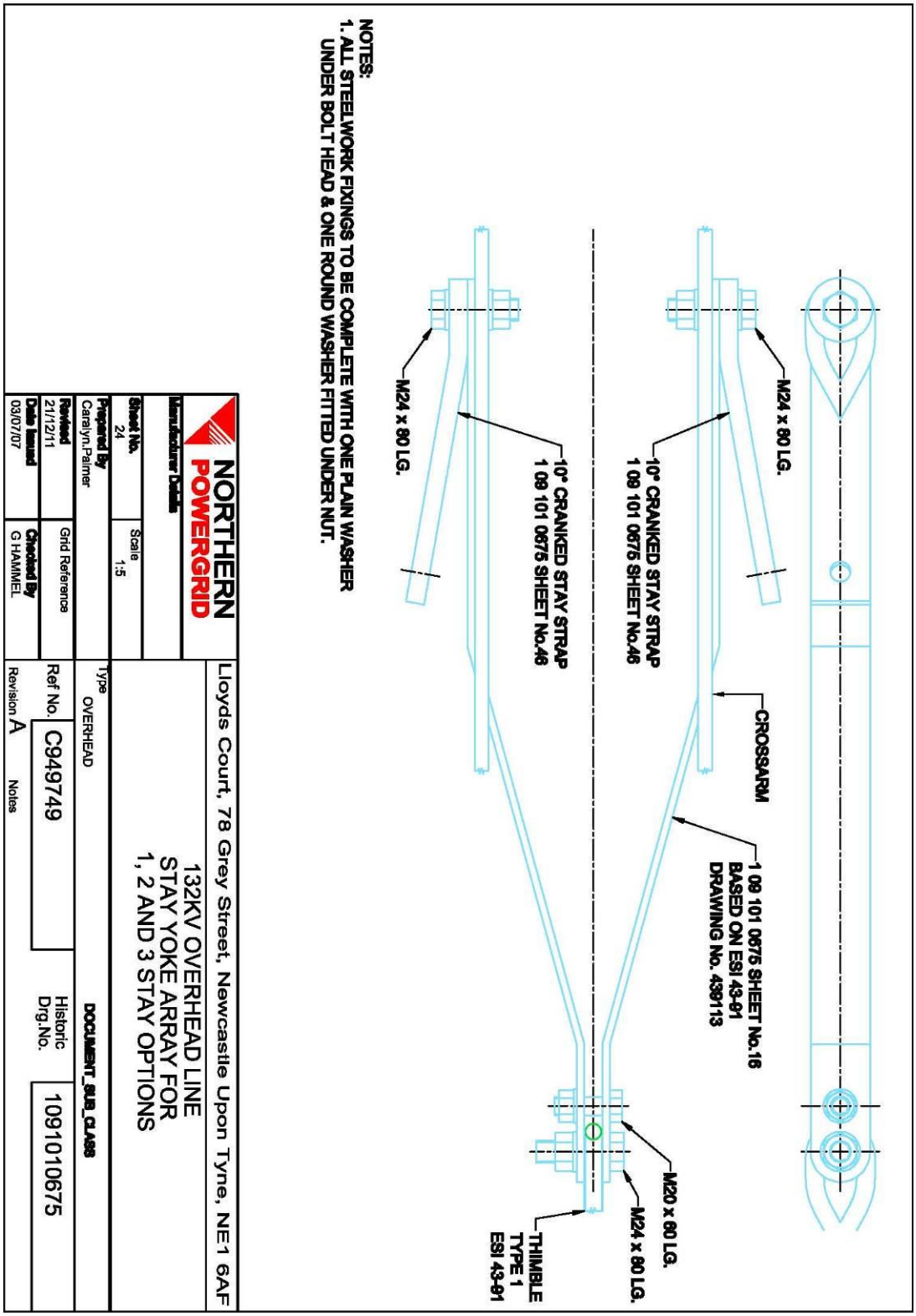
ITEM 6 300 x 235 x 15 STEEL PLATE

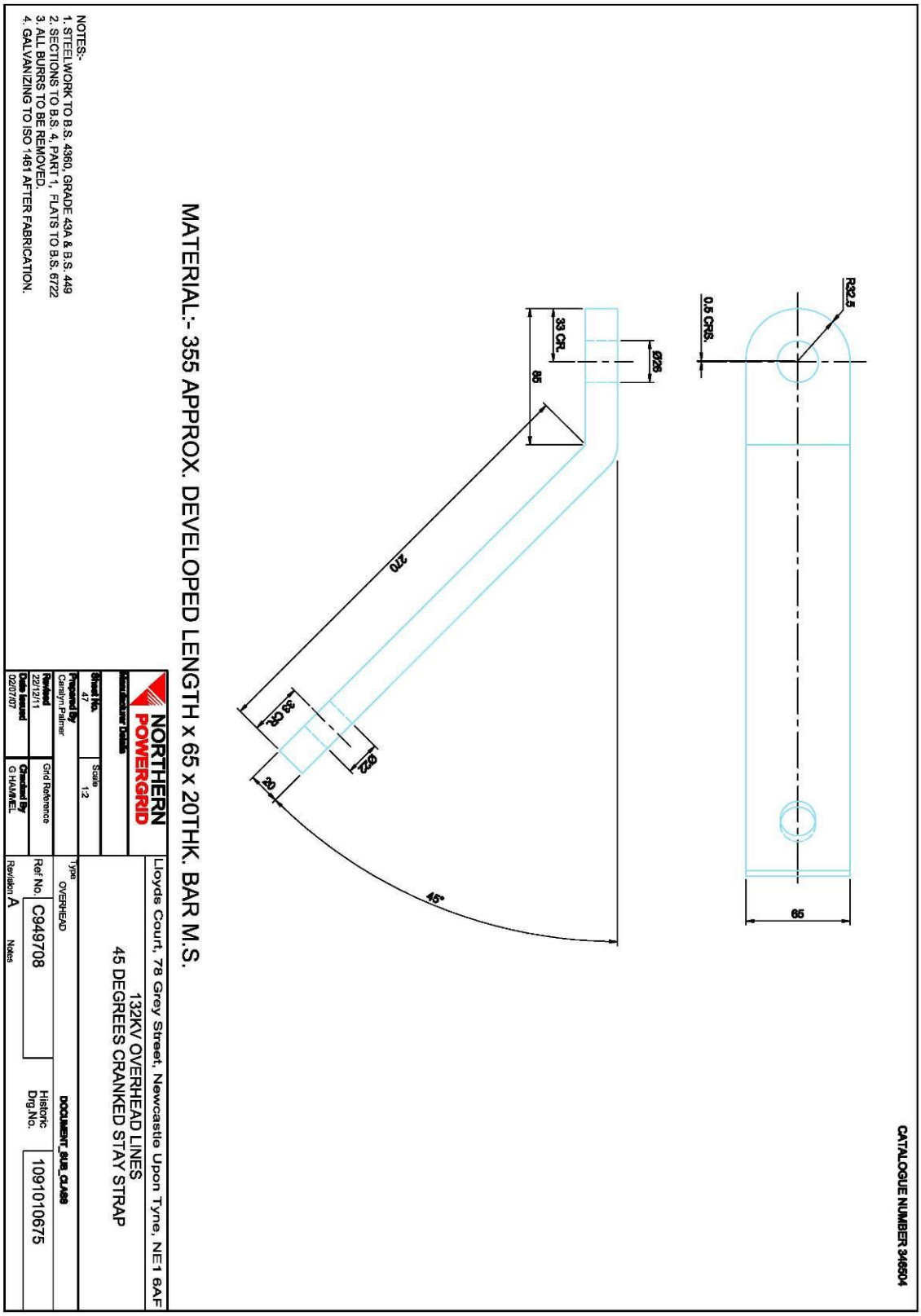
NOTES:-

1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. GALVANISING TO B.S. 729 AFTER FABRICATION
4. HOLES ARE 22mm DIA. EXCEPT HOLES MARKED OTHERWISE
5. 22mm DIA. SLOTS TO HAVE STRAIGHT PARALLEL SIDES.

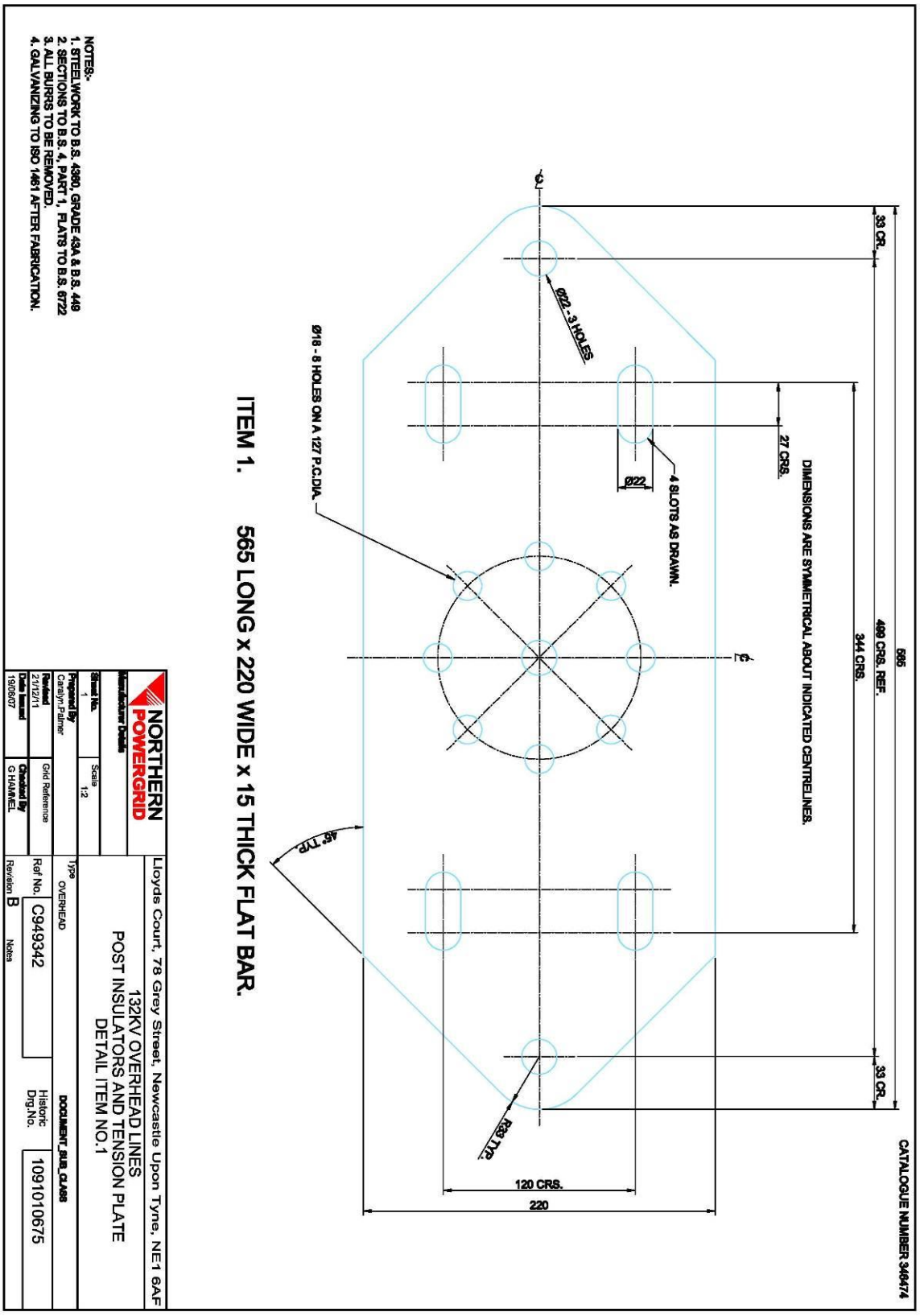
CE Electric UK Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF 132KV SINGLE CIRCUIT OVERHEAD LINES POLYMERIC INSULATOR - POST INSULATOR BASE PLATE ITEM 6
Sheet No. 6	Scale 1:2	
Prepared By Barbara.Gordon		Type OVERHEAD LINES
Revised 12/08/08	Grid Reference	Ref No. C966011 / Historic Drg.No. 1091010670
Date Issued 12/08/08	Checked By G HAMMEL	Revision B Notes

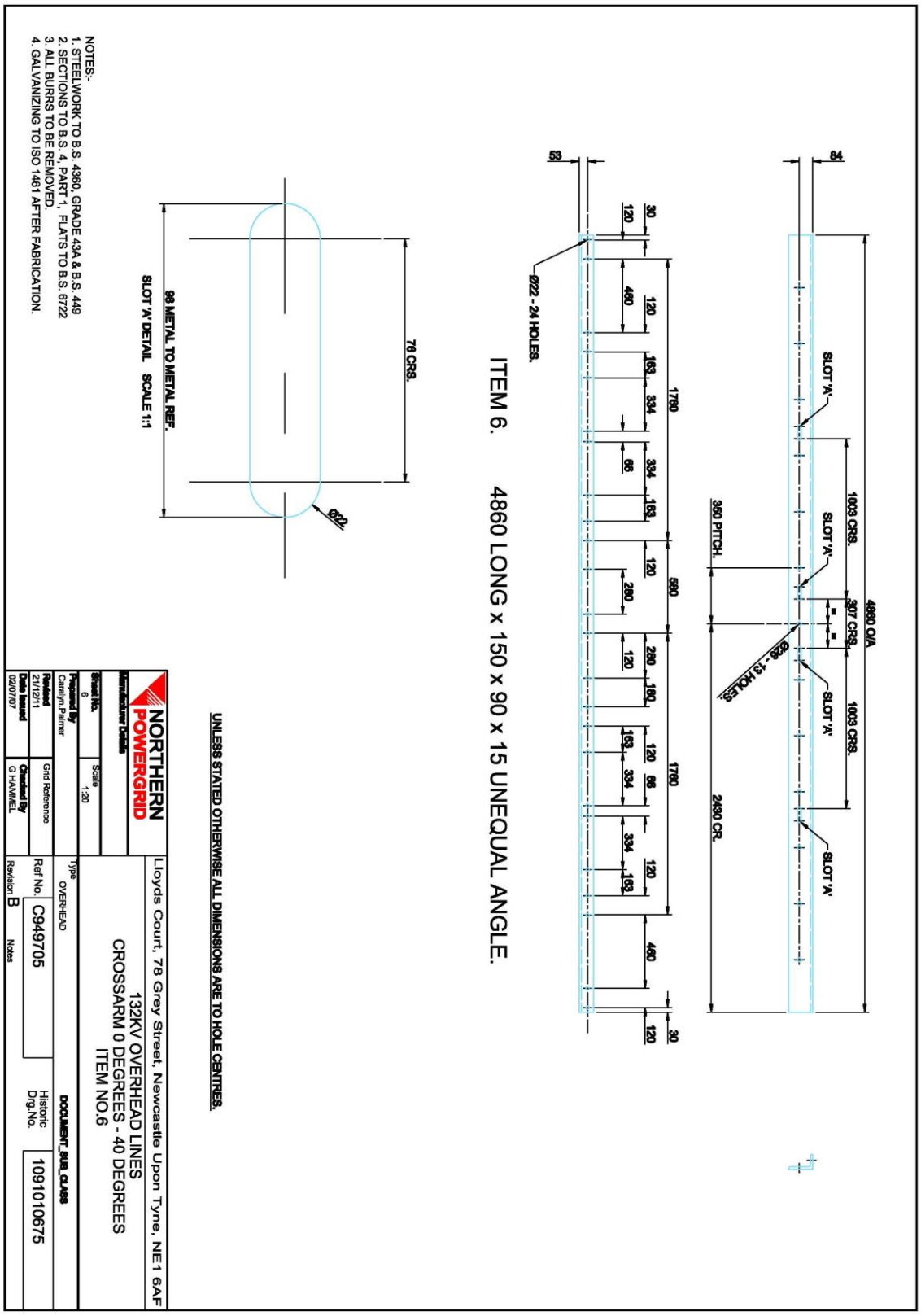

MATERIAL:- 1000 APPROX. DEVELOPED LENGTH x 65 x 8 THK. BAR M.S.
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
119
8
65
33 CR.
400
450
918 CRS. APPROX.
150
Ø22
50 CRS.
33 CR.
Ø26 - 2 HOLES.
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 16
Scale 1:5
Prepared By Carolyn.Palmer
Revised 21/12/11
Date Issued 02/07/07
Grid Reference
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
STAY YOKE LEG DETAIL
Type OVERHEAD
DOCUMENT_SUB_CLASS
Ref No. C949711
Historic Drg.No. 1091010675
Revision A
Notes

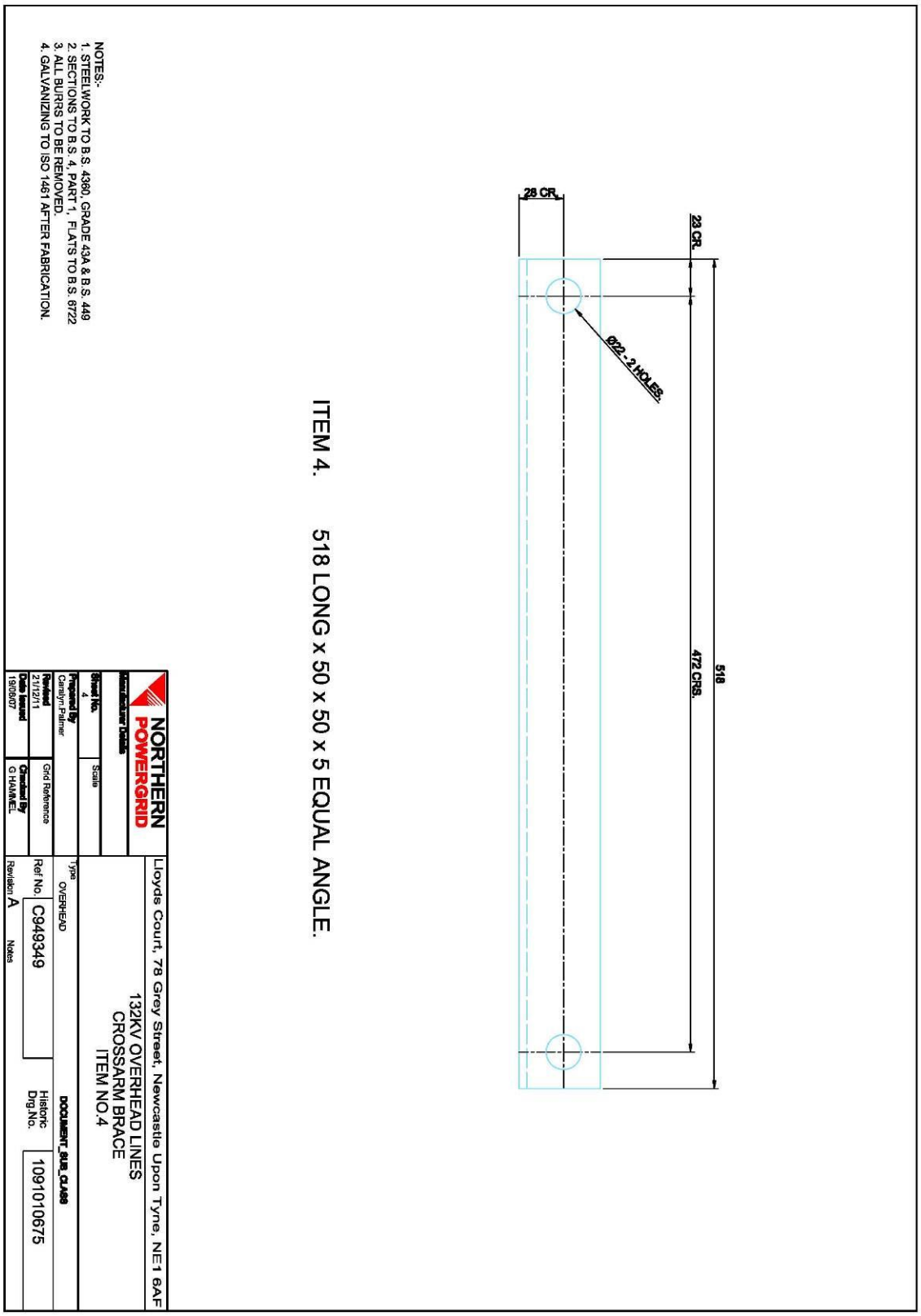

NOTES:
1. ALL STEELWORK FIXINGS TO BE COMPLETE WITH ONE PLAIN WASHER UNDER BOLT HEAD & ONE ROUND WASHER FITTED UNDER NUT.
M24 x 80 LG.
10° CRANKED STAY STRAP 1 09 101 0675 SHEET No.46
M24 x 80 LG.
10° CRANKED STAY STRAP 1 09 101 0675 SHEET No.46
CROSSARM
1 09 101 0675 SHEET No.16 BASED ON ESI 43-91 DRAWING No. 439113
M20 x 60 LG.
M24 x 80 LG.
THIMBLE TYPE 1 ESI 43-91
NORTHERN POWERGRID
Manufacturer Details
Sheet No. 24
Scale 1:5
Prepared By Carolyn.Palmer
Revised 21/12/11
Date Issued 03/07/07
Grid Reference
Checked By G HAMMEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINE
STAY YOKE ARRAY FOR
1, 2 AND 3 STAY OPTIONS
Type OVERHEAD
DOCUMENT_SUB_CLASS
Ref No. C949749
Historic Drg.No. 1091010675
Revision A
Notes

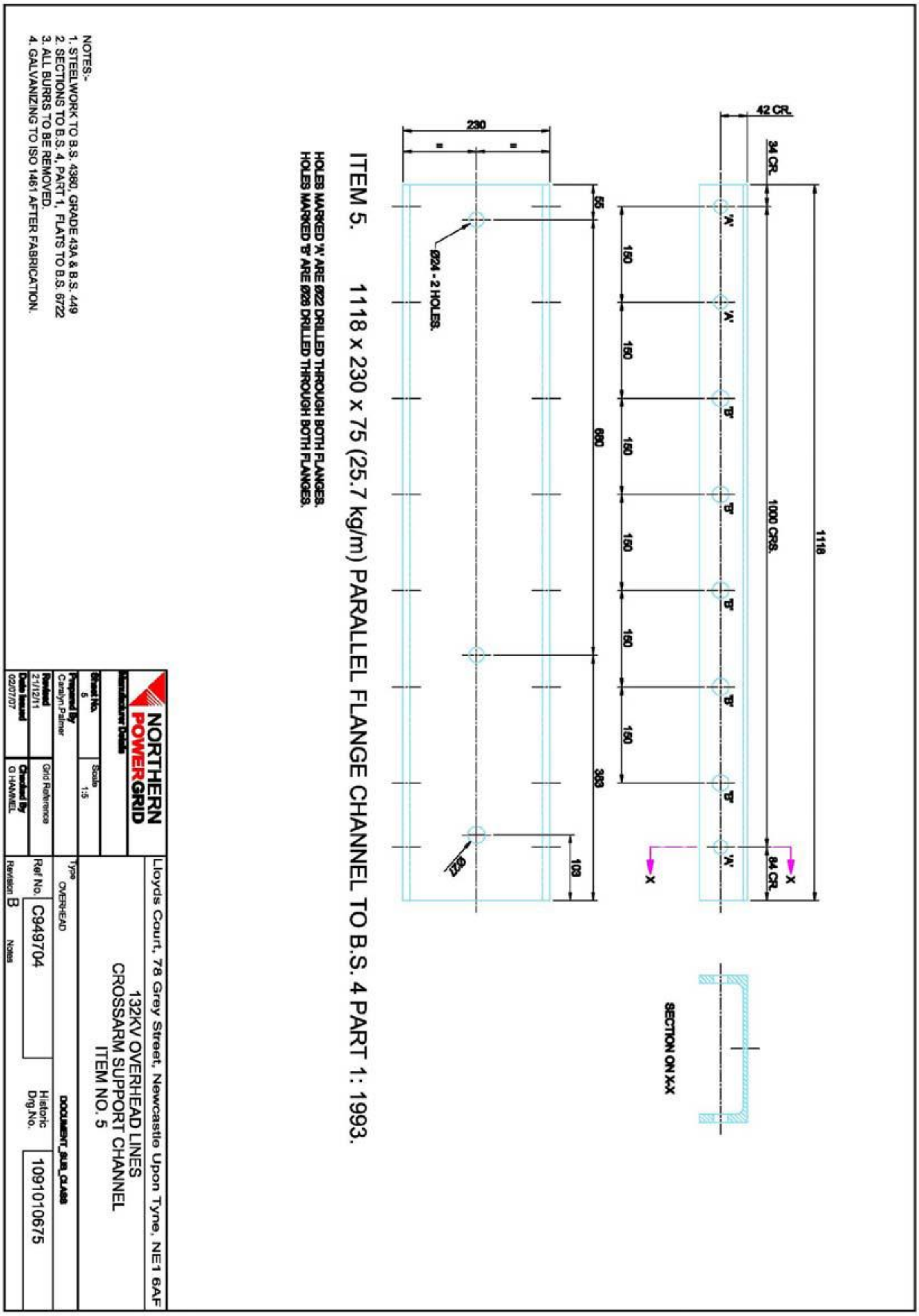

CATALOGUE NUMBER 346504
R32.5
0.5 CRS.
33 CR.
Ø26
85
270
33 CR.
Ø26
20
45°
65
MATERIAL:- 355 APPROX. DEVELOPED LENGTH x 65 x 20THK. BAR M.S.
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
45 DEGREES CRANKED STAY STRAP
Sheet No. 47
Scale 1:2
Prepared By Carolyn Palmer
Revised 22/12/11
Date Issued 02/07/07
Checked By G HAMMEL
Grid Reference
Type OVERHEAD
Ref No. C949708
Historic Drg.No. 1091010675
Revision A
Notes

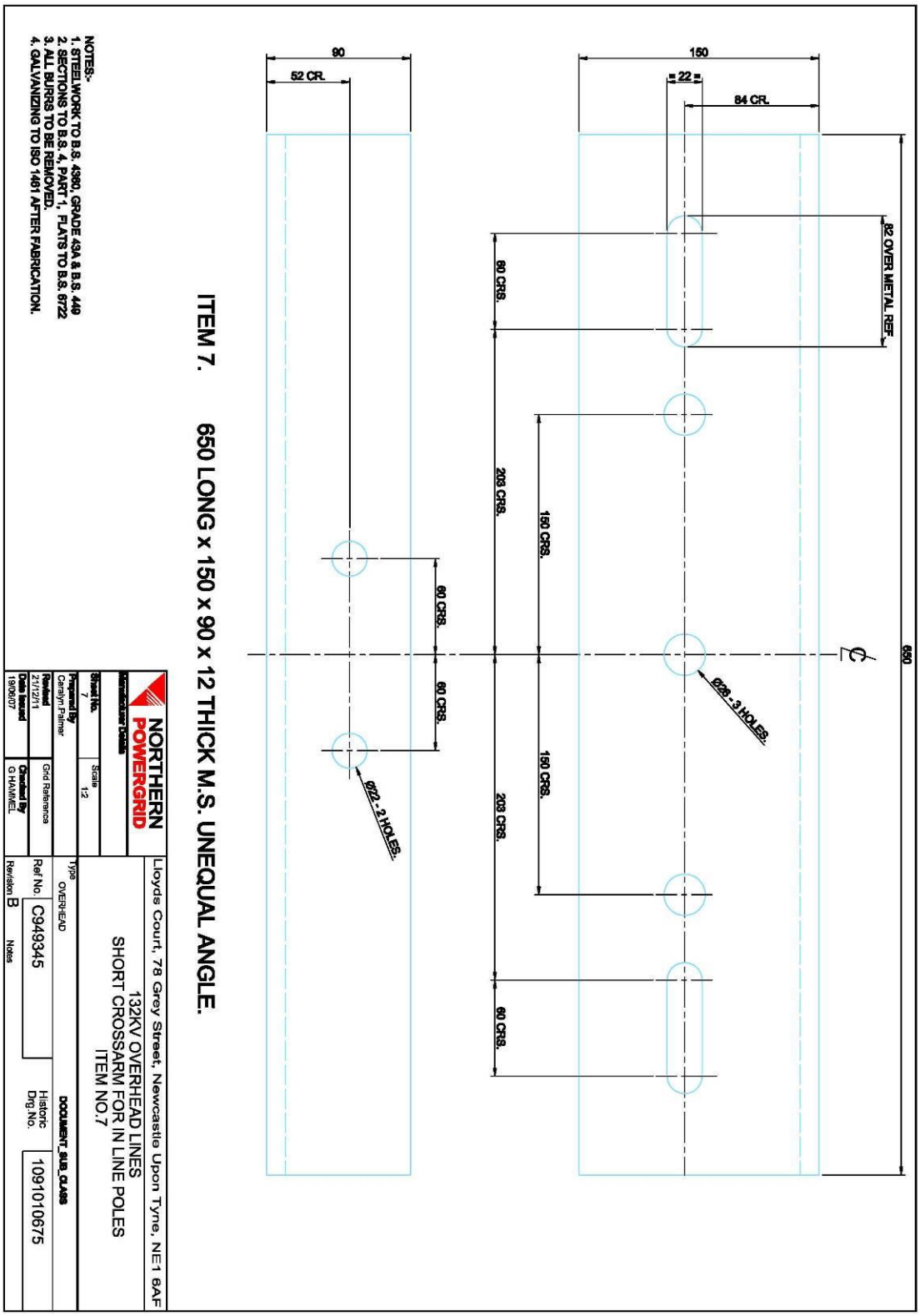
CROSSARM ATTACHMENT END.
65
28
Ø22 - 2 HOLES.
12 x 45° CHAMFER - 2 PLACES THIS END ONLY
SHACKLE END
65
0.5 CRS.
0.5
35
R22.5
TRUE VIEW ON SHACKLE END.
125
SEE TRUE VIEW ON SHACKLE END.
35
35
40°
MATERIAL:- 252 APPROX. DEVELOPED LENGTH x 65 x 20THK. BAR M.S.
GENERAL NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
ASSEMBLY NOTE:-
1. CRANKED STAY STRAP IS TO BE FITTED TO 'H' POLE BY MEANS OF REMOVAL OF A TOTAL OF FOUR FIXING BOLTS M20 x 60 LONG FROM ONE CROSSARM. THE LOCATION OF WHICH IS IN THE INNER & OUTER STIFFENERS, CLOSEST TOO THE TIMBER POLE CENTRELINE. LOCATE BETWEEN CROSSARM WEB & RE-USE EXISTING 6° TAPER WASHER AND PLAIN WASHER.
2. EQUIPMENT REQUIRED:
4 x 40° CRANKED STAY STRAP 1 09 101 0676 SHEET No.48
4 x SHACKLE 22/22A
4 x BOLT M8 HEX GALV M20 x 70 LONG (DISCARD THE EXISTING M20 x 50 LONG BOLT).
4 x NUT M8 HEX GALV M20 (DISCARD THE EXISTING M20 NUT).
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
40 DEGREES CRANKED STAY STRAP
FOR 'H' POLE STAYS
Sheet No. 48
Scale 1:2
Type OVERHEAD
DOCUMENT_SUB_CLASS
Prepared By Carolyn Palmer
Grid Reference
Ref No. C949721
Historic Drg.No. 109101067S
Revised 22/12/11
Checked By G HAMMEL
Date Issued 02/07/07
Revision B
Notes

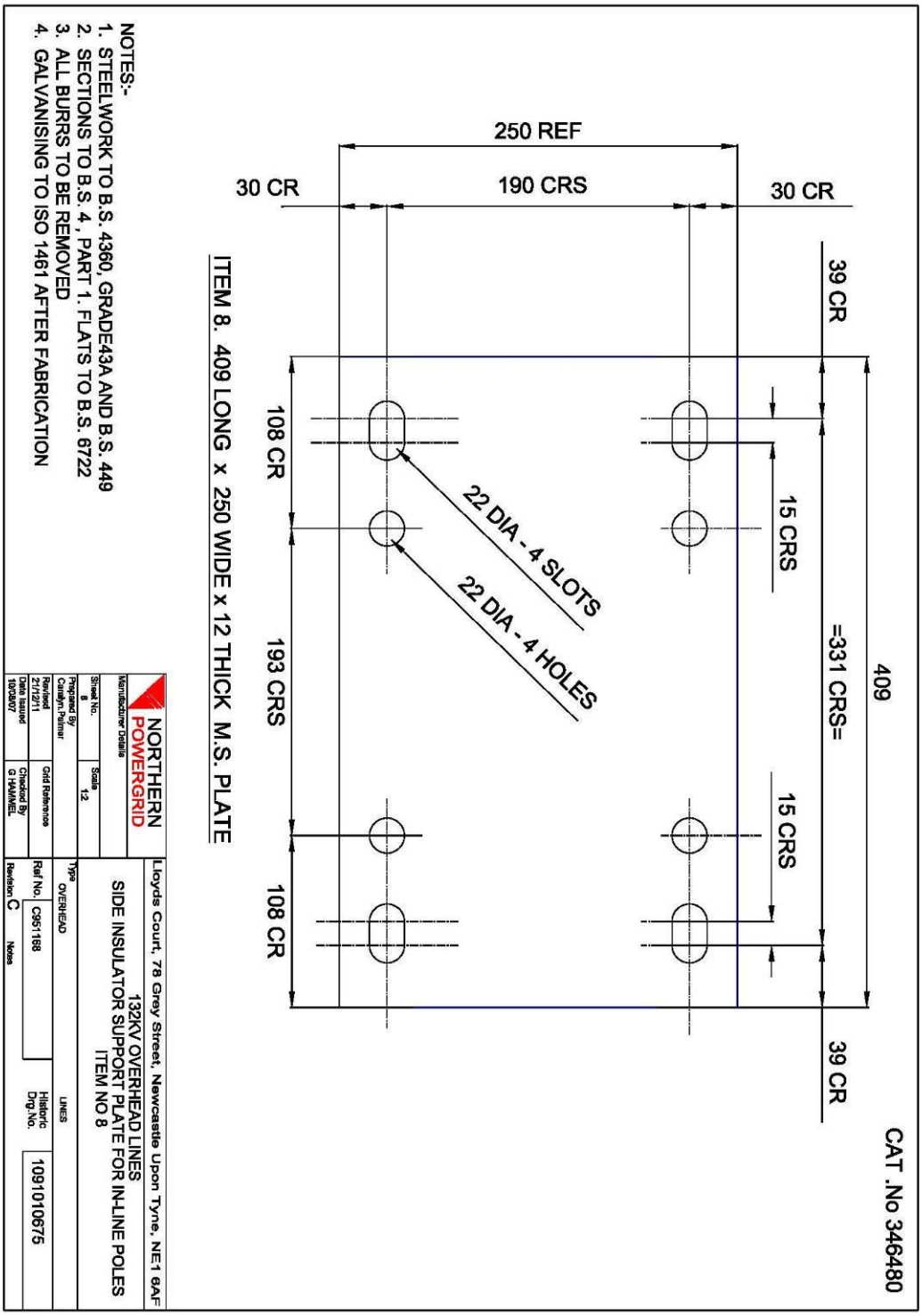

NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
ITEM 1. 565 LONG x 220 WIDE x 15 THICK FLAT BAR.
565
499 CRS. REF.
344 CRS.
33 CR.
33 CR.
Ø22 - 3 HOLES
Ø18 - 8 HOLES ON A 127 P.C.DIA.
27 CRS.
Ø22
4 SLOTS AS DRAWN.
DIMENSIONS ARE SYMMETRICAL ABOUT INDICATED CENTRELINES.
45° TYP.
R55 TYP.
120 CRS.
220
CATALOGUE NUMBER 346474
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Sheet No. 1
Scale 1:2
Prepared By Carolyn Palmer
Grid Reference
Revised 21/12/11
Date Issued 19/08/07
Checked By G HAMMEL
Type OVERHEAD
DOCUMENT_SUB_CLASS
132KV OVERHEAD LINES
POST INSULATORS AND TENSION PLATE
DETAIL ITEM NO.1
Ref No. C949342
Revision B
Notes
Historic Drg.No. 1091010675

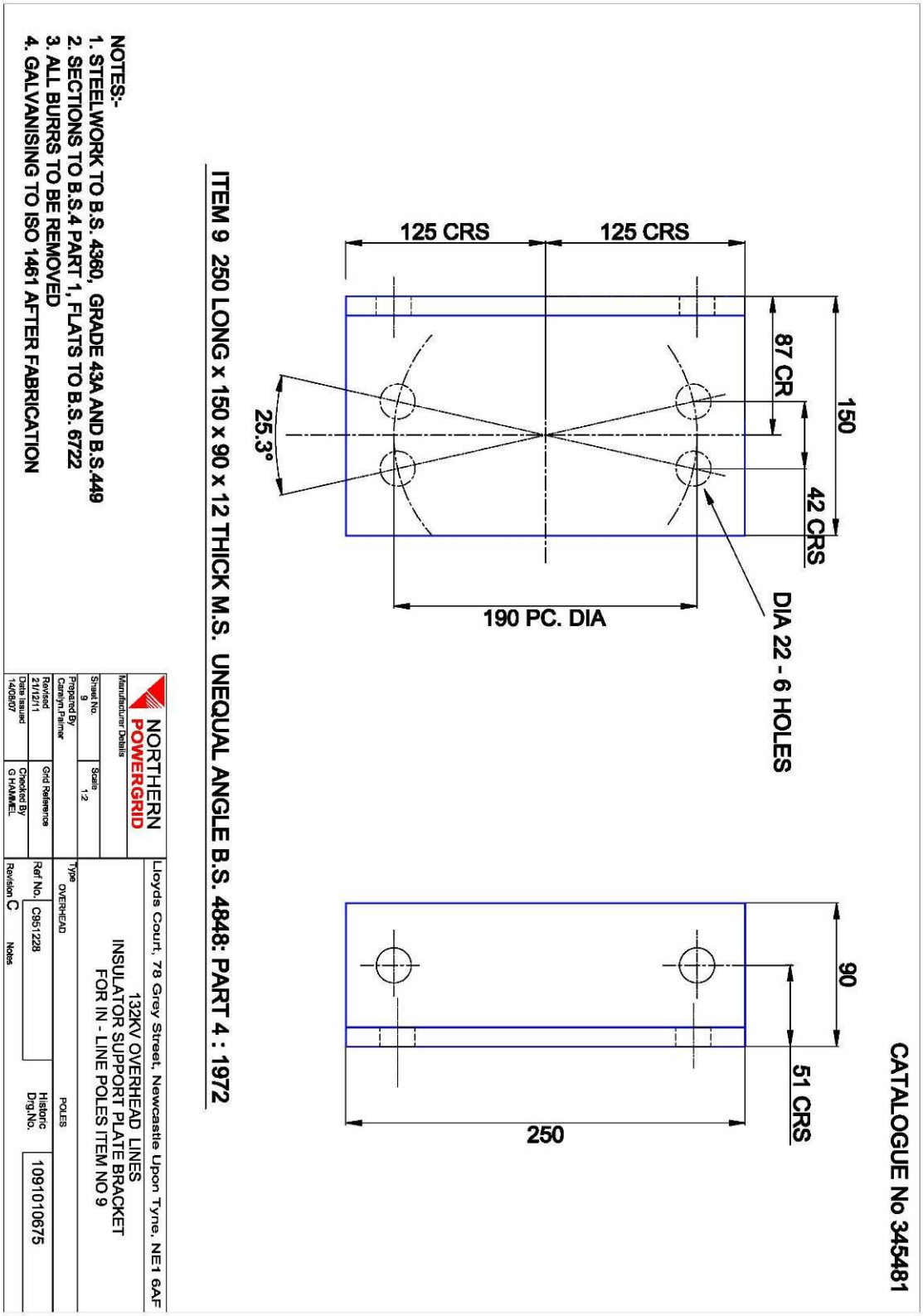

ITEM 6. 4860 LONG x 150 x 90 x 15 UNEQUAL ANGLE.
4860 O/A
84
53
SLOT 'A'
1003 CRS.
307 CRS.
360 PITCH.
2430 CR.
Ø22 - 19 HOLES.
Ø22 - 24 HOLES.
30
120
460
163
334
66
1760
580
280
190
SLOT 'A' DETAIL SCALE 1:1
98 METAL TO METAL REF.
78 CRS.
Ø22
UNLESS STATED OTHERWISE ALL DIMENSIONS ARE TO HOLE CENTRES.
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
CROSSARM 0 DEGREES - 40 DEGREES
ITEM NO.6
Sheet No. 6
Scale 1:20
Prepared By Carolyn Palmer
Type OVERHEAD
Grid Reference
Ref No. C949705
Revision B
Notes
Revised 21/12/11
Date Issued 02/07/07
Checked By G HAMMEL
DOCUMENT_SUB_CLASS
Historic Drg.No. 1091010675


NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
ITEM 4. 518 LONG x 50 x 50 x 5 EQUAL ANGLE.
28 CRS.
23 CRS.
Ø22 - 2 HOLES.
472 CRS.
518
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
CROSSARM BRACE
ITEM NO.4
Sheet No. 4
Scale
Prepared By Carolyn Palmer
Grid Reference
Revised 21/12/11
Date Issued 19/08/07
Checked By G HAMMEL
Type OVERHEAD
DOCUMENT_SUB_CLASS
Ref No. C949349
Historic Drg.No. 1091010675
Revision A
Notes


ITEM 5. 1118 x 230 x 75 (25.7 kg/m) PARALLEL FLANGE CHANNEL TO B.S. 4 PART 1: 1993.
HOLES MARKED 'A' ARE Ø22 DRILLED THROUGH BOTH FLANGES.
HOLES MARKED 'B' ARE Ø26 DRILLED THROUGH BOTH FLANGES.
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
Ø24 - 2 HOLES.
SECTION ON X-X
1000 CRS.
1118
42 CR.
34 CR.
84 CR.
230
150
680
383
103
55
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
CROSSARM SUPPORT CHANNEL
ITEM NO. 5
Scale 1:5
Prepared By Caralyn Palmer
Checked By G HANNEL
Revised 21/12/11
Date Issued 02/07/07
Type OVERHEAD
Ref No. C949704
Revision B
Historic Drg.No. 1091010675


NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
ITEM 7. 650 LONG x 150 x 90 x 12 THICK M.S. UNEQUAL ANGLE.
90
52 CR.
150
22
84 CR.
82 OVER METAL REF.
650
60 CRS.
203 CRS.
150 CRS.
60 CRS.
60 CRS.
Ø26 - 3 HOLES.
Ø22 - 2 HOLES.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
SHORT CROSSARM FOR IN LINE POLES
ITEM NO.7
Sheet No. 7
Scale 1:2
Prepared by Geralyn Palmer
Grid Reference
Revised 21/12/11
Checked by G HAMMEL
Date Issued 19/09/07
Type OVERHEAD
Ref No. C949345
Revision B
Notes
DOCUMENT_SUB_CLASS
Historic Drg.No. 10910106675


250 REF
190 CRS
30 CR
30 CR
39 CR
15 CRS
=331 CRS=
15 CRS
39 CR
409
108 CR
193 CRS
108 CR
22 DIA - 4 SLOTS
22 DIA - 4 HOLES
CAT .No 346480
ITEM 8. 409 LONG x 250 WIDE x 12 THICK M.S. PLATE
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE43A AND B.S. 449
2. SECTIONS TO B.S. 4., PART 1. FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED
4. GALVANISING TO ISO 1461 AFTER FABRICATION
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Sheet No. 8
Scale 1:2
Prepared By Carolyn Palmer
Grid Reference
Revised 21/12/11
Date Issued 10/08/07
Checked By G HAMMEL
132KV OVERHEAD LINES
SIDE INSULATOR SUPPORT PLATE FOR IN-LINE POLES
ITEM NO 8
Type OVERHEAD
UNES
Ref No. C951168
Historic Drg.No. 10910106?5
Revision C
Notes


CATALOGUE No 345481
125 CRS
125 CRS
87 CR
150
42 CRS
25.3°
190 PC. DIA
DIA 22 - 6 HOLES
90
51 CRS
250
ITEM 9 250 LONG x 150 x 90 x 12 THICK M.S. UNEQUAL ANGLE B.S. 4848: PART 4 : 1972
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A AND B.S.449
2. SECTIONS TO B.S.4 PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED
4. GALVANISING TO ISO 1461 AFTER FABRICATION
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Sheet No. 9
Scale 1:2
Prepared By Carolyn.Palmer
Grid Reference
Checked By G HAMMEL
Revised 21/12/11
Date Issued 14/08/07
132KV OVERHEAD LINES
INSULATOR SUPPORT PLATE BRACKET
FOR IN - LINE POLES ITEM NO 9
Type OVERHEAD
POLES
Ref No. C9512228
Historic Drg.No. 1091010675
Revision C
Notes

ITEM 10. 1263 LONG x 230 WEB x 75 FLANGE (25.7 kg/m) PARALLEL FLANGE CHANNEL TO B.S. 4 PART 1: 1993.

HOLES MARKED 'A' ARE Ø22 DRILLED THROUGH BOTH FLANGES.
HOLES MARKED 'B' ARE Ø28 DRILLED THROUGH BOTH FLANGES.

SCALE 1:4

NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO B.S. 729 AFTER FABRICATION.
5. THE 3 x Ø28 HOLES AT EACH SIDE ARE FOR ATTACHMENT POINTS FOR SAFETY HARNESSES ETC.

NORTHERN POWERGRID

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

132KV OVERHEAD LINE
SHORT CROSSARM SUPPORT CHANNEL
FOR IN LINE POLES ITEM NO.10

Sheet No. 10	Scale AS SHOWN	Type OVERHEAD	
Prepared By Carolyn Palmer			DOCUMENT_SUB_CLASS
Revised 21/12/11	Grid Reference	Ref No C949337	Historic Drg No. 1091010675
Date Issued 19/06/07	Checked By G HAMMEL	Revision B	Notes

CATALOGUE No 345481

51 CRS

250

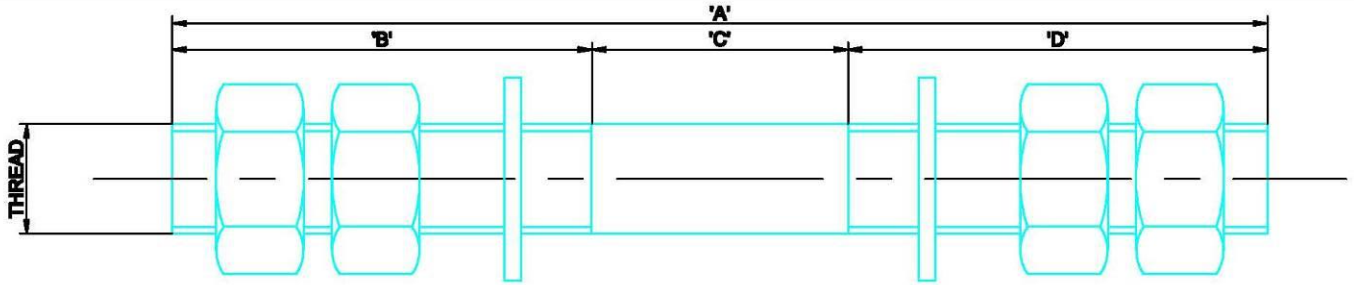
1972

et, Newcastle Upon Tyne, NE1
VERHEAD LINES
IPPORT PLATE BRACKET
NE POLES ITEM NO 9

POLES

Historic Drg.No. 1091010675

Docur Ve



ITEM No.	THREAD	'A'	'B'	'C'	'D'
1	M20	1200	200	800	200
2	M20	980	190	600	190
3	M20	940	295	350	295
4	M20	360	95	170	95
5	M20	700	250	200	250
6	M16	514	107	300	107
7	M16	554	107	340	107
8	M16	474	107	260	107
9	M20	550	125	300	125
10	M20	800	250	300	250
11	M20	450	125	200	125

NOTES

1. TIE ROD MATERIAL: STEEL TO B.S. 4190, STRENGTH GRADE DESIGNATION 4.6 & SHALL MEET REQUIREMENTS AS SHOWN IN B.S. 4190 TABLE 14.
2. TIE RODS SHALL BE SUPPLIED WITH FOUR FULL NUTS TO B.S. 4190 & TWO PLAIN WASHERS TO B.S. 4320.
3. ALL ITEMS SHALL BE GALVANISED TO B.S. 729 AFTER FABRICATION.

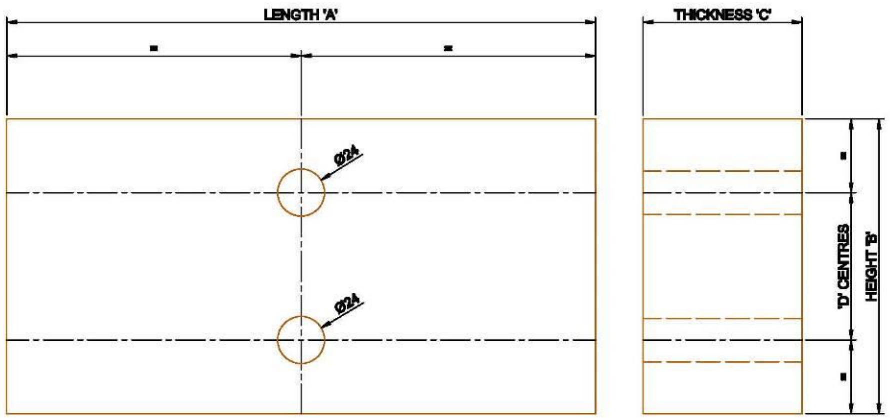
NORTHERN POWERGRID

Manufacturer Details

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

OVERHEAD LINES
M22 AND M16 TIE ROD SCHEDULE

Sheet No. 29	Scale N.T.S.		
Prepared By Caralyn.Palmer		Type OVERHEAD	DOCUMENT_SUB_CLASS
Revised 21/12/11	Grid Reference	Ref No. C949712	Historic Drg.No. 1091010675
Date Issued 02/07/07	Checked By G HAMMEL	Revision A Notes	

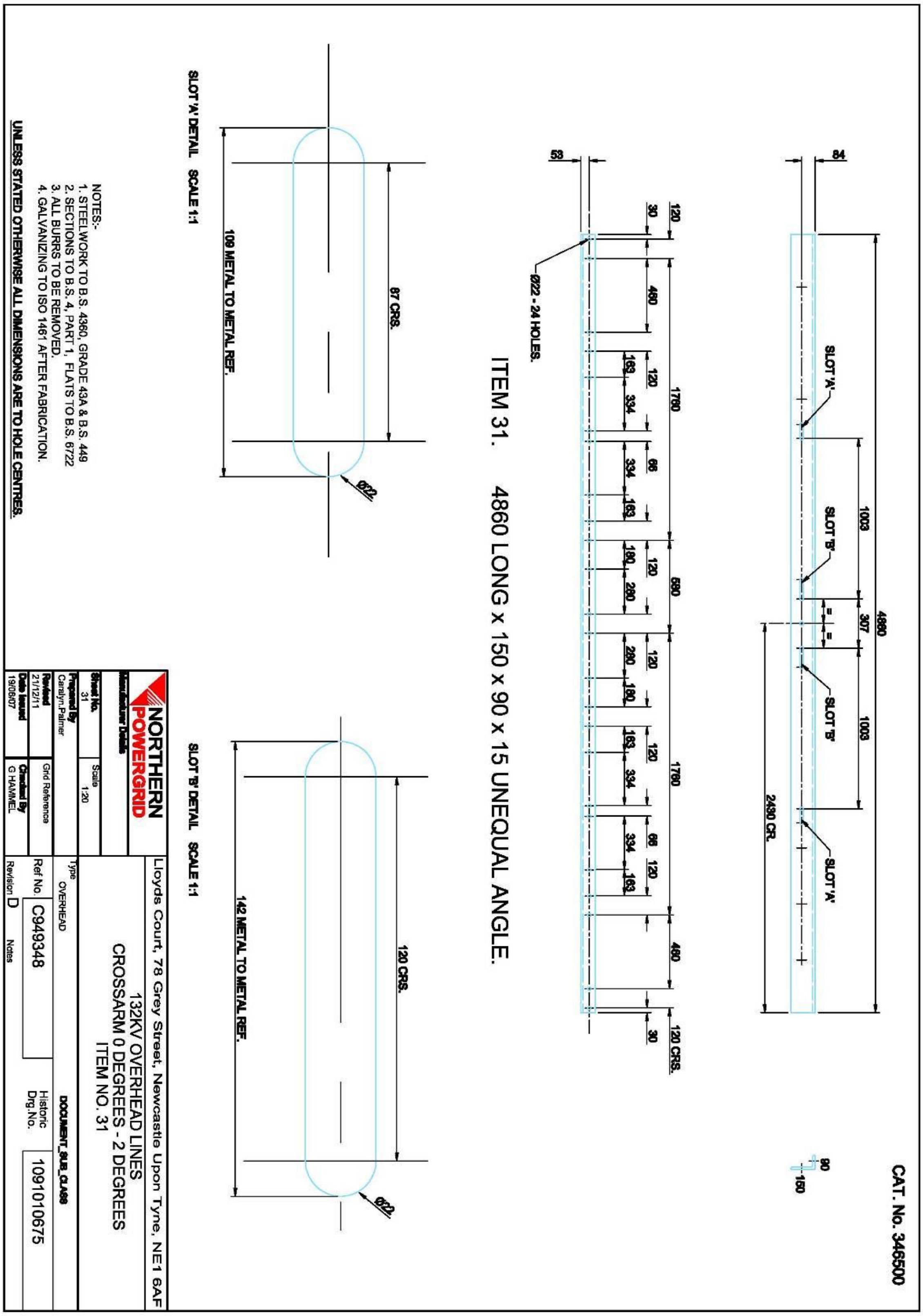


ITEM No.	LENGTH 'A'	HEIGHT 'B'	THICKNESS 'C'	'D' CENTRES	MATERIAL
1	175	300	100	150	ANGELIM PEDRA
2	175	250	100	86	ANGELIM PEDRA
3	1300	250	125	86	PINUS SYLVESTRIS
4	2500	250	125	86	PINUS SYLVESTRIS
5	1300	250	125	150	PINUS SYLVESTRIS
6	2500	250	125	150	PINUS SYLVESTRIS
7	240	300	130	150	ANGELIM PEDRA
8	210	300	130	150	ANGELIM PEDRA
9	2500	250	125	150	PINUS SYLVESTRIS
10	1300	250	125	150	PINUS SYLVESTRIS
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

NOTES

1. SEE MATERIAL COLUMN IN TABLE. A SUITABLE ALTERNATIVE MAY BE USED PROVIDED IT IS OF SUITABLE STRENGTH & DURABILITY.
2. BLOCKS TO BE CUT FROM SAWN TIMBER.
3. TIMBER GRAIN TO BE LONGITUDINALLY ALONG LENGTH 'A'.
4. LONGITUDINALLY CUT SURFACES TO BE STRAIGHT & CLEAN & ANNUALAR GROWTH RINGS SHALL BE APPROX. PARALLEL.

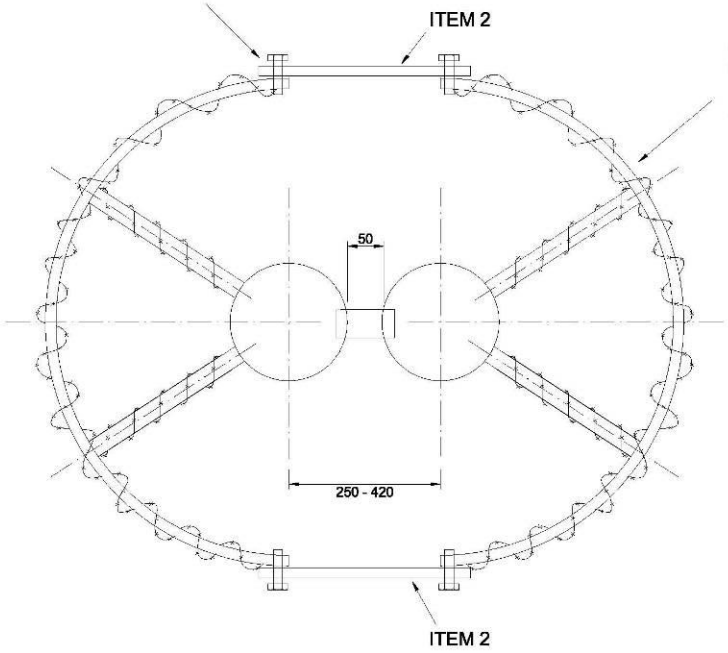
NORTHERN POWERGRID	Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details	132KV OVERHEAD LINES RUTTER TYPE POLE SHEAR BLOCK SCHEDULE
Sheet No. 30 / Scale N.T.S.	
Prepared By Caralyn.Palmer	Type OVERHEAD / DOCUMENT_SUB_CLASS
Revised 21/12/11 / Grid Reference	Ref No. C949240 / Historic Drg.No. 1091010675
Date Issued 13/08/07 / Checked By G HAMMEL	Revision A / Notes ITEMS 7,8,9 AND 10 ADDED


CAT. No. 346500
ITEM 31. 4860 LONG x 150 x 90 x 15 UNEQUAL ANGLE.
SLOT 'A'
SLOT 'B'
Ø22 - 24 HOLES.
2430 CR.
120 CRS.
SLOT 'A' DETAIL SCALE 1:1
109 METAL TO METAL REF.
87 CRS.
Ø22
SLOT 'B' DETAIL SCALE 1:1
142 METAL TO METAL REF.
120 CRS.
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
UNLESS STATED OTHERWISE ALL DIMENSIONS ARE TO HOLE CENTRES.
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
CROSSARM 0 DEGREES - 2 DEGREES
ITEM NO. 31
Sheet No. 31
Scale 1:20
Prepared By Carolyn Palmer
Revised 21/12/11
Date Issued 19/06/07
Checked By G HAMMEL
Type OVERHEAD
Ref No. C949348
Historic Drg.No. 1091010675
Revision D

ITEM 32. 250 LONG x 100 x 75 x 12 THICK M.S. UNEQUAL ANGLE.
CATALOGUE NUMBER 346301
250
63.5 CRS.
Ø24 - 2 HOLES.
30 REF.
Ø22 - 2 HOLES.
190 CRS.
75
40.5 CR.
45 CR.
100
NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
HORIZONTAL INSULATOR SUPPORT ANGLE
Sheet No. 32
Scale 1:2
Prepared by Carolyn Palmer
Grid Reference
Type OVERHEAD
DOCUMENT_SUB_CLASS
Revised 21/12/11
Ref No. C951091
Historic Drg.No. 1091010675
Date Issued 08/08/07
Checked By G HAMMEL
Revision A
Notes 40.5 CR WAS 43.5 CR

ITEM 2	CAT NO	244981
ITEM 1	CAT NO	251362

FIXING SET BOLTS
(PULL DOWN TO
MEET GUARD RING)



STANDARD DARFEN
GUARD RING ITEM 1

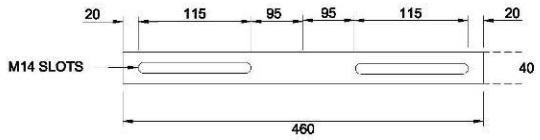
SEE 1.09.101.0408 SHEET 8

ITEM	DRG/REF	DESCRIPTION	QTY PER RUTTER
1	DP 2047	GUARD RING	2
2	ITEM 2	STRAPS	2
3		M12 x 35 LONG BOLT	4
3		M12 HEX NUT	4
3		M12 FLAT WASHER	8
		GALV COACH BOLT	8

ITEM 2 TO BE USED IN CONJUNCTION WITH ITEM 1.
SUTIBLE FOR USE ON BOTH WOODHOUSE MAST
REPLACEMENT RUTTER POLES OR CE/C/36 RUTTER
POLES.

ITEM 2

PRE WRAPPED STRAP 40x5 (TO BE WRAPPED END TO END)

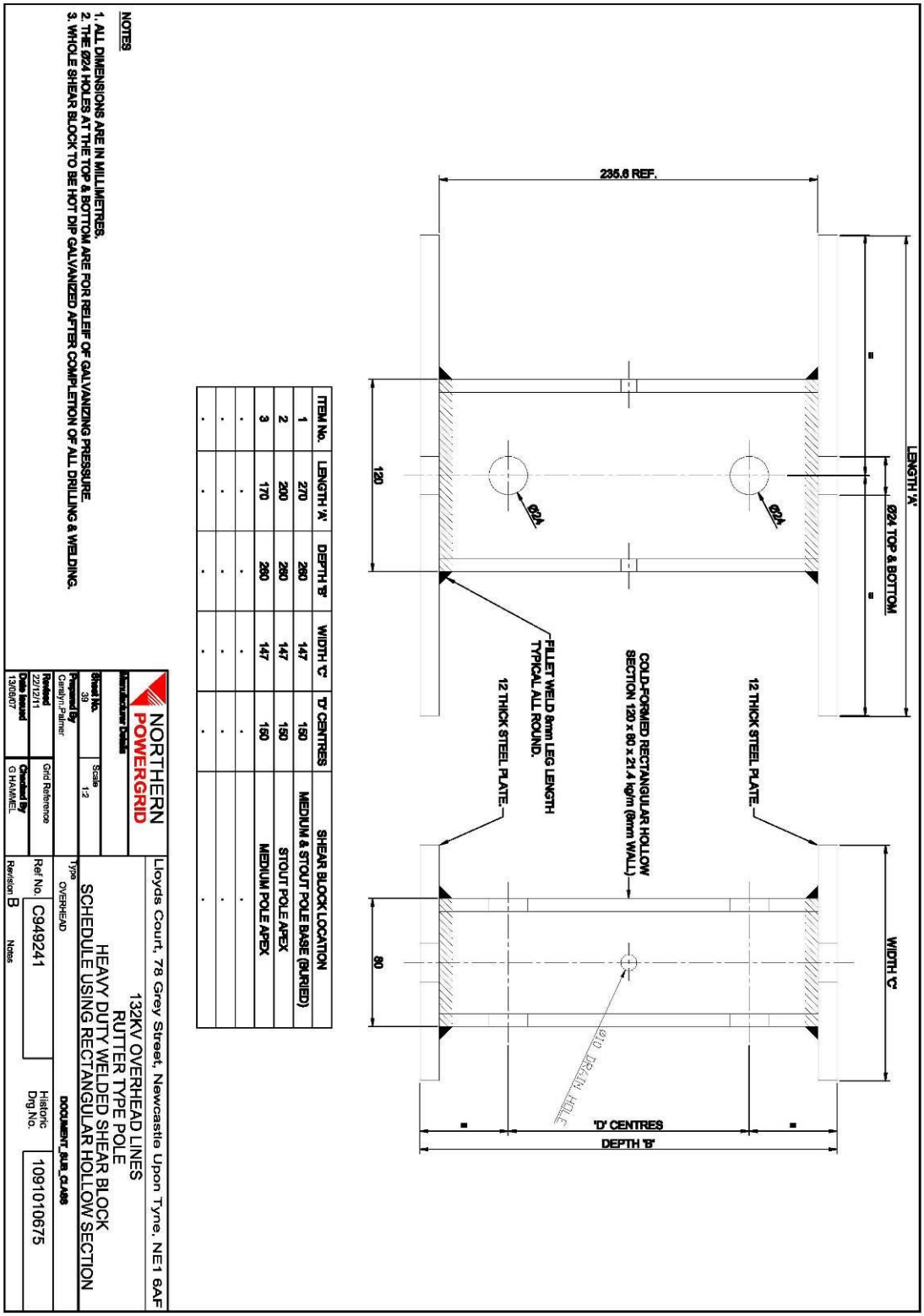


NORTHERN POWERGRID
Manufacturer Details

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

ENHANCED ANTI-CLIMBING DEVICE
FOR RUTTER TYPE POLE ASSEMBLY

Sheet No. 34	Scale N.T.S.
Prepared By Caralyn.Palmer	Type OVERHEAD LINES
Revised 22/12/11	Grid Reference
Date Issued 08/08/07	Checked By G HAMMEL
Ref No. C951111	Historic Drg.No. 1091010675
Revision B	Notes



ITEM No.	LENGTH 'A'	DEPTH 'B'	WIDTH 'C'	'D' CENTRES	SHEAR BLOCK LOCATION
1	270	280	147	150	MEDIUM & STOUT POLE BASE (BURIED)
2	200	280	147	150	STOUT POLE APEX
3	170	280	147	150	MEDIUM POLE APEX
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. THE Ø24 HOLES AT THE TOP & BOTTOM ARE FOR RELIEF OF GALVANIZING PRESSURE.
3. WHOLE SHEAR BLOCK TO BE HOT DIP GALVANIZED AFTER COMPLETION OF ALL DRILLING & WELDING.

NORTHERN POWERGRID

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

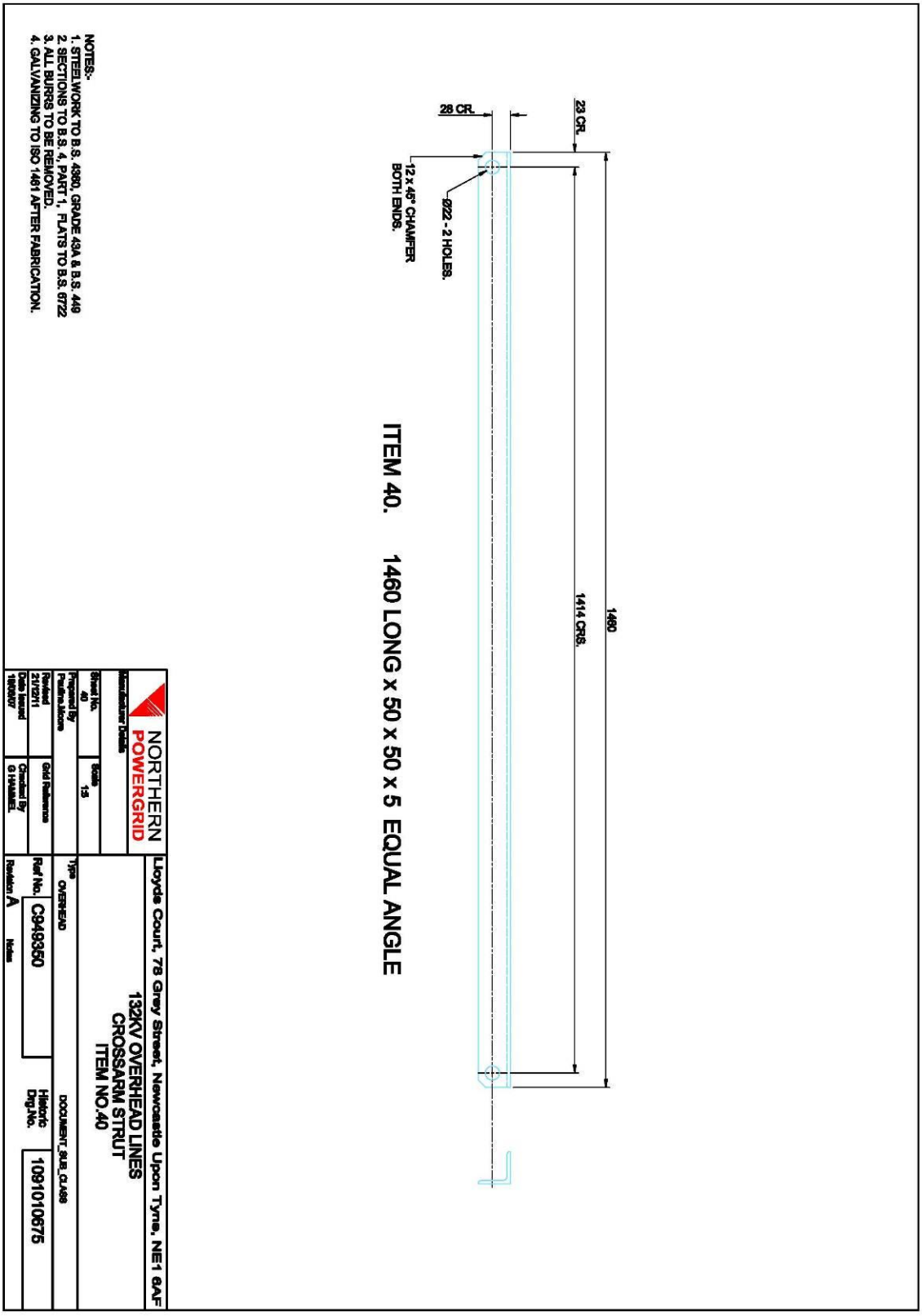
Sheet No. 39 | Scale 1:2 | Prepared By Carolyn Palmer | Grid Reference | Revised 22/12/11 | Date Issued 13/06/07 | Checked By G HAMMEL

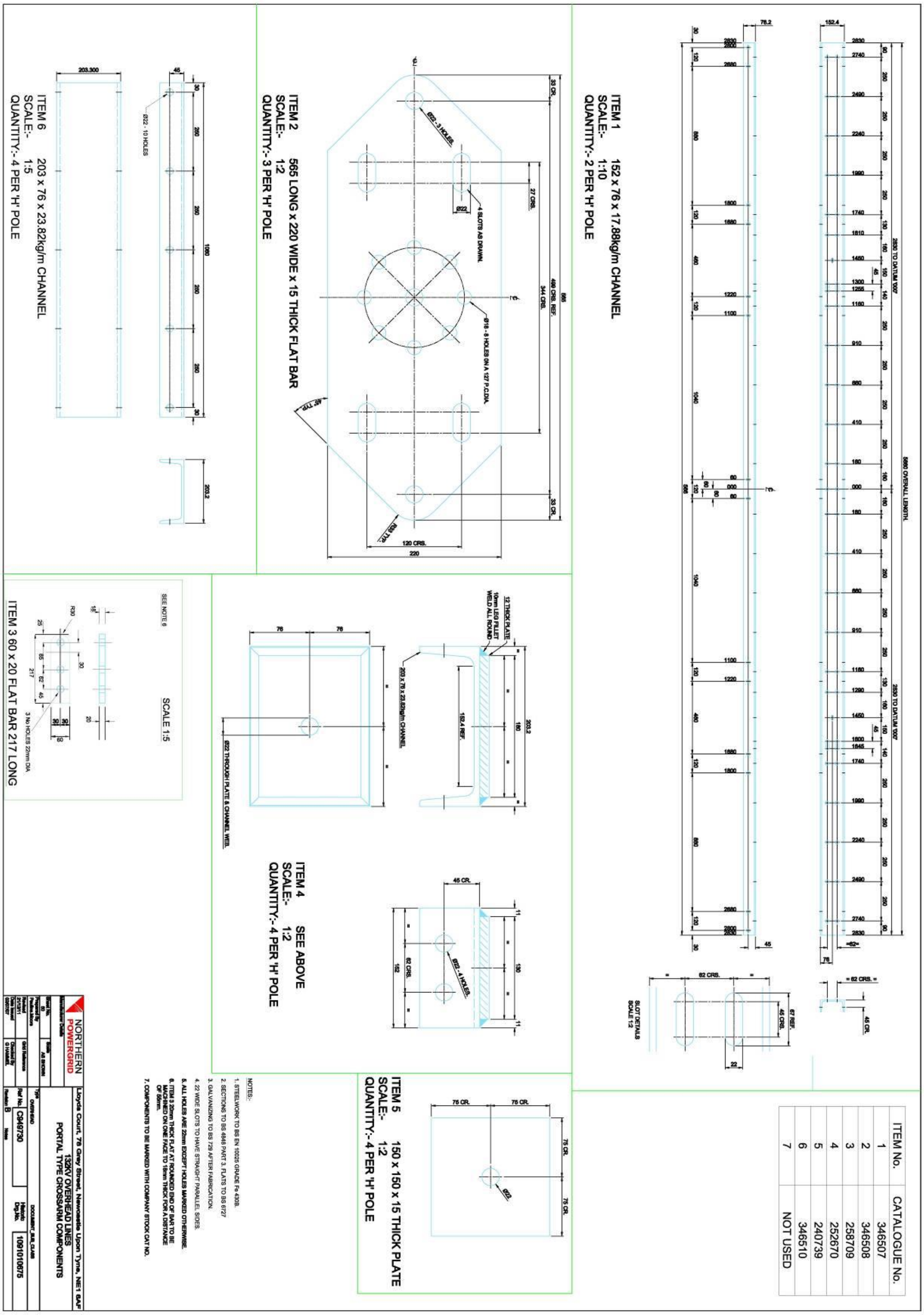
132KV OVERHEAD LINES
RUTTER TYPE POLE
HEAVY DUTY WELDED SHEAR BLOCK
SCHEDULE USING RECTANGULAR HOLLOW SECTION

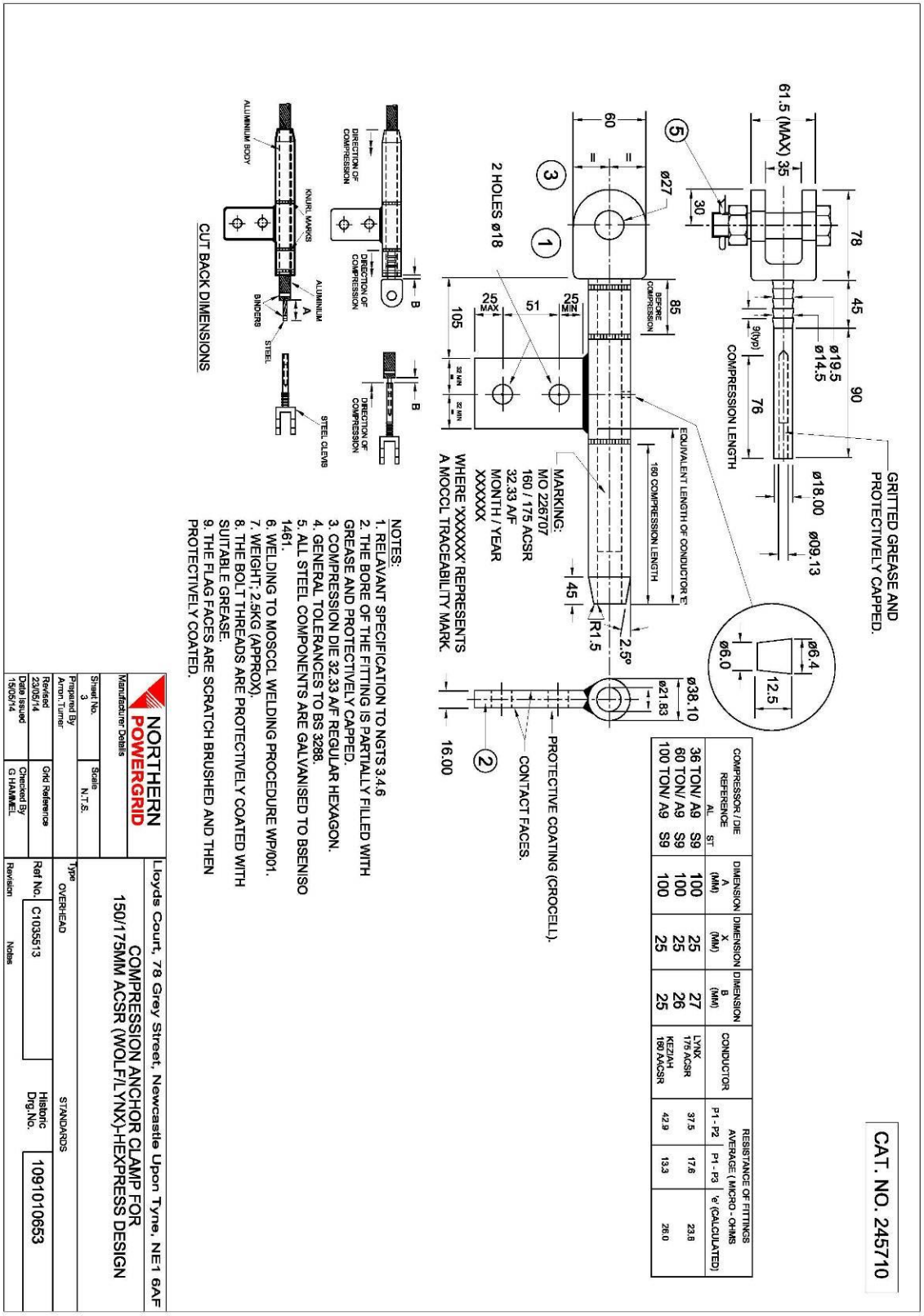
Type OVERHEAD | DOCUMENT_SUB_CLASS

Ref No. C949241 | Historic Drg.No. 1091010675

Revision B | Notes


NOTES:-
1. STEELWORK TO B.S. 4360, GRADE 43A & B.S. 449
2. SECTIONS TO B.S. 4, PART 1, FLATS TO B.S. 6722
3. ALL BURRS TO BE REMOVED.
4. GALVANIZING TO ISO 1461 AFTER FABRICATION.
28 CR.
23 CR.
12 x 45° CHAMFER BOTH ENDS.
Ø22 - 2 HOLES.
1414 CRS.
1460
ITEM 40. 1460 LONG x 50 x 50 x 5 EQUAL ANGLE
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
132KV OVERHEAD LINES
CROSSARM STRUT
ITEM NO.40
Sheet No. 40
Scale 15
Prepared By Pauline Moore
Grid Reference
Revised 21/12/11
Date Issued 18/08/97
Checked By G HAMMEL
Type OVERHEAD
DOCUMENT_SUB_CLASS
Ref No. C9498350
Revision A
Notes
Historic Dgn.No. 10910106775


ITEM 1 152 x 76 x 17.88kg/m CHANNEL
SCALE:- 1:10
QUANTITY:- 2 PER 'H' POLE
ITEM 2 565 LONG x 220 WIDE x 15 THICK FLAT BAR
SCALE:- 1:2
QUANTITY:- 3 PER 'H' POLE
ITEM 3 60 x 20 FLAT BAR 217 LONG
SCALE 1:5
ITEM 4 SEE ABOVE
SCALE:- 1:2
QUANTITY:- 4 PER 'H' POLE
ITEM 5 150 x 150 x 15 THICK PLATE
SCALE:- 1:2
QUANTITY:- 4 PER 'H' POLE
ITEM 6 203 x 76 x 23.82kg/m CHANNEL
SCALE:- 1:5
QUANTITY:- 4 PER 'H' POLE
ITEM No. CATALOGUE No.
1 346507
2 346508
3 258709
4 252670
5 240739
6 346510
7 NOT USED
132kV OVERHEAD LINES
PORTAL TYPE CROSSARM COMPONENTS
NORTHERN POWERGRID


CAT. NO. 245710
GRITTED GREASE AND PROTECTIVELY CAPPED.
61.5 (MAX)
35
78
45
90
ø19.5
ø14.5
ø18.00
ø09.13
30
3(typ)
76
COMPRESSION LENGTH
ø27
85
BEFORE COMPRESSION
60
2 HOLES ø18
25 MAX
25 MIN
51
105
32 MIN
32 MIN
EQUIVALENT LENGTH OF CONDUCTOR 'E'
160 COMPRESSION LENGTH
45
R1.5
2.5°
MARKING:
MO 226707
160 / 175 ACSR
32.33 A/F
MONTH / YEAR
XXXXXX
WHERE 'XXXXXX' REPRESENTS A MOCCL TRACEABILITY MARK.
ø38.10
ø21.83
16.00
PROTECTIVE COATING (CROCELL).
CONTACT FACES.
ø6.4
ø6.0
12.5
DIRECTION OF COMPRESSION
ALUMINIUM BODY
KNURL MARKS
ALUMINIUM
BINDERS
STEEL
STEEL CLEVIS
CUT BACK DIMENSIONS
NOTES:
1. RELAVANT SPECIFICATION TO NGTS 3.4.6
2. THE BORE OF THE FITTING IS PARTIALLY FILLED WITH GREASE AND PROTECTIVELY CAPPED.
3. COMPRESSION DIE 32.33 A/F REGULAR HEXAGON.
4. GENERAL TOLERANCES TO BS 3288.
5. ALL STEEL COMPONENTS ARE GALVANISED TO BSENISO 1461.
6. WELDING TO MOSCCL WELDING PROCEDURE WP/001.
7. WEIGHT; 2.5KG (APPROX).
8. THE BOLT THREADS ARE PROTECTIVELY COATED WITH SUITABLE GREASE.
9. THE FLAG FACES ARE SCRATCH BRUSHED AND THEN PROTECTIVELY COATED.
COMPRESSOR / DIE REFERENCE
AL
ST
DIMENSION A (MM)
DIMENSION X (MM)
DIMENSION B (MM)
CONDUCTOR
RESISTANCE OF FITTINGS AVERAGE (MICRO - OHMS
P1 - P2
P1 - P3
'e' (CALCULATED)
36 TON/ A9 S9 100 25 27 LYNX 175 ACSR 37.5 17.6 23.8
60 TON/ A9 S9 100 25 26 KEZIAH 160 AACSR 42.9 13.3 26.0
100 TON/ A9 S9 100 25 25
NORTHERN POWERGRID
Manufacturer Details
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
COMPRESSION ANCHOR CLAMP FOR 150/175MM ACSR (WOLF/LYNX)-HEXPRESS DESIGN
Sheet No. 3
Scale N.T.S.
Prepared By Arron Turner
Type OVERHEAD
STANDARDS
Revised 23/05/14
Grid Reference
Ref No. C1035513
Historic Drg.No. 1091010653
Date Issued 15/05/14
Checked By G HAMMEL
Revision Notes

	CAT. No.
ITEM 1	241924
ITEM 2	241943
ITEM 3	241962
ITEM 4	250800
ITEM 5	241982

	CONDUCTOR		NAME	DIA. mm / In		SPACING
60mm² ACSR	12/7/2.68mm	SKUNK	12.95 (.510)	ITEM 1	760mm
70mm² ACSR	12/7/2.79mm	HORSE	13.95 (.550)	ITEM 1	840mm
100mm² ACSR	6/4.72 & 7/1.57mm	DOG	14.15 (.557)	ITEM 1	840mm
100mm² ACSR	18/1/3.35mm	DINGO	16.75 (.660)	ITEM 2	990mm
150mm² ACSR	30/7/2.59mm	WOLF	18.13 (.714)	ITEM 3	1070mm
175mm² ACSR	18/1/3.61mm	BURGS	16.4 (.646) COMPACTED	ITEM 2	990mm
175mm² ACSR	30/7/2.79mm	LYNX	19.53 (.770)	ITEM 3	1140mm
175mm² ACSR	18/1/3.61mm	CARACAL	18.05 (.711)	ITEM 3	1070mm
100mm² AL. ALLOY	7/4.65mm	OAK	13.95 (.550)	ITEM 1	840mm
175mm² AL. ALLOY	19/3.78mm	ELM	18.8 (.740)	ITEM 3	1070mm
200mm² AL ALLOY	33/2.87mm	POPLAR	20.1	ITEM 5	800mm
300mm AL. ALLOY	37/3.53mm	UPAS	24.71 (.973)	ITEM 4	1300mm

NOTE
1. SPACING DIMENSION TO BE TAKEN FROM END OF COMPRESSION TERMINATOR AT SECTION POINT OR FROM TONGUE ENDED SUSPENSION CLAMP.

NORTHERN POWERGRID

Manufacturer Details

Sheet No. 1 | Scale N.T.S.

Prepared By Joan.Oakley

Grid Reference

Revised 23/11/11
Date Issued 08/08/07

Checked By G HAMMEL

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

VIBRATION DAMPER

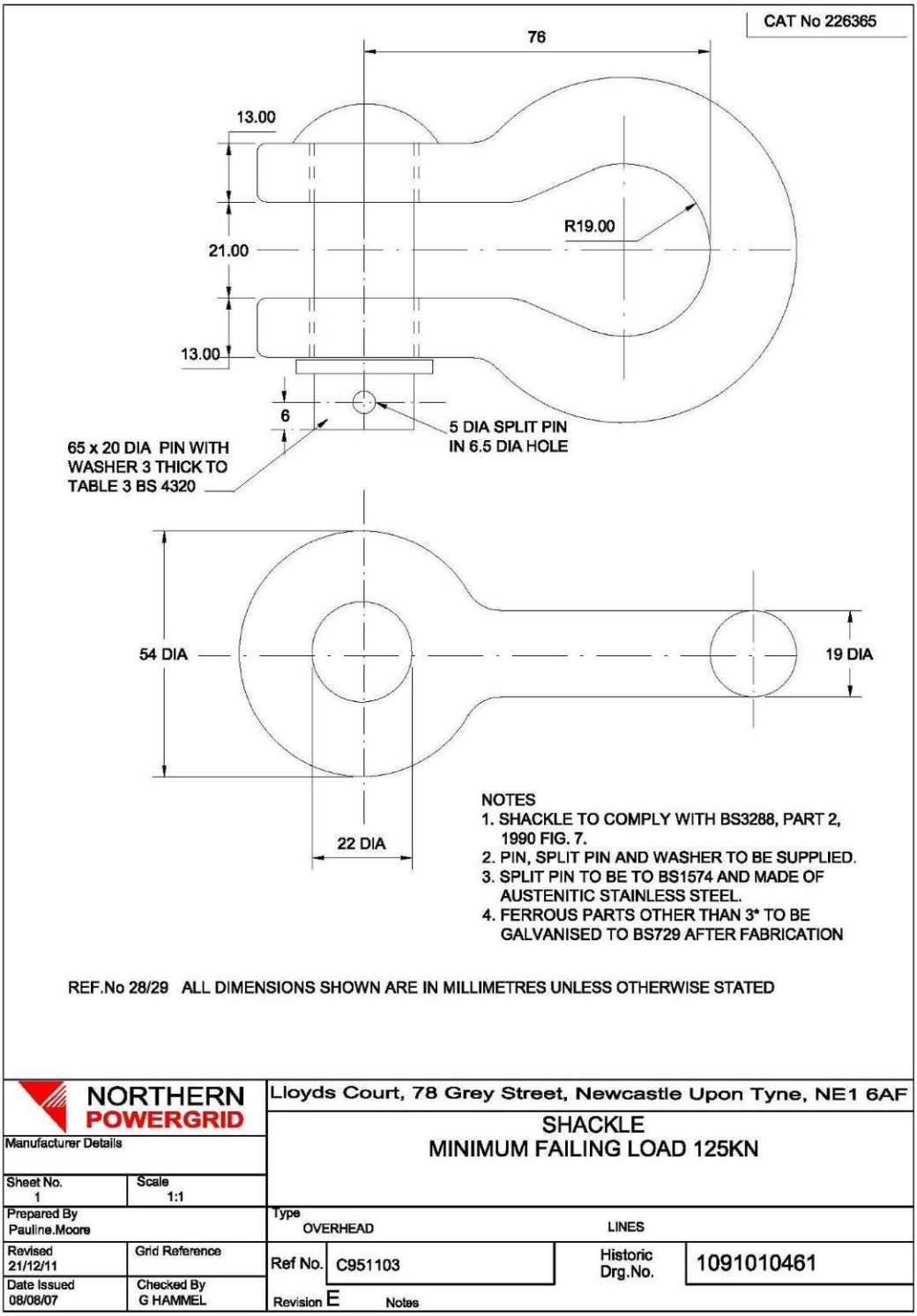
Type OVERHEAD LINES

Ref No. C951106

Historic Drg.No. 1091010188

Revision E

Notes


CAT No 226365
76
13.00
21.00
13.00
R19.00
6
5 DIA SPLIT PIN
IN 6.5 DIA HOLE
65 x 20 DIA PIN WITH
WASHER 3 THICK TO
TABLE 3 BS 4320
54 DIA
19 DIA
22 DIA
NOTES
1. SHACKLE TO COMPLY WITH BS3288, PART 2, 1990 FIG. 7.
2. PIN, SPLIT PIN AND WASHER TO BE SUPPLIED.
3. SPLIT PIN TO BE TO BS1574 AND MADE OF AUSTENITIC STAINLESS STEEL.
4. FERROUS PARTS OTHER THAN 3* TO BE GALVANISED TO BS729 AFTER FABRICATION
REF.No 28/29 ALL DIMENSIONS SHOWN ARE IN MILLIMETRES UNLESS OTHERWISE STATED
NORTHERN POWERGRID
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
Manufacturer Details
SHACKLE
MINIMUM FAILING LOAD 125KN
Sheet No. 1
Scale 1:1
Prepared By Pauline.Moore
Type OVERHEAD LINES
Revised 21/12/11
Grid Reference
Ref No. C951103
Historic Drg.No. 1091010461
Date Issued 08/08/07
Checked By G HAMMEL
Revision E
Notes

APPENDIX D – SELF-SUPPORTING STEEL MASTS

D1. Introduction

This Appendix covers the design and constructional requirements for new 3-phase overhead lines on self-supporting steel masts to replace the Woodhouse Mast structures and to operate at voltages up to and including 132 kV in accordance with the requirements of BS EN 50341-1:2012 Overhead Electrical Lines Exceeding AC 45 kV. The structures have been designed utilising 200 mm² bare aluminium alloy (AAAC) conductors and comply with the "Empirical" design approach as detailed in BS EN 50341-3-9:2015 and ENA TS 43-97 Steel Supports for Single Circuit 132 kV Overhead Lines with the exception of the partial strength parameters which shall be as detailed below.

D2. Design Criteria

The steel masts detailed in this Appendix are designed to be self-supporting structures without guys and designed to resist the loads due to the climatic, accidental-security conditions, construction and maintenance conditions as given in the main code of practice except as detailed below.

The following clauses differ from those given in the main body of the Woodhouse Mast Replacement Code of practice. Otherwise the clauses given in the Woodhouse Mast Replacement Code of practice shall apply.
The supports detailed in this Appendix may be used for different conductors, spans and loading conditions subject to satisfactory design analysis.

The designs may be in accordance with ANSI/NEMA TT1 – “Tapered Tubular Steel Structures” published by the American National Standards Institute or alternative approved design method.

D2.1 Type tests

Where manufactures cannot provide suitable evidence to demonstrate that they have experience of designing and fabricating similar structures to those detailed in ENA TS 43-97, they will be required to confirm the adequacy of the design by submitting the structures for type tests. The results of the type tests shall be applied to any supports not tested using the same design methods as for the tested pole support. For this purpose the interpretation of the test results, the actual geometry and strength properties of the tested pole support shall be taken into account. One method of achieving this is to be found in BS 5649 part 8.

The tests on complete supports shall be in accordance ENA TS 43-97 Issue 2, Part 2 Test Requirements.

D2.2 Security Loads

D2.2.1 Broken Wire

The self-supporting steel masts detailed here have been designed to withstand longitudinal loads resulting from a “broken wire” condition defined as the static tension of one broken phase conductor.

D2.3 Partial Factors

D2.3.1 Partial Strength Factors

The following partial strength factors shall be used for steel poles and crossarms

Component	Clause	Material Property	γ_m
Steel Members	5.5	Resistance of cross sections and buckling of sections (based on yield strength)	1.15
Mild steel		Nominal yield (275 N/mm²) 240 N/mm²	
High yield steel		Nominal yield (355N/mm²) 310 N/mm²	
Bolts		Grade 8.8 according to BS 5950	1.15
Welds		Electrodes to E43/E51 according to BS639	1.15

D2.3.2 Deflection

The deflection at the top of the pole shall not exceed 1.5% of its overall length when subjected to its unfactored working loads excluding the effect of foundation rotation.

D3. Construction and Dimensions

The pole shafts shall be octagonal and of folded plate construction as detailed. The steel crossarms shall be tapered and either of hollow section or folded plate. Fabrication, welding and tolerances shall be in accordance with ENA TS 43-97 - Steel Supports for Single Circuit 132 kV Overhead Lines unless detailed otherwise within this.

Each pole support shall be permanently marked on the base adjacent to the concreting hatch with the pole type and length, year of manufacture, manufacturers name and the Contract Reference.

D3.1 Pole and Crossarm Assemblies

Poles and Steel crossarms shall be designed in accordance with BS 5950 Structural use of Steelwork in Building, Part 1, Code of Practice for Design – Rolled and Welded Sections, except that partial factors for loads shall be in accordance with Clause 2.5.1 Partial Factors for Actions as given in this code of practice.

D3.2 Materials

D3.2.1 Steel

All steel shall comply with the requirements of BS EN 10025, BS EN 10137 or BS EN 10210 as appropriate and shall be suitable for all the usual fabrication processes, including hot and cold working within the specified ranges.

The quality of finished steel shall be in accordance with BS EN 10163 or BS EN 10210 as appropriate. All steel shall be free from blisters, scale, laminations, segregations and other defects. There shall be no rolling laps at the toes of rolled sections or rolled-in mill scale.

a) Unless stated to the contrary the following grades of stell shall be applicable:
b) Mild Steel shall be grade S275JR (Fe430B)
c) High Tensile steel shall be grade S355JR (Fe510B) for sections less than 20mm thick and grade S355JO (Fe510C) for sections greater or equal to 20mm, except for plates which shall be greater or equal to 40mm thick. The minimum steel thickness shall be 5mm.
d) Steel plates for folded, pressed braked or stretch bending pole supports shall be of a suitable grade to meet the recommendations of clause 7.4.3 of part 1
e) Mils steel and high tensile hollow sections shall be grade S275J2H and S377J2H respectively
Steel section profiles shall be in accordance with the requirements of BS4 part 1, BS EN 10056, BS EN 10210 and BS EN 10279 as appropriate.
f) Hot rolled steel plates greater or equal to 3mm thick shall be in accordance with BS EN 10029 or BS EN 10137 as appropriate.

D3.2.2 Bolts Nuts and washers

a) Unless stated otherwise in the code of practice the following grades of steel shall be acceptable:
b) Steel for bolts smaller or equal to 12mm diameter shall be grade S275JR
c) Steel for bolts greater or equal to 16mm diameter shall be to grade S355JR, unless otherwise agreed.
d) Steel for non-structural step bolts shall be grade S275JR
e) Nuts shall be grade S275JR
f) Holding down bolts shall be strength grade 8.8/10 to BS 4190
g) Unless stated to the contrary bolts and nuts shall be ISO Metric Black Hexagon to BS 4190, and shall be threaded ISO Metric Course pitch to BS3643 part 2, tolerance class 7H/8g
h) Unless stated to the contrary holding down bolts shall be supplied complete with two full nuts and one locknut.
i) Countersunk and other bolts without hexagon heads shall have slotted heads.
j) All flat washers shall comply with the requirements of BS4320, Form E, Grade 4.6. Unless specified to the contrary they shall be 3mm thick. Pack washers shall have an external diameter of twice the nominal bolt diameter plus 15mm, a hole with a diameter of the nominal bolt diameter plus 2mm and a thickness as specified on the appropriate fabrication drawing.

D3.2.3 Welding

All welding shall be carried out in accordance with the requirements of BS 5135 and BS EN 1011-1.

D3.2.4 Erection Marks

Before leaving the fabricators works, all members shall be stamped with distinguishing numbers and or letters corresponding to those on the general arrangement or fabrication drawings. Additionally, the agreed fabricators identification symbol must appear adjacent to the erection mark.

Erection marks shall be stamped on before galvanising, using characters at least 10mm high and shall be clearly legible after galvanising.

Erection marks shall be located as follows:

All members – stamped within 600mm of the end but clear of the holes.
Plates or flat bars – stamped at the most suitable position between holes
Horizontal members – stamped at either end of the bar

Steel pole sections – 100mm either side of the joint.
Steel poles shall be marked on the base adjacent to the earthing lug with the year of manufacture, the manufacturers name and the contract reference.

D3.3 Slip Joints

Slip joints shall develop the full required design strength. They should be detailed for a minimum lap of 1.5 times the larger diameter with an allowance of 75mm for fabrication tolerance.

D3.4 Corrosion Protection

Unless stated to the contrary, after completion of all fabrication processes (including all drilling, punching, stamping, cutting, bending and welding) support steelwork, poles and pole steelwork including nuts, bolts and washers shall be hot dip galvanised and tested in accordance with the requirements of BS EN ISO 1461. Electro-galvanising is not an acceptable alternative.

Excessively thick or brittle coatings due to high levels of silicon or phosphorous in the steel, which may result in an increased risk of coating damage and/or other features that make the final product “not fit for purpose” shall be cause for rejection.

All materials prior to galvanising shall be free from oil, grease or any other substance which may adversely affect the quality or finish.

All bolts and screwed rods, including the threaded portions, shall be galvanised. The threads shall be cleaned of all surplus spelter by spinning or brushing. Dies shall not be used for the cleaning threads other than nuts. Nuts shall be galvanised and tapped 0.4mm oversize and threads shall be oiled.

D3.5 Cat Ladder

The cat ladder step bolts shall be M16 x 200mm long grade 8.8 bolts and shall commence at 2.0m above ground level and be continuous to within 1m from the pole top. Step bolt spacing shall typically be 300mm.

D3.6 Type and Range of Structures

The range of the steel pole supports have been selected such that the existing Woodhouse Mast lines can be replaced and uprated without the need to insert additional support structures. The new steel pole designs are based on overall pole lengths of 12 m, 14m and 16m. This range of pole lengths will allow the existing poles to be replaced without exceeding the existing structure heights. However, subject to the approval of the Engineer, if any ground clearance infringements are encountered then these can be overcome by using the next height of pole provided the height increase is 10% or less.

The structures detailed provide for the following angles of deviation.

Structure Type	Deviation
Intermediate	0º
Section D10	0º – 10º
Section D30	10º - 30º
Section D45	30º – 45º

D3.7 Foundations

Structure foundations shall be designed for three soil conditions in accordance with Clause 4.10 of the main body of this Code of practice. Steel mast foundations shall be of the mass concrete monoblock type, installed at the minimum depths shown on the drawings. The detail drawings are based on 628kN/m^2 or “good” soil on the premise that soil additives will be used when required.

Concrete shall be designated mix FND3 in accordance with BS8500: Part 2 and shall be cast in one pour and fully compacted. The inside of the pole shall be filled with compacted concrete to ground level via the concreting hatch provided.

D3.7.1 Protection of buried steelwork

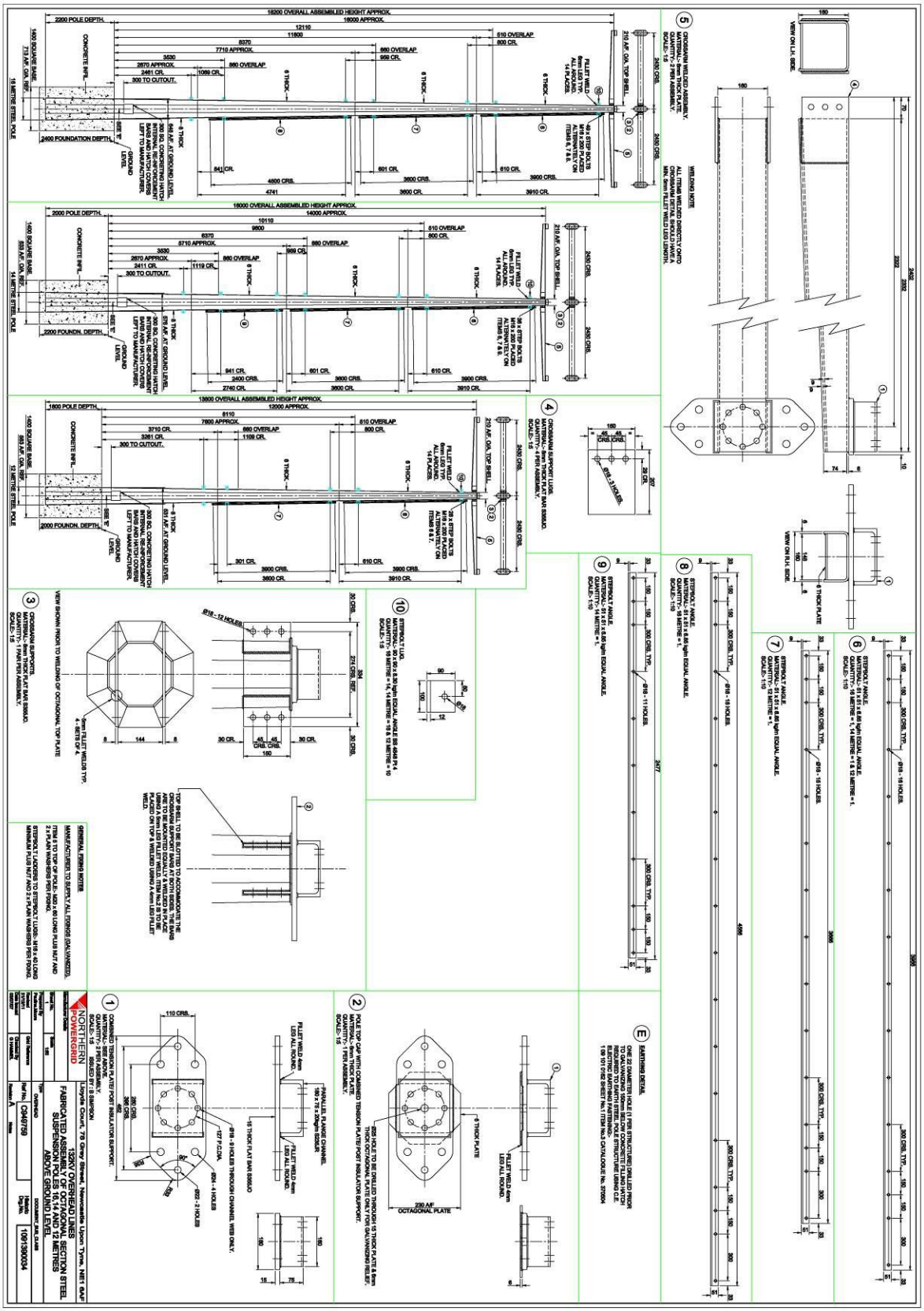
Any part of the pole support steelwork buried in the ground is to be given additional anti-corrosion protection. This should consist of a heavy duty bituminous paint with a density of 1kg/litre to be applied at a rate of 1.7 to 2.1sq.m/litre over the whole of the exterior and interior surfaces of the complete base section and to extend to 300mm above known ground level.

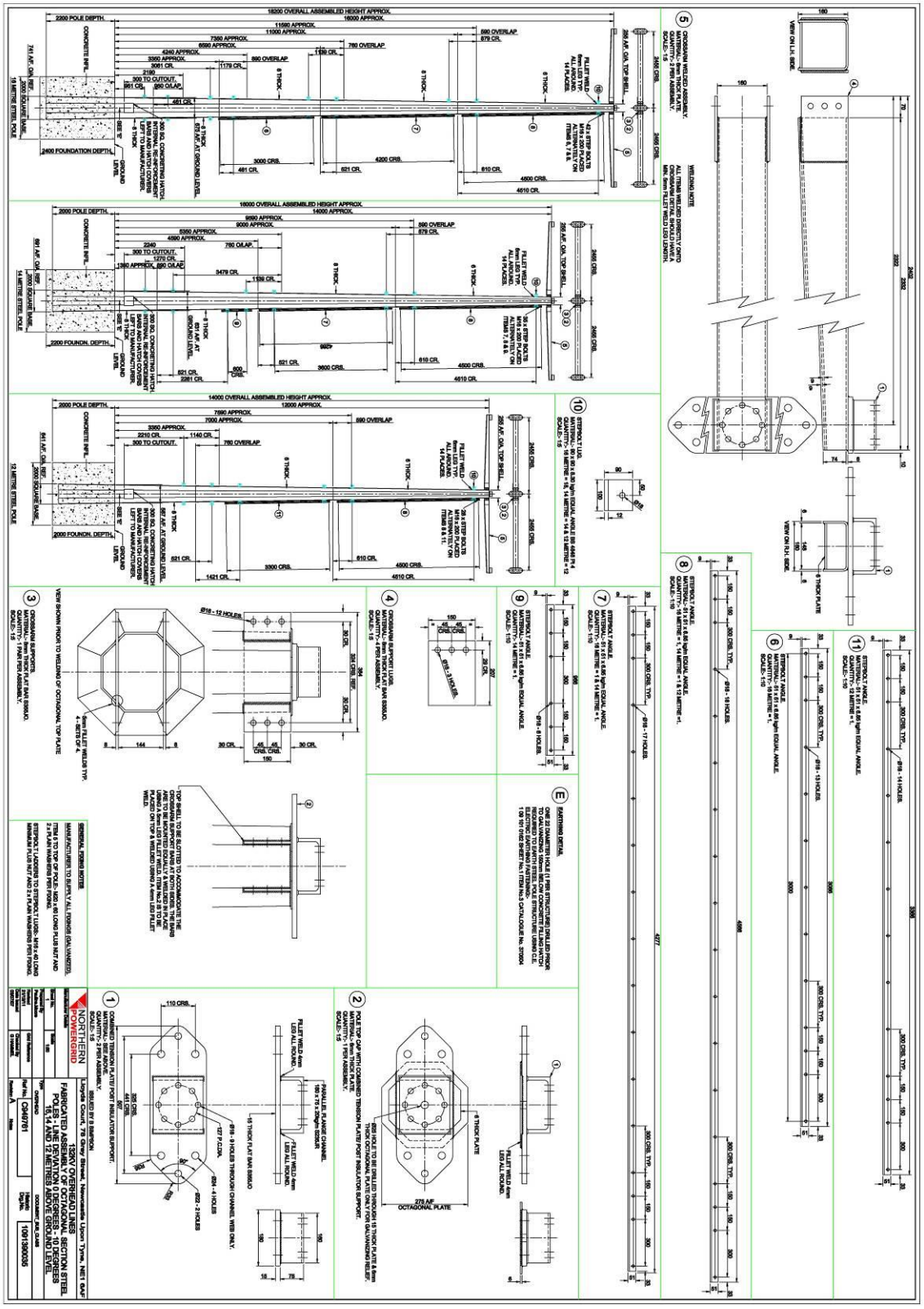
D3.8 Earthing

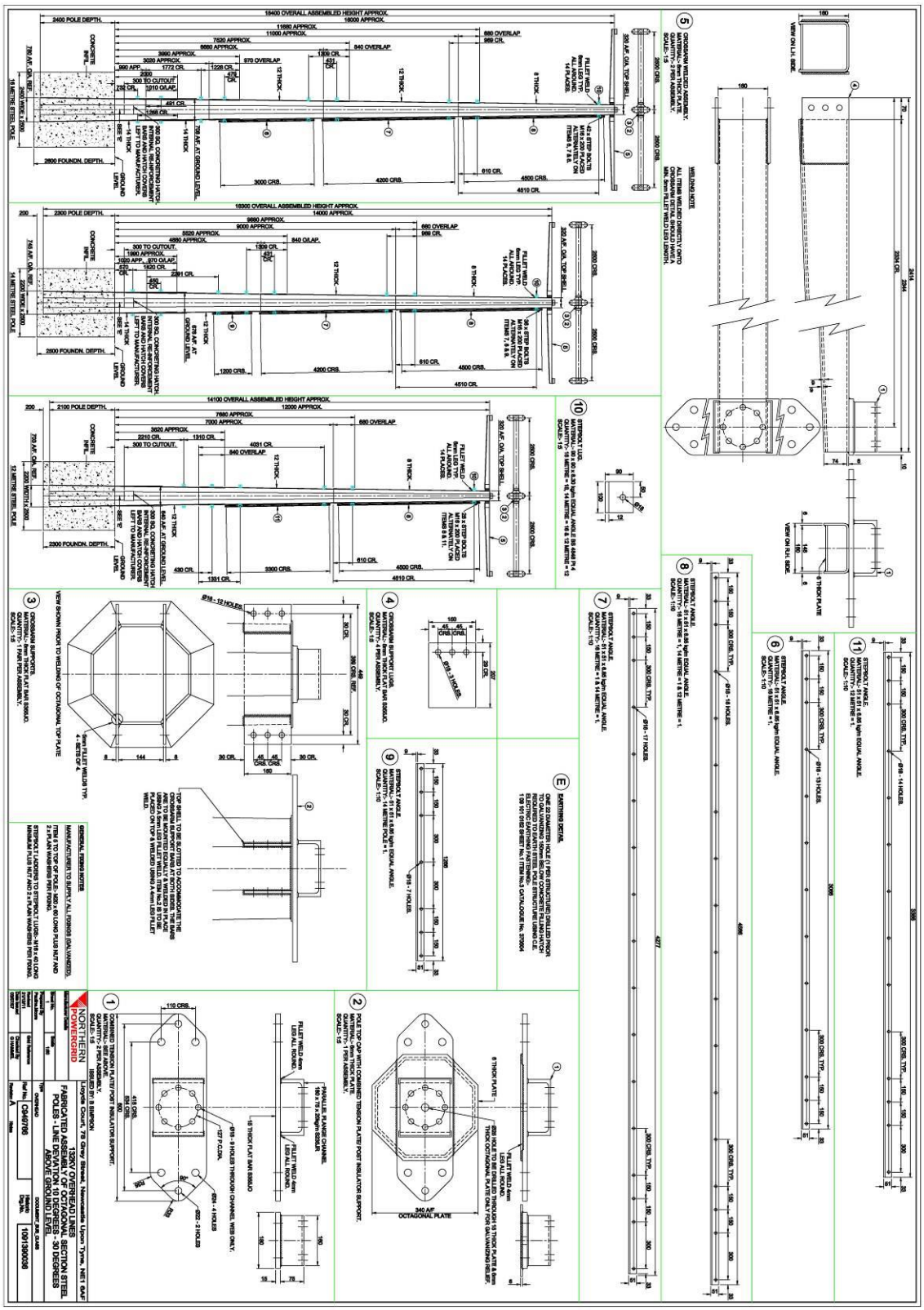
All steel structures shall be earthed with the earth cable connected to the pole and earth rods as required to obtain a maximum earth resistance of not more than 10 ohms. Earth rods and their connectors shall comply with the requirements of ENA TS 43-94.

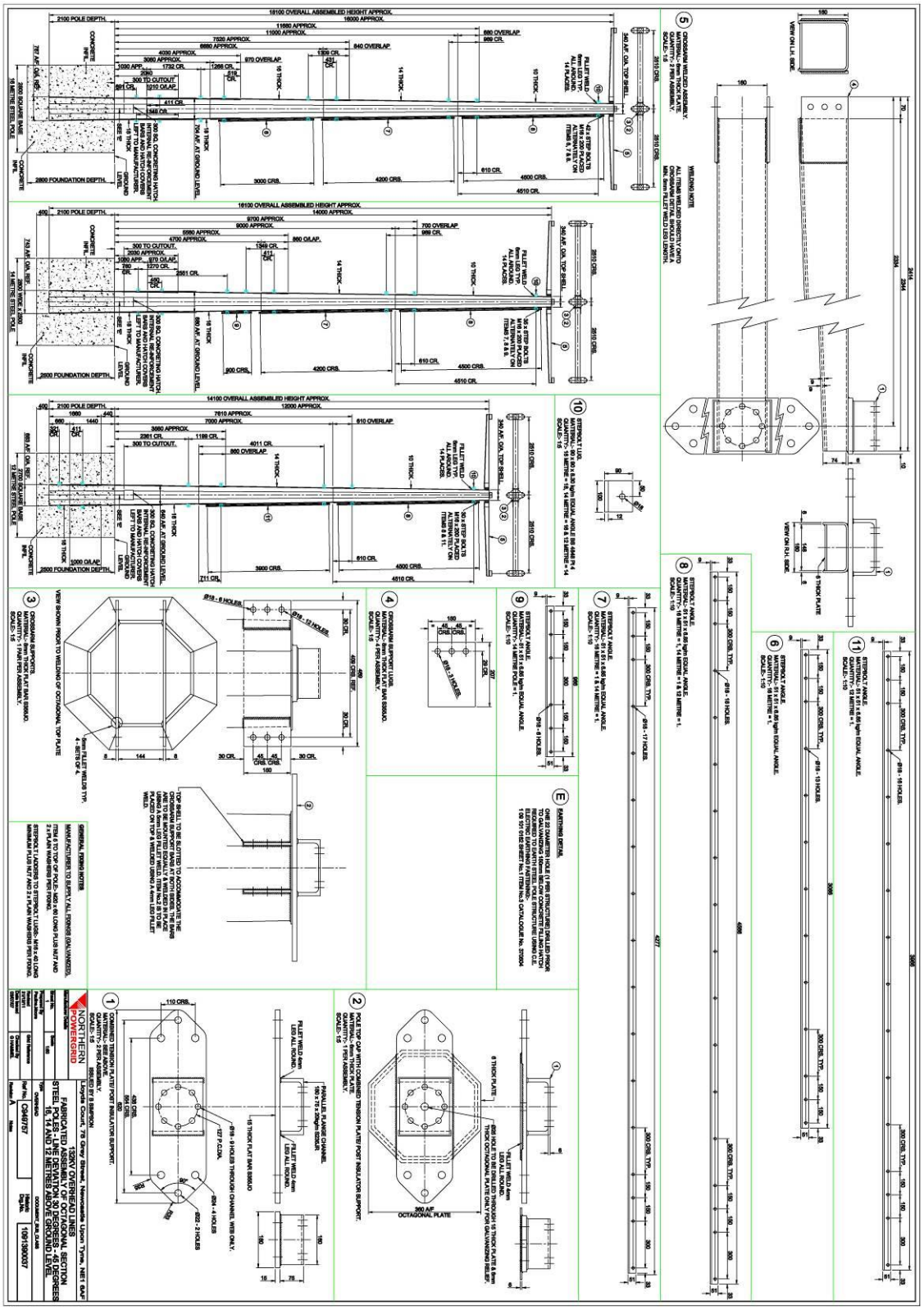
D3.9 Self Supporting Steel Mast Drawing Arrangements

The following pages detail a selection of self-supporting steel mast structures to be used in conjunction with the main body of this document where specific design conditions are encountered


132KV OVERHEAD LINES
FABRICATED ASSEMBLY OF OCTAGONAL SECTION STEEL SUSPENSION TOWER WITH 12 METRES ABOVE GROUND LEVEL
CM40799
1091300034

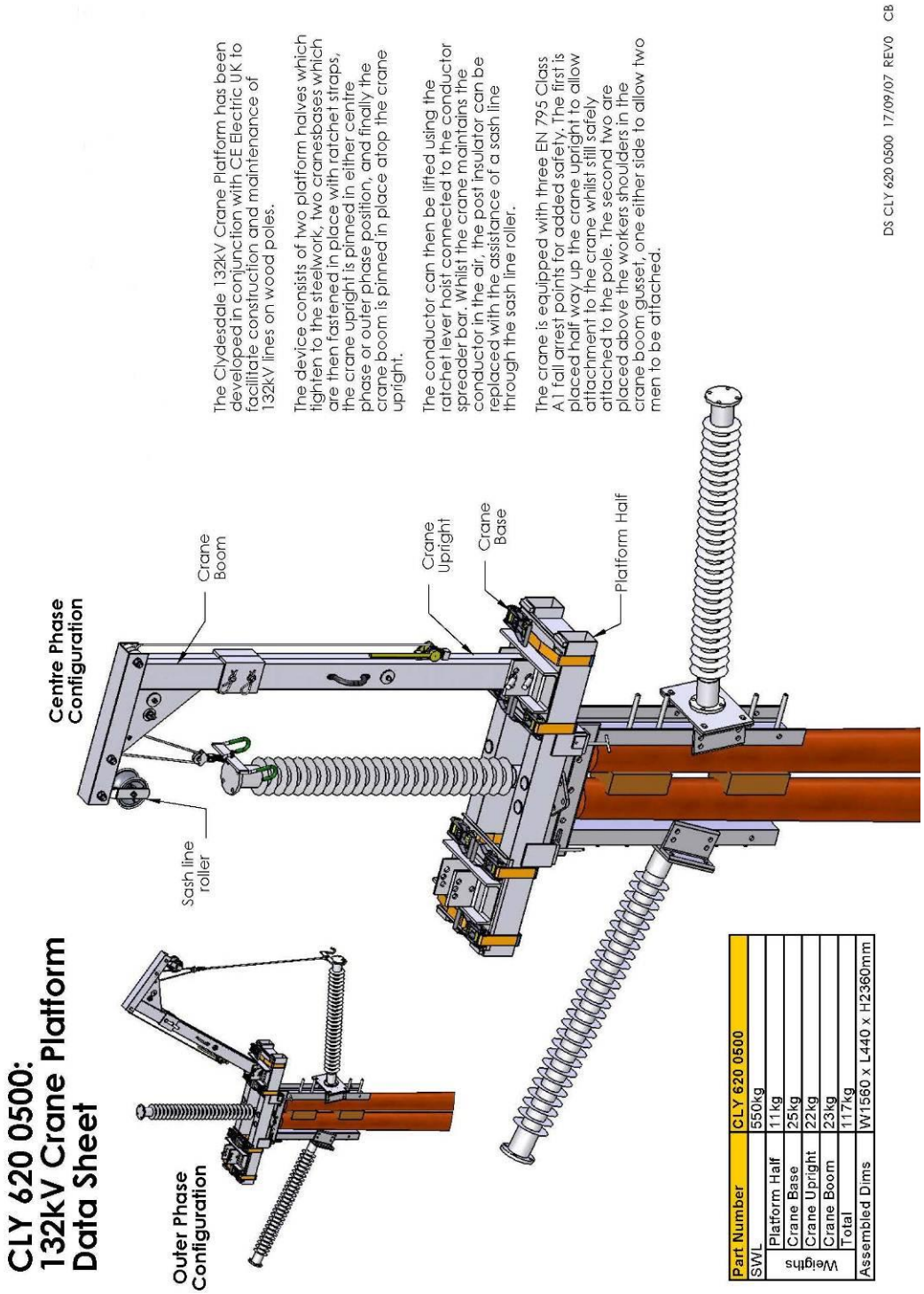



FABRICATED ASSEMBLY OF OCTAGONAL SECTION STEEL POLES - LINE DEVIATION 10 DEGREES - 30 DEGREES ABOVE GROUND LEVEL
NORTHERN POWERGRID
Lingfield Court, 79 Grey Street, Newcastle Upon Tyne, NE1 6AF
DRAWING NUMBER
10913800036
DRAWN BY S SIMPSON
CHECKED BY S CHAMBERS
DATE 13/06/2017
Part No. CM/47/06
TYPE OCTAGON
Revision A
Note
Approved By
Date
Issue No.
Checked By
Drawn By
Issued By
Drawing No.
Title
Sheet No.
Size
Scale
Revision

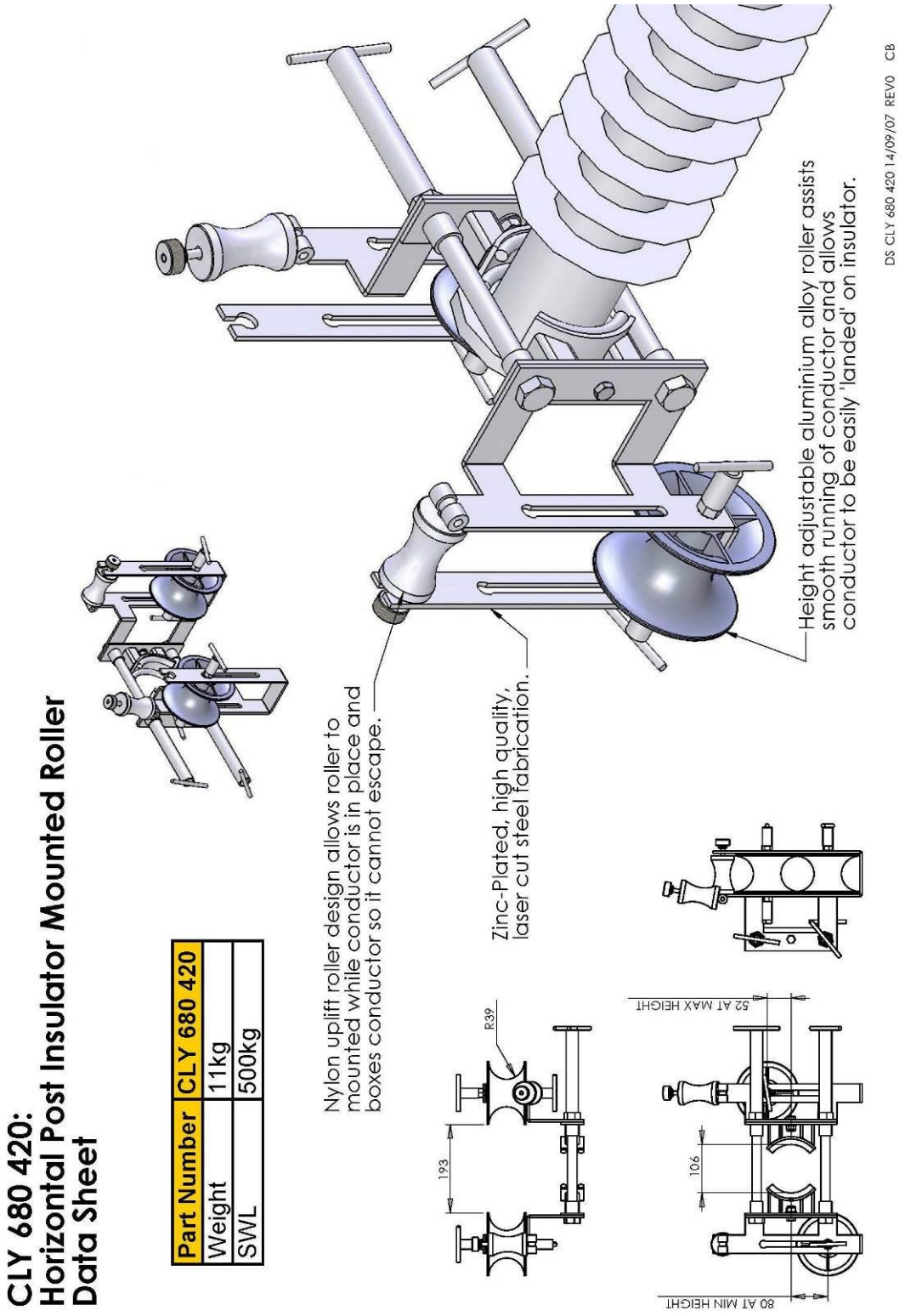

FABRICATED ASSEMBLY OF OCTAGONAL SECTION STEEL POLE FOR 132kV OVERHEAD LINES
16, 14 AND 12 METRES ABOVE GROUND LEVEL
Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF
10910900037

APPENDIX E – SPECIALIST POLE TOP EQUIPMENT

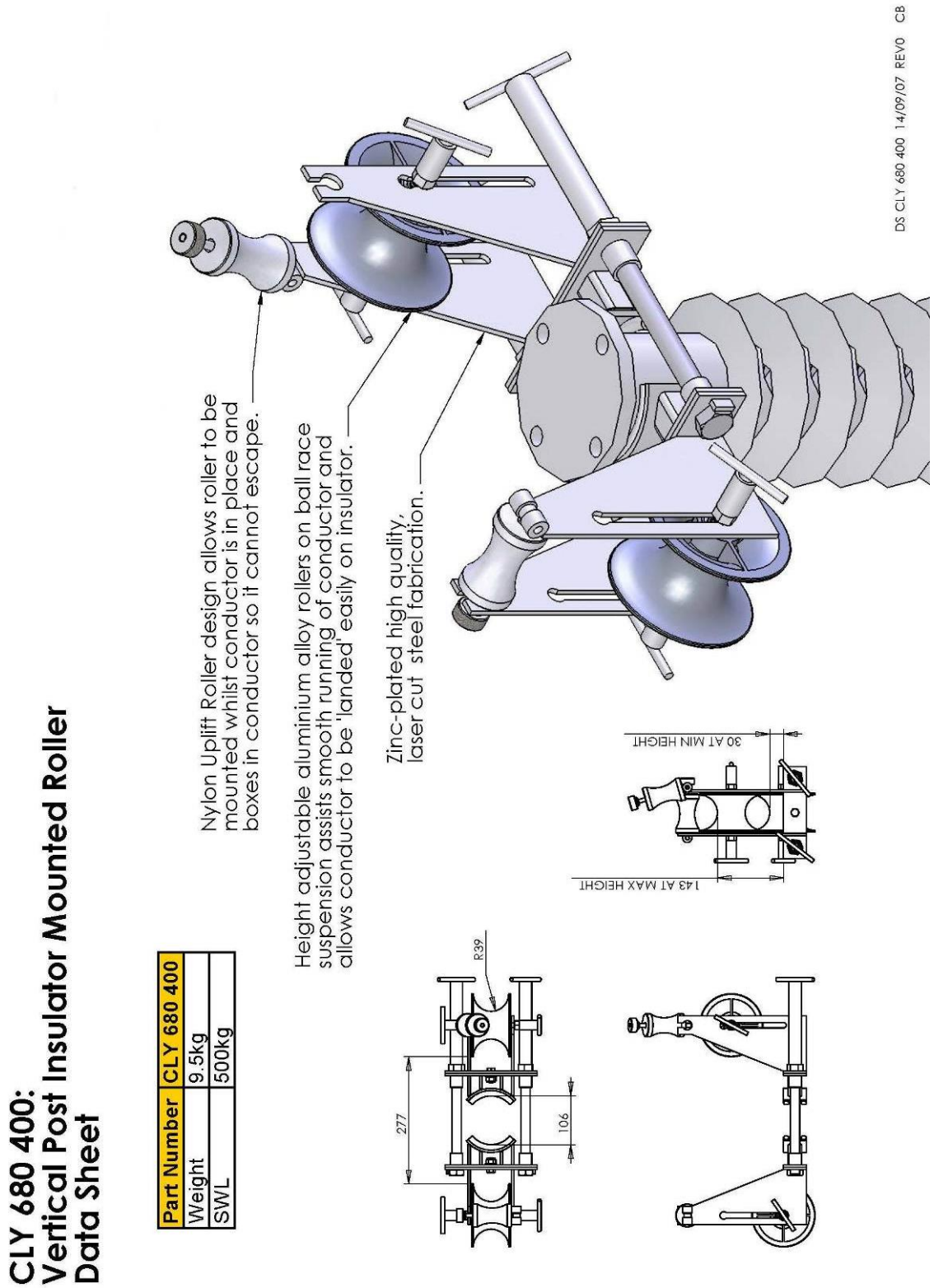
E1 Crane / Platform



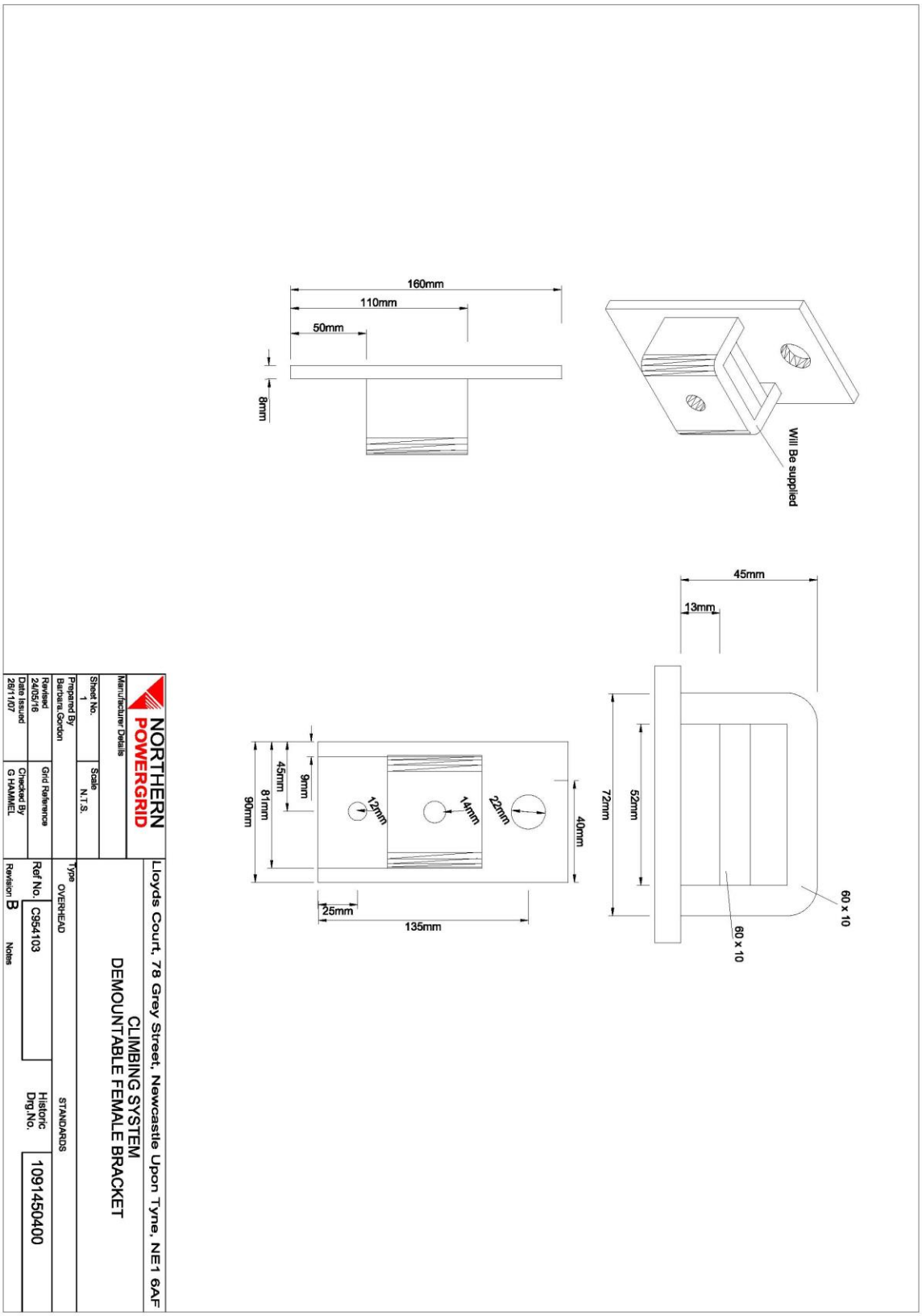
E2 Horizontal Insulator Mounted Roller



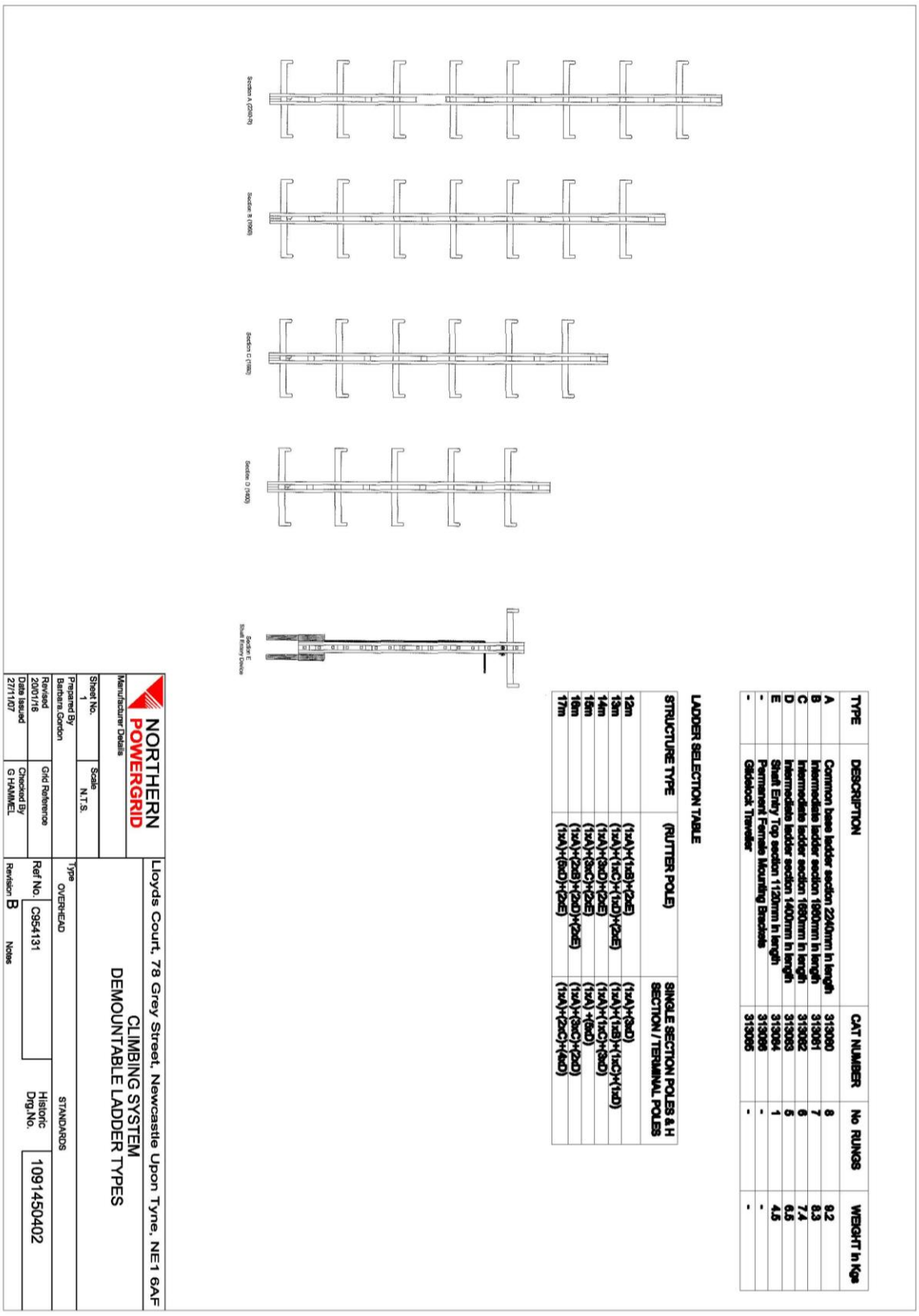
E3 Vertical Insulator Mounted Roller



E4 Fixed Bracket for Demountable Ladders



E5 Demountable Ladder System



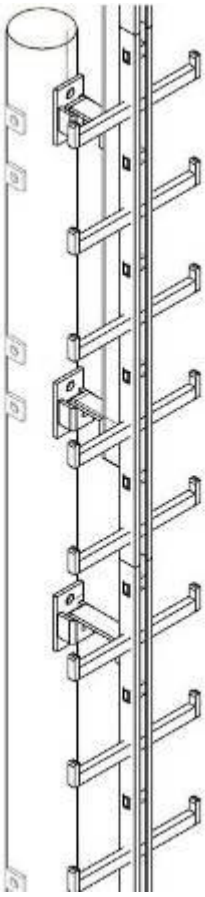
TYPE	DESCRIPTION	CAT NUMBER	No RUNGS	WEIGHT In Kgs
A	Common base ladder section 2240mm ht length	313060	8	9.2
B	Intermediate ladder section 1680mm ht length	313061	7	8.3
C	Intermediate ladder section 1680mm ht length	313062	6	7.4
D	Intermediate ladder section 1400mm ht length	313063	5	6.5
E	Shaft Entry Top section 1120mm ht length	313064	1	4.5
-	Permanent Ferrule Mounting Brackets	313066	-	-
-	Gibdock Traveller	313065	-	-

LADDER SELECTION TABLE

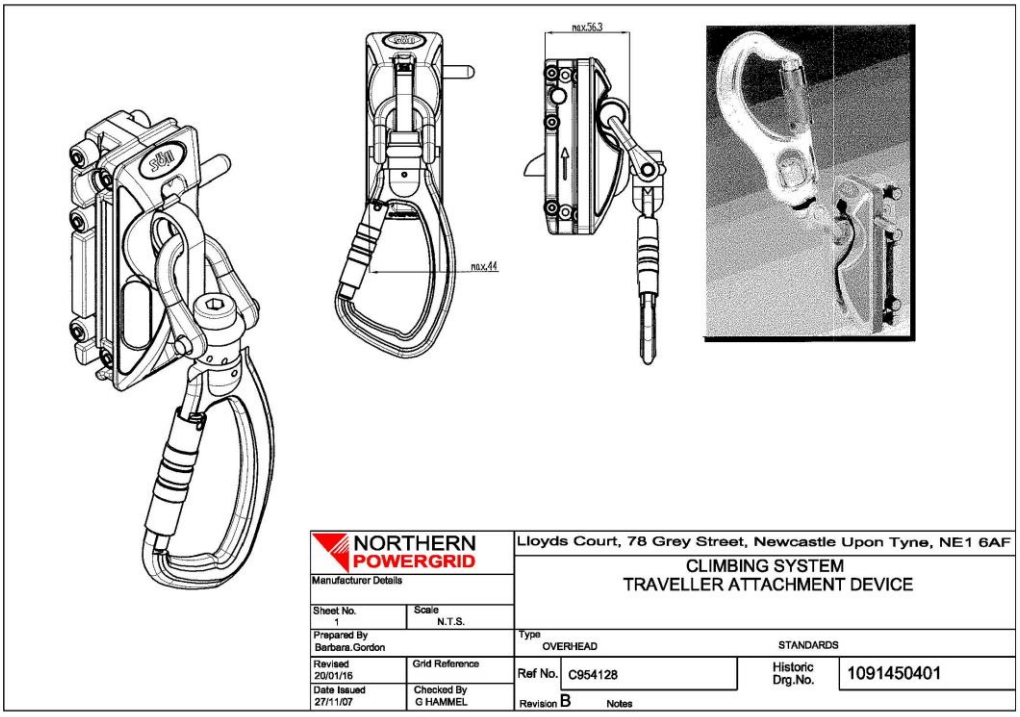
STRUCTURE TYPE	(RUTTER POLE)	SINGLE SECTION POLES & H SECTION / TERMINAL POLES
12m	(1xA)+(1xB)+(2xE)	(1xA)+(3xD)
13m	(1xA)+(1xC)+(1xD)+(2xE)	(1xA)+(1xB)+(1xC)+(1xD)
14m	(1xA)+(3xD)+(2xE)	(1xA)+(1xC)+(3xD)
15m	(1xA)+(3xC)+(2xE)	(1xA) +(5xD)
16m	(1xA)+(2xB)+(2xD)+(2xE)	(1xA)+(3xC)+(2xD)
17m	(1xA)+(5xD)+(2xE)	(1xA)+(2xC)+(4xD)

NORTHERN POWERGRID Manufacturer Details		Lloyds Court, 78 Grey Street, Newcastle Upon Tyne, NE1 6AF	
Sheet No. 1	Scale N.T.S.	CLIMBING SYSTEM DEMOUNTABLE LADDER TYPES	
Prepared By Barbara.Gordon		Type OVER-HEAD	STANDARDS
Revised 20/01/16	Grid Reference	Ref No. C954131	Historic Drg.No. 10914504O2
Date Issued 27/11/07	Checked By G HAMMEL	Revision B Notes	

E5.1 Demountable Ladder System



E6 Traveller Attachment Device



APPENDIX F – ADDITIONAL COP DESIGN CRITERIA

F1 Loads

F1.1 Construction and Maintenance Loads

The following construction and maintenance loads have been considered in the design of the structures in Appendix A, the Loads assume an ambient temperature of 5ºC in still air conditions and partial factors of 1.5 on static loads and 2.0 on dynamic loads. The structure designs in Appendix A take account of the additional point loadings of 1.5 kN created as the result of a linesman working. A partial factor of 2.0 is assumed.

F1.2 Short Circuit Loadings

This code of practice assumes that the forces due to short circuit currents on long, flexible conductors are less onerous than the climatic loadings.

F2 Partial Factors

F2.1 Partial Factors for Actions

The following partial factors s taken from BS EN 50341-2-9 shall be used:

Action (load)	Partial factor
Normal load cases – variable actions	
Climatic loads and conductor tension	
High wind (Load case 1)	1.1
Combined wind and ice (Load case 2 & 3)	2.5
Permanent actions	
Self-weight	
High wind (Load case 1)	1.1
Combined wind and ice (Load case 2 &3)	2.5
Static cantilever loads (All load cases)	1.0
Construction and maintenance (Load case 6)	1.5 on static loads 2.0 on dynamic loads

F2.2 Partial Strength Factors

The following partial strength factors taken from BS EN 50341-2-9 Table 4.13.2/GB.2 shall be used for overhead line components.

Component	Clause	Material Property	γ_m
Steel Members (Grade S275) used as ancillaries on wood poles	7.3.6.1	Resistance of cross sections and buckling of sections (based on yield strength)	0.63
		Resistance of bolted connections: (based on ultimate tensile strength)	(c)
		- Shear	1.33
		- Tension	1.0
		- Bearing	2.0
		Resistance of welded connections (based on yield strength of parent steel)	0.63 (c)
Timber Poles	7.5.5.1	Resistance of body of pole, cross-section, elements and bolted connections (based on mean ultimate strength of the timber)	2.5 (a)
Guyed Structures	7.7.4.1	Resistance of Guys (based on nominal failing load)	2.5
Foundations	8	Refer to project specification	2.5
Conductor	9.6.2	Resistance of conductors (based on nominal breaking load) (d) Combined wind and ice	2.0

Tension and Post Insulator Sets (b)	10.7	All string components (based on nominal failing load)	1.0
Notes	(a) Based on the application of mean modulus of rupture as defined in Clause 7.5.5/GB.4 of BS EN 50341-2-9. For wood pole intermediate un-guyed supports, the effects of the vertical loading shall be ignored unless specified in the Project Specification. (b) The coefficient applies only to ceramic (glass and porcelain) insulators: where non-ceramic insulators are to be used the coefficient will be defined in the Project Specification. (c) The appropriate γ_m factor has been determined based on the ratio of yield strength to ultimate tensile strength assuming grade S275 steel to BSEN 10025. For other steel grades, use same ratio to provide γ_m value. (d) The Nominal Breaking Load of conductors is a client defined percentage of the Rated Strength of the conductor as given in the appropriate standard e.g. BSEN 50182.		

F2.3 Partial Factors for actions, Intermediate pole declination

In respect of all intermediate structures on wood poles, it is normal practice in GB to design the structure considering transverse loading only. In order to take account of increasing p-delta effects and crippling loading with increasing declination, the factors indicated in the following Table BSEN 50341-2-9 table 4.13.2/GB.2 are generally employed.

Action (Load)	Partial Factor
Declination gradient – climatic loads	
Level Conditions – 1:25 (Load cases 2, 3 and 4)	2.5
1:25 - 1: 7.5 (Load cases 2, 3 and 4)	3.0
>1: 7,5 – 1: 5 (Load cases 2, 3 and 4)	3.5

F3.0 Supports

Supports have been designed to resist the specified loads due to the climatic conditions, accidental-security conditions and construction and maintenance conditions taking into consideration the specified partial load factors and partial material strength factors.

The following support loading criteria has been adopted in this code of practice:-

The wind loading spans on intermediate supports are based on pole strengths in accordance with BS 1990 and the limiting case between the pole strength and the foundation capability compared against the bending stresses induced in the supports from the pole top conductor loads.

The centre phase loadings are applied 1755 mm above pole top and outer phase loadings are applied 802 mm below pole top creating a combined pole loading point of 50mm below the pole top.

In addition the support capability may be further restricted by the available clashing performance offered within the selected basic span scenario detailed within clause 3.1

The stresses created in stayed supports are crippling stresses due to stay tension and vertical conductor loads acting at the pole top. The distribution of stresses in the limbs of 'H' supports on which all stays are adjusted to equal tension is considered to be as stayed equally on each limb – 50% of stress in each limb.

APPENDIX G – CONDUCTOR SAG CHARTS

200mm AAAC (Poplar) -150m Basic

CONDUCTOR SAG/TENSION PARAMETERS for DESIGN

Conductor Code Name (if any)	POPLAR
Greased Conductor Weight (kg/m)	0.68992
Cross Sectional Area of Conductor (mm²)	239.4
Conductor Overall Diameter (mm)	20.1
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm²)	5700
Rated Breaking Strength of Conductor (kgf)	7200.2
Basic / Recommended Span (m)	150
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	9.5
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	2379.3
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	1440.04
Temperature at EDT Limit (Degrees C)	5

Maximum Conductor Tension (MCT) (kgf)	at	-5.6°C	2379.3
Maximum Conductor Weight (MCW) (kg/m)			1.496
Maximum Conductor Pressure (MCP) (kg/m)			1.515
Freezing Point Tension (FPT) (kgf)	at	0°C	1463.2

Conductor Code Name	POPLAR	
Basic / Recommended Span (m)	150	
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

DESIGN TABLE

Temp. (Deg. C)	Tension (kgf)	Sag (m) for Span Length (m) 120	130	140	150	160	170	180	190	200
-5.6	1594.2	0.78	0.91	1.06	1.22	1.38	1.56	1.75	1.95	2.16
0	1463.2	0.85	1.00	1.16	1.33	1.51	1.70	1.91	2.13	2.36
5	1354.0	0.92	1.08	1.25	1.43	1.63	1.84	2.06	2.30	2.55
10	1252.9	0.99	1.16	1.35	1.55	1.76	1.99	2.23	2.48	2.75
15	1160.3	1.07	1.26	1.46	1.67	1.90	2.15	2.41	2.68	2.97
20	1076.5	1.15	1.35	1.57	1.80	2.05	2.32	2.60	2.89	3.20
25	1001.4	1.24	1.46	1.69	1.94	2.20	2.49	2.79	3.11	3.44
30	934.5	1.33	1.56	1.81	2.08	2.36	2.67	2.99	3.33	3.69
35	875.2	1.42	1.67	1.93	2.22	2.52	2.85	3.19	3.56	3.94
40	822.8	1.51	1.77	2.05	2.36	2.68	3.03	3.40	3.78	4.19
45	776.5	1.60	1.88	2.18	2.50	2.84	3.21	3.60	4.01	4.44
50	735.4	1.69	1.98	2.30	2.64	3.00	3.39	3.80	4.23	4.69
55	699.0	1.78	2.09	2.42	2.78	3.16	3.57	4.00	4.45	4.94
60	666.5	1.86	2.19	2.54	2.91	3.31	3.74	4.19	4.67	5.18
65	637.4	1.95	2.29	2.65	3.04	3.46	3.91	4.38	4.88	5.41
70	611.3	2.03	2.38	2.77	3.17	3.61	4.08	4.57	5.09	5.64
75	587.7	2.11	2.48	2.88	3.30	3.76	4.24	4.75	5.30	5.87
80	566.4	2.19	2.57	2.98	3.43	3.90	4.40	4.93	5.50	6.09

Conductor Code Name	POPLAR	
Basic / Recommended Span (m)	150	
Temperature Shift for Creep (Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)	10.0	at 15°C
Required Percentage Increase in Tension (%)	10	at 15°C

ERECTION TABLE

Temp. (Deg. C)	Tension (kgf)	Sag (m) for Span Length (m) 120	130	140	150	160	170	180	190	200
-5.6	1748.3	0.71	0.83	0.97	1.11	1.26	1.43	1.60	1.78	1.97
0	1608.6	0.77	0.91	1.05	1.21	1.37	1.55	1.74	1.94	2.14
5	1490.5	0.83	0.98	1.13	1.30	1.48	1.67	1.87	2.09	2.31
10	1379.5	0.90	1.06	1.23	1.41	1.60	1.81	2.03	2.26	2.50
15	1276.3	0.97	1.14	1.32	1.52	1.73	1.95	2.19	2.44	2.70
20	1181.7	1.05	1.23	1.43	1.64	1.87	2.11	2.36	2.63	2.92
25	1095.8	1.13	1.33	1.54	1.77	2.01	2.27	2.55	2.84	3.15
30	1018.6	1.22	1.43	1.66	1.90	2.17	2.45	2.74	3.06	3.39
35	949.8	1.31	1.53	1.78	2.04	2.32	2.62	2.94	3.28	3.63
40	888.8	1.40	1.64	1.90	2.18	2.48	2.80	3.14	3.50	3.88
45	834.8	1.49	1.75	2.02	2.32	2.64	2.99	3.35	3.73	4.13
50	787.1	1.58	1.85	2.15	2.47	2.81	3.17	3.55	3.96	4.38
55	744.8	1.67	1.96	2.27	2.61	2.96	3.35	3.75	4.18	4.63
60	707.3	1.76	2.06	2.39	2.74	3.12	3.52	3.95	4.40	4.88
65	673.9	1.84	2.16	2.51	2.88	3.28	3.70	4.15	4.62	5.12
70	644.1	1.93	2.26	2.62	3.01	3.43	3.87	4.34	4.83	5.36
75	617.3	2.01	2.36	2.74	3.14	3.58	4.04	4.53	5.04	5.59
80	593.2	2.09	2.46	2.85	3.27	3.72	4.20	4.71	5.25	5.82

200mm AAAC (Poplar) -200m Basic

CONDUCTOR SAG/TENSION PARAMETERS for DESIGN

Conductor Code Name (if any)	POPLAR
Greased Conductor Weight (kg/m)	0.68992
Cross Sectional Area of Conductor (mm²)	239.4
Conductor Overall Diameter (mm)	20.1
Coefficient of Linear Expansion (/Degree C)	2.3E-05
Modulus of Elasticity (kg/mm²)	5700
Rated Breaking Strength of Conductor (kgf)	7200.2
Basic / Recommended Span (m)	200
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	9.5
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	2379.3
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	1440.04
Temperature at EDT Limit (Degrees C)	15

Maximum Conductor Tension (MCT) (kgf)	at	-5.6°C	2379.3
Maximum Conductor Weight (MCW) (kg/m)			1.496
Maximum Conductor Pressure (MCP) (kg/m)			1.515
Freezing Point Tension (FPT) (kgf)	at	0°C	1171.1

Conductor Code Name	POPLAR	
Basic / Recommended Span (m)	200	
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

DESIGN TABLE

Temp. (Deg. C)	Tension (kgf)	Sag (m) for Span Length (m) 120	130	140	150	160	170	180	190	200
-5.6	1250.2	0.99	1.17	1.35	1.55	1.77	1.99	2.24	2.49	2.76
0	1171.1	1.06	1.24	1.44	1.66	1.89	2.13	2.39	2.66	2.95
5	1107.5	1.12	1.32	1.53	1.75	1.99	2.25	2.52	2.81	3.11
10	1049.9	1.18	1.39	1.61	1.85	2.10	2.37	2.66	2.97	3.29
15	998.0	1.24	1.46	1.69	1.94	2.21	2.50	2.80	3.12	3.46
20	951.0	1.31	1.53	1.78	2.04	2.32	2.62	2.94	3.27	3.63
25	908.5	1.37	1.60	1.86	2.14	2.43	2.74	3.08	3.43	3.80
30	870.1	1.43	1.68	1.94	2.23	2.54	2.86	3.21	3.58	3.96
35	835.2	1.49	1.75	2.02	2.32	2.64	2.98	3.35	3.73	4.13
40	803.4	1.55	1.81	2.10	2.42	2.75	3.10	3.48	3.87	4.29
45	774.4	1.60	1.88	2.18	2.51	2.85	3.22	3.61	4.02	4.45
50	747.9	1.66	1.95	2.26	2.59	2.95	3.33	3.74	4.16	4.61
55	723.5	1.72	2.01	2.34	2.68	3.05	3.44	3.86	4.30	4.77
60	701.1	1.77	2.08	2.41	2.77	3.15	3.55	3.99	4.44	4.92
65	680.4	1.83	2.14	2.48	2.85	3.24	3.66	4.11	4.58	5.07
70	661.2	1.88	2.20	2.56	2.93	3.34	3.77	4.23	4.71	5.22
75	643.3	1.93	2.27	2.63	3.02	3.43	3.87	4.34	4.84	5.36
80	626.8	1.98	2.33	2.70	3.10	3.52	3.98	4.46	4.97	5.50

Conductor Code Name	POPLAR	
Basic / Recommended Span (m)	200	
Temperature Shift for Creep (Deg. C)	-20	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)	24.4	at 15°C
Required Percentage Increase in Tension (%)	0	at 15°C

ERECTION TABLE

Temp. (Deg. C)	Tension (kgf)	Sag (m) for Span Length (m) 120	130	140	150	160	170	180	190	200
-5.6	1605.3	0.77	0.91	1.05	1.21	1.38	1.55	1.74	1.94	2.15
0	1494.3	0.83	0.98	1.13	1.30	1.48	1.67	1.87	2.08	2.31
5	1402.7	0.89	1.04	1.21	1.38	1.57	1.78	1.99	2.22	2.46
10	1318.4	0.94	1.11	1.28	1.47	1.67	1.89	2.12	2.36	2.62
15	1241.3	1.00	1.17	1.36	1.56	1.78	2.01	2.25	2.51	2.78
20	1171.1	1.06	1.24	1.44	1.66	1.89	2.13	2.39	2.66	2.95
25	1107.5	1.12	1.32	1.53	1.75	1.99	2.25	2.52	2.81	3.11
30	1049.9	1.18	1.39	1.61	1.85	2.10	2.37	2.66	2.97	3.29
35	998.0	1.24	1.46	1.69	1.94	2.21	2.50	2.80	3.12	3.46
40	951.0	1.31	1.53	1.78	2.04	2.32	2.62	2.94	3.27	3.63
45	908.5	1.37	1.60	1.86	2.14	2.43	2.74	3.08	3.43	3.80
50	870.1	1.43	1.68	1.94	2.23	2.54	2.86	3.21	3.58	3.96
55	835.2	1.49	1.75	2.02	2.32	2.64	2.98	3.35	3.73	4.13
60	803.4	1.55	1.81	2.10	2.42	2.75	3.10	3.48	3.87	4.29
65	774.4	1.60	1.88	2.18	2.51	2.85	3.22	3.61	4.02	4.45
70	747.9	1.66	1.95	2.26	2.59	2.95	3.33	3.74	4.16	4.61
75	723.5	1.72	2.01	2.34	2.68	3.05	3.44	3.86	4.30	4.77
80	701.1	1.77	2.08	2.41	2.77	3.15	3.55	3.99	4.44	4.92

175mm ACSR (Lynx) – 150m Basic

CONDUCTOR SAG/TENSION PARAMETERS for DESIGN

Conductor Code Name (if any)	LYNX
Greased Conductor Weight (kg/m)	0.8626
Cross Sectional Area of Conductor (mm²)	226.2
Conductor Overall Diameter (mm)	19.5
Coefficient of Linear Expansion (/Degree C)	1.8E-05
Modulus of Elasticity (kg/mm²)	8157.73
Rated Breaking Strength of Conductor (kgf)	8154.7
Basic / Recommended Span (m)	150
Wind Pressure on Conductor (N/m²)	380
Radial Ice Thickness (mm)	9.5
Ice Density (kg/m³)	913
Absolute Maximum Working Tension (MWT) Limit (kgf)	2379.3
Temperature at MWT Limit (Degrees C)	-5.6
Maximum "Everyday" Tension (EDT) Limit (kgf)	1630.9
Temperature at EDT Limit (Degrees C)	5
Maximum Conductor Tension (MCT) (kgf) at -5.6°C	2379.3
Maximum Conductor Weight (MCW) (kg/m)	1.653
Maximum Conductor Pressure (MCP) (kg/m)	1.492
Freezing Point Tension (FPT) (kgf) at 0°C	1368.2

Conductor Code Name	LYNX	
Basic / Recommended Span (m)	150	
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

DESIGN TABLE

Temp. (Deg. C)	Tension (kgf)	Sag (m) for Span Length (m) 120	130	140	150	160	170	180	190	200
-5.6	1464.6	1.06	1.24	1.44	1.66	1.88	2.13	2.39	2.66	2.94
0	1368.2	1.13	1.33	1.54	1.77	2.02	2.28	2.55	2.85	3.15
5	1289.9	1.20	1.41	1.64	1.88	2.14	2.42	2.71	3.02	3.34
10	1218.7	1.27	1.50	1.73	1.99	2.26	2.56	2.87	3.19	3.54
15	1154.2	1.35	1.58	1.83	2.10	2.39	2.70	3.03	3.37	3.74
20	1095.7	1.42	1.66	1.93	2.21	2.52	2.84	3.19	3.55	3.94
25	1042.9	1.49	1.75	2.03	2.33	2.65	2.99	3.35	3.73	4.14
30	995.1	1.56	1.83	2.12	2.44	2.77	3.13	3.51	3.91	4.33
35	951.8	1.63	1.91	2.22	2.55	2.90	3.27	3.67	4.09	4.53
40	912.5	1.70	2.00	2.32	2.66	3.02	3.41	3.83	4.27	4.73
45	876.8	1.77	2.08	2.41	2.77	3.15	3.55	3.98	4.44	4.92
50	844.2	1.84	2.16	2.50	2.87	3.27	3.69	4.14	4.61	5.11
55	814.5	1.91	2.24	2.59	2.98	3.39	3.83	4.29	4.78	5.30
60	787.2	1.97	2.31	2.68	3.08	3.51	3.96	4.44	4.94	5.48
65	762.1	2.04	2.39	2.77	3.18	3.62	4.09	4.58	5.11	5.66
70	738.9	2.10	2.47	2.86	3.28	3.74	4.22	4.73	5.27	5.84
75	717.5	2.16	2.54	2.95	3.38	3.85	4.34	4.87	5.43	6.01
80	697.6	2.23	2.61	3.03	3.48	3.96	4.47	5.01	5.58	6.18

Conductor Code Name	LYNX	
Basic / Recommended Span (m)	150	
Temperature Shift for Creep (Deg. C)	0	Insert minus sign as necessary
Equivalent Percentage Increase in Tension (%)	10.0	at 15°C
Required Percentage Increase in Tension (%)	10	at 15°C

ERECTION TABLE

Temp. (Deg. C)	Tension (kgf)	Sag (m) for Span Length (m) 120	130	140	150	160	170	180	190	200
-5.6	1631.3	0.95	1.12	1.30	1.49	1.69	1.91	2.14	2.39	2.64
0	1520.5	1.02	1.20	1.39	1.60	1.82	2.05	2.30	2.56	2.84
5	1429.4	1.09	1.27	1.48	1.70	1.93	2.18	2.44	2.72	3.02
10	1345.9	1.15	1.35	1.57	1.80	2.05	2.32	2.60	2.89	3.20
15	1269.6	1.22	1.44	1.66	1.91	2.17	2.45	2.75	3.07	3.40
20	1200.3	1.29	1.52	1.76	2.02	2.30	2.60	2.91	3.24	3.59
25	1137.4	1.37	1.60	1.86	2.13	2.43	2.74	3.07	3.42	3.79
30	1080.6	1.44	1.69	1.96	2.25	2.55	2.88	3.23	3.60	3.99
35	1029.2	1.51	1.77	2.05	2.36	2.68	3.03	3.39	3.78	4.19
40	982.7	1.58	1.85	2.15	2.47	2.81	3.17	3.55	3.96	4.39
45	940.6	1.65	1.94	2.25	2.58	2.93	3.31	3.71	4.14	4.59
50	902.3	1.72	2.02	2.34	2.69	3.06	3.45	3.87	4.31	4.78
55	867.5	1.79	2.10	2.44	2.80	3.18	3.59	4.03	4.49	4.97
60	835.8	1.86	2.18	2.53	2.90	3.30	3.73	4.18	4.66	5.16
65	806.7	1.92	2.26	2.62	3.01	3.42	3.86	4.33	4.83	5.35
70	780.0	1.99	2.34	2.71	3.11	3.54	3.99	4.48	4.99	5.53
75	755.5	2.06	2.41	2.80	3.21	3.65	4.12	4.62	5.15	5.71
80	732.8	2.12	2.49	2.88	3.31	3.77	4.25	4.77	5.31	5.89