NSP/004/112 (OHI 12) Guidance for the Inspection and testing of Wood & Steel Poles

1. Purpose

The purpose of this document is to provide guidance on the inspection, testing, recording and classification of wood & steel poles for use on the Northern Powergrid Distribution System.

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

<table>
<thead>
<tr>
<th>Ref</th>
<th>Version</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSP/004/112</td>
<td>July 2006</td>
<td>NSP/004/112 (OHI 12) Guidance for the Inspection and testing of Wood &amp; Steel Poles</td>
</tr>
<tr>
<td>OHI 12</td>
<td>June 1999</td>
<td>Inspection, Testing, Recording &amp; Classification Of Wood &amp; Steel Poles In Position</td>
</tr>
<tr>
<td>RTN/001/500/701/002</td>
<td>June 1995</td>
<td>GN 70-02 - Guidance Note precautions before Ascending a Wood Pole</td>
</tr>
<tr>
<td>RTN/001/500/701/004</td>
<td>Feb 1997</td>
<td>GN 70-04 - Purl Testing Wood Poles</td>
</tr>
</tbody>
</table>

2. Scope

This document includes details on the inspection, testing, recording and classification of wood & steel poles. In addition it provides guidance on the precautions to be taken prior to ascending wood poles.
2.1. Table of Contents

1. Purpose................................................................................................................. 1
2. Scope ..................................................................................................................... 1
  2.1. Table of Contents ............................................................................................. 2
3. Technical Specification ......................................................................................... 3
  3.1. Testing of wood poles before climbing ............................................................. 3
  3.2. Routine Inspection and testing of Wood Poles in Position ............................... 3
  a) Visual Inspection................................................................................................. 3
  b) Hammer Test ..................................................................................................... 4
  c) Prodding Test .................................................................................................... 5
  d) Additional Exploration – Ground Level Decay ............................................... 5
  e) Quick Decay Scan test - using PURL or the Resistograph tester ..................... 6
  3.3. Full detailed pole test – Using PURL or Resistograph Testers ....................... 6
  3.4. Notes on Decay Assessment ........................................................................... 6
  3.5. Condition rating of wood poles and urgency for replacement ....................... 7
  3.6. Testing Cobra Treated Poles with Aluminium Bandages ............................... 7
  3.7. Boron rod treated poles – identification and replacement ............................. 8
  3.8. Poles suspected of being subjected to shock loading ..................................... 8
  3.9. Reinstated Poles using Retrofitted Pole Support Systems ............................. 8
  3.10. Making a suspect pole safe to ascend using guy ropes: ............................... 9
  3.11. Assessment of steel poles ............................................................................. 9
    3.11.1. Ultrasonic testing of Steel Poles............................................................... 10
4. References ............................................................................................................ 12
  4.1. External Documentation .................................................................................. 12
  4.2. Internal documentation .................................................................................. 12
  4.3. Summary of Amendments ............................................................................. 12
5. Definitions ........................................................................................................... 13
6. Authority for issue ............................................................................................... 14
  6.1. CDS Assurance ............................................................................................... 14
  6.2. Author ............................................................................................................ 14
  6.3. Technical Assurance ....................................................................................... 14
  6.4. Approval ......................................................................................................... 14
  6.5. Authorisation ................................................................................................ 14
Appendix 1 - PURL Testing Wood Poles ................................................................. 15
Appendix 2 – Resistograph Testing Wood Poles ................................................... 19
Appendix 3 - Northern Powergrid - Historical Pole Type Classification Table ........ 20
3. Technical Specification

3.1. Testing of wood poles before climbing

Before a pole is climbed or relied upon for personal support, it is the duty of the person who is to climb the pole to verify that the pole is in a safe condition to climb. Sound external appearance does not necessarily mean that a pole is safe. Poles showing any signs of damage, significant decay or weakness as identified in this guidance note shall not normally be relied upon for personal support.

The following tests shall be applied to all poles before they are climbed:

(a) Visual Examination
(b) The HAMMER test, which consists of striking the pole a sharp blow.
(c) The PRODDING test, which consists of prodding or probing the surface with the point of a pocket knife or other similar tool.

The condition of the pole shall be classified as follows, according to the symptoms indicated:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Test</th>
<th>Symptom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe</td>
<td>Visual</td>
<td>No damage</td>
</tr>
<tr>
<td></td>
<td>Hammer</td>
<td>A good ring</td>
</tr>
<tr>
<td></td>
<td>Prodding</td>
<td>No decay</td>
</tr>
<tr>
<td>Unsafe</td>
<td>Visual</td>
<td>Pole damaged or structurally unsafe</td>
</tr>
<tr>
<td></td>
<td>Hammer</td>
<td>Very hollow sound (all round pole)</td>
</tr>
<tr>
<td></td>
<td>Prodding</td>
<td>Prodding decay to a single depth point of 50mm or about 25mm if all round</td>
</tr>
</tbody>
</table>

To ensure the safety of our staff, poles that fail any of the tests detailed in clause 3.2 (a-e) or without any pole age identifier must be identified with a ‘D’ notice as shown on Drawing Number 109101.0228 and not climbed until the actual level of decay and remaining residual strength have been confirmed.

See clause 3.4 for further guidance on decay assessment, poles with residual strength levels of less than 80% shall be supported in accordance with clause 3.10 before being ascended or accessed using other non-climbing means e.g. MEWP’s.

If the tests taken as required by clause 3.2 indicate that the pole is safe to climb, the linesman may climb as required by the work he is to undertake. During the climb, attention should be given to the condition of the pole and further hammer tests made if considered necessary.

To correctly categorise the condition of a pole suspected of having decay for its suitability for continued use, the pole shall be subjected to a detailed test procedures using either a PURL (Pole Ultra-sonic Rot Locator) or Resistograph tester.

3.2. Routine Inspection and testing of Wood Poles in Position

a) Visual Inspection

Poles shall be inspected visually from the ground over its entire length above ground for :-

- A sign of decay, such as wet crumbly wood, “D” labels, fungal growth, or evidence that suggests the pole has been “PURL” tested, i.e. nails at ground, 1M and 2M levels.
• Signs of damage or weakness, caused by Woodpeckers, vehicles or farm machinery, excessive animal rubbing. The bending strength of a pole is proportional to the cube of the diameter so particular attention should be paid to external decay or the effect of cattle rubbing on the pole which results in a reduction in the diameter. It is recommended that creosoted laggings be fitted to prevent cattle rubbing where this has occurred previously.

• Signs of splitting or cracks. Many poles suffer from large cracks due to drying out, these are not detrimental except that they may expose the untreated sapwood and heartwood.

• Fire Damage. Evidence of Pole top fire damage or burn marks adjacent to earthed steelwork lower down the pole are normally indicative of damaged insulators or insulation on pole top equipment resulting in leakage current through the wood down to ground. Damage of this type must be reported to Network Control immediately to allow the line to be made dead before any further work or contact with the support.

• Damaged insulators or steelwork. If the insulators are damaged the line must be made dead before any further work or contact with the support.

• Signs that suggest the pole may not be stable, such as recent excavations around the pole, dikes or trenches nearby, or the gouge mark/disc high above the ground suggesting the pole may not be planted to the correct sinking depth. In some cases, although relatively rare, poles may be found without any pole gouge marks or year of manufacture indications. Where these circumstances are identified, the pole shall not be climbed without either supporting it in accordance with clause 3.10 or accessing it with a MEWP. If neither alternative system is appropriate due to the location of the pole then the pole shall be programmed for replacement.

• During a line inspection a note should be taken of any poles which are buckling or which have their pole head greater than two pole head diameters out of true. This sometimes occurs on 'light' poles fitted with 'tee off' stays etc. A pole buckling under normal conditions will break during heavy loading and should therefore be programmed for replacement if the buckling is due to load and not just a deformed pole.

• Poles located in dense vegetation such that the base of the pole cannot be accessed and inspected shall be reported to Vegetation Management to clear the obstructions allowing a proper inspection to be carried out.

• Poles located in areas of permanent standing water shall be recorded and reported to the “Overhead Remedial’s Manager” with a view to relocating the pole outside the affected area as the integrity of these poles cannot be guaranteed and access may not always be possible depending on the depth of the water.

• Signs that suggest a pole(s) may be suffering from pole top decay. This may be indicated by signs such as grass or other vegetation growing out of the pole top or a wet looking patch near the pole top. Overhead line routes subjected to helicopter inspections shall be vigilant for this type of issue as it will often be more prominent from this viewpoint.

Notes
Where poles are examined, particular attention should be given to poles erected during the following periods 1939 to 1945, and during the rural electrification period of the 1950’s. The shortage of poles during these periods was acute and the inadequate seasoning which followed caused poles fabricated during these periods to suffer from premature decay.

b) Hammer Test

Using a 2lb hammer and commencing at ground level hit the pole at close intervals at not more than 25mm spacing all around its circumference, the test should then continue spirally round the pole at 300mm spacing until the height of normal reach is achieved. Listen for a good ringing sound as the hammer strikes the poles indicating solid timber. A change in tone will be heard when the hammer passes from sound to decayed wood. A dull or dead tone indicates external or slight internal decay whilst a hollow note indicates extensive internal decay. Any areas of wood identified as suspect during the hammer test must be prod tested.
c) **Prodding Test**

Using a long thin screwdriver or a measuring tool as detailed in Drawing No 1091010606, test the resistance of the timber to prodding by attempting to penetrate the pole surface. This should be done at and just below ground level by using the screwdriver at 45° angle and at areas found to be suspect as a result of the hammer test. Carry out this test at close intervals around the pole circumference. Decayed timber, unlike sound timber, will offer little resistance insertion and removal of the screwdriver blade.

d) **Additional Exploration – Ground Level Decay**

Particular attention to pole decay identification shall be carried out in the area just above ground level. If the tests detailed above indicate the likelihood of decay being present below ground level, then the ground around the pole shall be excavated for a depth of 300 mm, and the section of pole thus exposed tested as above. Observations shall be made to ensure that any changes in previous ground level are identified. Failure to do so could result in unidentified hidden decay. Use of the Resistograph tester can prove particularly useful in this assessment process as it can be applied at a 45° angle into the pole below ground level without the need to excavate or remove and replace finished ground level surfaces.
e) Quick Decay Scan test - using PURL or the Resistograph Tester

Scan Test
The standard hammer test can be supplemented by using the PURL Ultra-sonic tester or the Resistograph pole test device which will confirm the presence of decay, but not the level of decay or the remaining residual strength.

3.3. Full detailed pole test – Using PURL or Resistograph Testers

Notes:
Where a pole is being inspected as part of a routine inspection process it is envisaged that the initial walk through inspection will identify and mark poles suspected as being defective because they fail one or more of the visual and physical tests identified in clause 3.2 (a,b,c,d or e) and that the full detailed tests described below will be a follow up exercise revisiting the suspect poles to confirm and classify the level of decay and its subsequent condition rating as detailed in clause 3.4 and 3.5.

Detailed tests shall be made with the PURL or Resistograph pole testers to calculate the degree of residual strength remaining in the pole.

Information on the correct use of the PURL tester can be found in appendix 1
Information on the correct use of the Resistograph tester can be found in appendix 2

The results from the tests shall be recorded on the pre-printed report sheets for the PURL tester for more detailed analysis back in the office or entered into a mobile device capable of providing an onsite decay assessment.

3.4. Notes on Decay Assessment

Decay of pole timber is mainly caused by fungal attack at ground level where soil can readily contribute fungi and destructive bacteria. Moisture which is vital for the development of the fungal spores is present in the wood cells for considerably longer periods at ground level than above and hence it is here that the pole will be most intensely attacked.

Pole strength depends not only on the extent of decay, but also on its position in the pole. For example, decay in the centre of a pole with a substantial sound outer ring reduces the strength by a negligible amount. It is sometimes difficult to decide whether decay is sufficiently extensive to necessitate pole changing. In terms of residual strength, this will be provided by the PURL or Resistograph tester.

Minimum levels of residual strength

>80% Pole may be retained, but shall be treated with Boron Rods and given a condition rating rating of 3
<80% Pole shall be replaced and given a condition rating rating of 4

Notes:
Where practicable the results from the PURL or Resistograph testers shall be analysed and the pole graded accordingly before leaving site allowing previously applied ‘D’ notices to be removed from healthy poles, or the application of pole treatments to control the spread of decay and allow the pole to be retained in service until it is removed in a future replacement program. However where this is not achievable the recordings shall be returned to the supervising engineer to enable residual strength calculations to be carried out and a further visit planned.
### 3.5. Condition rating of wood poles and urgency for replacement

Where poles are inspected as part of the MNT/004 foot patrol inspection requirements, the poles shall be condition graded using the condition rating table below for inclusion into the company’s asset condition register.

<table>
<thead>
<tr>
<th>Condition Rating</th>
<th>Condition Description</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pole OK</td>
<td>Pole to be retained</td>
</tr>
<tr>
<td>2</td>
<td>Minor Damage</td>
<td>Pole to be retained</td>
</tr>
<tr>
<td>3</td>
<td>A level of minor pole decay has been identified in the pole but following a detailed residual strength test it has been found to have a value in excess of 80%.</td>
<td>Poles may be retained for a period of up to 10 years, provided they have been subjected to an NPg assessed decay preventative treatment to suspend the decay process or have been strengthened with a pole reinforcement system. Poles in this condition shall be replaced as part of a future authorised scheme within the next 10 years. Any previously applied ‘D’ notice shall be removed as the pole is still fit to climb.</td>
</tr>
<tr>
<td>4</td>
<td>Poles confirmed as being severely decayed or damaged. Following a detailed residual strength test the pole has been found to have a value of less than 80%.</td>
<td>Poles shall be identified with a ‘D’ notice and placed into a pole replacement program with a target replacement within 24 months.</td>
</tr>
</tbody>
</table>

Where poles are inspected as part of the preliminary works stage of an overhead line rebuild or refurbishment program, ahead of the main site works (which often happens at least 12 months ahead of any proposed site works) this may result in the identification of severely decayed poles and a dilemma as to whether the pole should be replaced immediately upon discovery or delayed until the main site works.

Such poles shall be subjected to further risk assessment to quantify the risk of temporarily leaving the decayed poles on the system until the main scheme starts. Poles may be retained providing they are not located adjacent to high risk sites as defined in NSP/004/012, are fitted with ‘D’ notices to stop further climbing activities and their minimum residual strength criteria is in excess of the following:

- Medium Grade Pole - >70%
- Stout Grade Pole - >60%

Where multiple decayed poles are found adjacent to each other, a higher risk to the lines reliability must be present as multiple pole failure represents a substantially increased return to service period under fault conditions. Where this condition exists and the residual strength of all of the tested poles would have resulted in the poles being allowed to be left for delayed replacement, a higher value of residual strength of 80% and 70% respectively must be present in all of the effected poles before they may be left for delayed replacement.

If the multiple pole value or the single pole value cannot be met, the poles shall be programmed for replacement as soon as possible. If at this time the information as to the routes up-rating requirement is not known, the poles shall be replaced with stout grade poles of the equivalent height as a default.

### 3.6. Testing Cobra Treated Poles with Aluminium Bandages

Cobra treated poles shall be tested as follows:

- Carry out the Visual, Hammer and prodding tests to exposed pole areas as detailed above.
- Excavate around the pole to just below the bandage (approx. 150mm)
Without removing the bandage, test the pole for indications of decay using the Purl Tester. (The transmitter may be applied to the pole above the aluminium bandage. The receiver shall then be placed at points around the circumference of the pole below the bandage to check for signals)

- Provided signals are received in all locations, the bandage can be retained in position.
- If no signal is obtained in any location, the bandage shall be removed and the degree of decay diagnosed in the normal way.
- After testing, the existing bandage shall be replaced back into its original place.

3.7 Boron rod treated poles – identification and replacement

In the early 1990’s a program of pole treatment with Boron Rods took place in the Northern Powergrid, Northeast licence area. Poles previously treated with Boron Rod preservative treatment are identifiable by a series of 3 or 4 (depending upon the pole grade) plastic plugs inserted at the base of the pole together with a last treatment date label. Once boron rod treatment has been applied to a pole its application shall be re-applied on a 10 -12 year repeat cycle. Re-application of the rods shall be achieved by removing the previous plastic plug and re-inserting the rods.

Care must be taken when re-inserting the plastic plugs into the holes to ensure that it achieves a tight fit. Failure to do so will result in the plug being ejected from the hole as the rod can expand when it gets wet forcing the treatment out of the hole instead of into the pole, negating the protective benefits given by the rod.

3.8 Poles suspected of being subjected to shock loading

Poles which are 20 years old and have been subjected to shock loading (i.e. pole or stay being struck by a vehicle, conductors being struck by falling trees or substantial tree limbs, poles where some but not all conductors have snapped and the remaining conductor will be unbound to effect repair) must be approached with caution.

In these circumstances the suspect pole shall be checked by applying leverage by means of a guy rope attached near the top of pole. The guy rope should be attached from the ground by means of J & P rods fitted with a positive grip head attachment and a guy rope applicator as shown on Drawing No 1091450203. The rope should be long enough and the staff pulling on it so placed to preclude any danger should the pole being tests collapse. If, following this test, the pole is still suspect then before it is climbed temporary stays shall be attached. The stays should be attached to the pole by means of the guy rope applicator as shown on Drawing No 1091450203.

If it is not practicable to carry out the check outlined above because of the pole arrangement, i.e. an existing stay, the ground around the base of the pole shall be excavated to a depth of 600 mm and the section of pole thus exposed cleaned and visually inspected. If no signs of fracture are visible, hammer and prod tests should be applied to the exposed area. Only after all three tests have indicated that the pole is sound may it be climbed having first backfilled the excavation at the base of the pole.

Tests which indicate that the pole is unsound must be reported to a supervisor and fitted with a D label as shown on Drawing Number 1091010228.

3.9 Reinstated Poles using Retrofitted Pole Support Systems

Retrofit pole support systems are now available whereby an existing damaged or decayed pole may be strengthened in situ. These systems are ideal for repairing and extending the life of an existing decayed or damaged support, especially where these issues occur on only 1 leg of a multi legged support or supports carrying HV or EHV cable terminations. NPg assessed systems are capable of returning a sub-standard support back to its original support capability and as such a repaired pole shall be deemed to be fit for climbing and use on the network for 10-20 years from the date of installation providing that the following additional checks are made:

CAUTION! - This document may be out of date if printed
• The “Multi-Tube Repair Splice” or equivalent NPg accessed system has been inspected for obvious damage or deformation that may have occurred due to vehicular or farm equipment damage. Deformation could also occur due to stress loading following severe weather. If either case is observed the “Multi-Tube repair splice shall be replaced.
• The Multi-Tube is 2400 mm in length with 1200 mm of exposed tube above ground level. A tolerance of +/-150 mm from the 1200 mm will be accepted due to typical backfill and ground conditions.
• Ensure that no cables or earth wires are obscured or interfered with by the installation of the system.
• Confirm that the Multi-Tube is pulled up as close to the pole as possible. The Multi-Tube repair splices can be fastened to the pole with either M20 bolts or steel straps and a tensioning buckle. When the Multi-Tube is fixed to the pole with bolts, ensure that the wood surrounding them is free from decay and that the wood between the top and bottom restraining bolts is sound.

3.10. Making a suspect pole safe to ascend using guy ropes:

• Pole’s that show minimal signs of damage or decay can be made safe to ascend by securing the pole with guy ropes after which only one person may ascend.
• Using a hydraulic bucket lift, or rope support and live line tapping rods, secure a minimum of three preferably four guy ropes to a point at least two thirds up the pole.
• Install bars, or ground anchors, a distance of at least the height of the ropes away from the pole. These anchors must be positioned equally around the pole. Remember to check for underground apparatus before knocking in the bars.
• Secure a guy rope to each anchor, take up the tension in all the ropes at the time and tie off securely.

3.11. Assessment of steel poles

Corrosion of steel poles is concentrated around ground level, at the joints where the pole changes diameter and at collar positions. Pole inspectors are required to pay particular attention to poles which appear bent at the junction of sections or show signs of metal erosion due to rust at or near ground level and report same.

Steel poles should be examined for corrosion every 10 years. The cement weather seal should be removed and an ultrasonic thickness test (using an approved tester) carried out to determine the amount of corrosion or loss of steel section.

Note
It will be necessary to excavate at least 100mm below ground level to carry out these tests correctly, being observant for signs of previous changes in ground level. The pole should them be repainted and the area from 100mm below to 700 mm above ground level painted with two coats of Sovereign K10 polyurethane elastomer. Poles showing corrosion but which do not require changing should be ultrasonically tested at five yearly intervals.

Approved Ultrasonic thickness tester:

Meritronics Digital Ultrasonic Thickness Meter used in conjunction with the UCA-2 couplant.
The visual inspection of the pole will indicate the need for painting. Repainting should be carried out before the existing coat has completely broken down. The finishing coat may vary depending on local authority requirements.

The table below indicates the original minimum design thickness of the various types of poles. Should the measured thickness be less than 80% of these at any point, then the pole should be replaced if measurements show that the pole is below the required thickness.

Modern galvanised steel poles supplied in accordance with NPS/004/018 are provided with a 200 Micron layer of galvanising providing them with a protective coating for a minimum of 30 years before the galvanising layer is damaged. As such poles of this type do not require testing with the Ultrasonic testing device until their 30th anniversary.

Note
The manufacturing date shall be marked on modern galvanised steel pole at the pole depth mark. Where this is missing then the poles shall be treated like traditional painted poles unless other collaborating evidence exists to confirm the true age of the poles. Non galvanised poles or galvanised poles over 30 years old shall be protected with paint as detailed within MNT/004 “Overhead line inspection and Maintenance Policy”

3.11.1. Ultrasound testing of Steel Poles.

The following decision sequence shall be used to identify the original steel pole type:

1. Measure base diameter or circumference of pole.
2. Locate base diameter or circumference in table.
3. If only one pole type associated with base size, identify required wall thickness shown on right hand side of table.
4. If more than one pole type indicated, measure length of middle section or bottom section as indicated in the table to identify exact pole type.
5. Use ultrasonic tester to obtain existing wall thickness of pole.
### Table 1: Decision table for the identification of Steel Poles

<table>
<thead>
<tr>
<th>Base Diameter</th>
<th>Base Circ.</th>
<th>Pole Type</th>
<th>Pole Length</th>
<th>Section Length</th>
<th>Wall Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Top</td>
<td>Middle</td>
</tr>
<tr>
<td>168.28</td>
<td>528.7</td>
<td>A</td>
<td></td>
<td>Not Available</td>
<td>Not Available</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B</td>
<td></td>
<td>9144</td>
<td>2134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(30 ft)</td>
<td>(7 ft)</td>
<td>(7 ft)</td>
</tr>
<tr>
<td>190.5</td>
<td>598.5</td>
<td>B</td>
<td></td>
<td>9750</td>
<td>2438</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(8 ft)</td>
<td>(8 ft)</td>
</tr>
<tr>
<td>193.7</td>
<td>608.6</td>
<td>E</td>
<td></td>
<td>9750</td>
<td>2850</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(9 ft 4 in)</td>
<td>(5 ft 9 in)</td>
</tr>
<tr>
<td>241.3</td>
<td>758.2</td>
<td>C</td>
<td></td>
<td>9144</td>
<td>2134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(30 ft)</td>
<td>(7 ft)</td>
<td>(7 ft)</td>
</tr>
<tr>
<td>244.5</td>
<td>768.2</td>
<td>C</td>
<td></td>
<td>9750</td>
<td>2438</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(8 ft)</td>
<td>(8 ft)</td>
</tr>
<tr>
<td>264.5</td>
<td>838</td>
<td>F</td>
<td></td>
<td>9750</td>
<td>2810</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(9 ft 3 in)</td>
<td>(6 ft 3 in)</td>
</tr>
<tr>
<td>266.7</td>
<td>857.8</td>
<td>D</td>
<td></td>
<td>9144</td>
<td>2134</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(30 ft)</td>
<td>(7 ft)</td>
<td>(7 ft)</td>
</tr>
<tr>
<td>273.0</td>
<td>9144</td>
<td>G</td>
<td></td>
<td>9750</td>
<td>2240</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(7 ft 4 in)</td>
<td>(7 ft 10 in)</td>
</tr>
<tr>
<td>273.0</td>
<td>9750</td>
<td>K</td>
<td></td>
<td>3000</td>
<td>2800</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(9 ft 10 in)</td>
<td>(9 ft 2 in)</td>
</tr>
</tbody>
</table>
4. References

4.1. External Documentation

Reference | Title
--- | ---
ENA ER L9 | “Structural testing of wood poles prior to climbing or use as a personal support”

4.2. Internal documentation

Reference | Title
--- | ---
MNT/004 | Policy for the Inspection and Maintenance of Overhead Systems
NPS/004/018 | Technical specification for Steel Poles
NSP/004/012 | Guidance on the Risk Assessment of Overhead Lines

4.3. Summary of Amendments

Reference | Title
--- | ---
Whole document | Document format updated to latest CDS format
Clause 2.1 | New section, table of contents created
Table of Contents | Additional guidance added to the visual inspection requirements of a pole. Namely to look for signs of possible fire damage, pole top decay, or evidence that might suggest a pole's stability may be in question.
Visual Inspection | Additional guidance notes have been applied which relate to poles located in permanent standing water or in dense vegetation areas making them difficult to inspect.
Clause 3.2 (b) hammer test | The methodology for the application of the hammer test has been updated to follow the recommendation of ENA ER L9 “Structural testing of wood poles prior to climbing or use as a personal support”. Including the addition of sketches
Clause 3.2 (d) – Ground Line Decay | This clause has been renumbered and moved adjacent to the other test procedures as it details testing 300mm below ground level under given circumstances. The revised clause now also includes a sketch taken from ENA ER L9 “Structural testing of wood poles prior to climbing or use as a personal support.”
Clause 3.2 (e) Quick Decay Scan Test | Amended guidance provided for this test to include the use of the resistograph
Clause 3.3 – Full detailed pole tests | Amended clause detailing the requirement for all poles that fail any visual or physical tests in clause 3.2 (a-e) to be subjected to a full test to determine the level of residual pole
Clause 3.4 – Notes on Decay assessment | Notes reworded to show “Where practicable the results from the PURL tester shall be analysed and the pole graded accordingly before leaving site. However where this is not achievable the recordings shall be returned to the supervising engineer to enable residual strength calculations to be carried out”.
Clause 3.5 – Condition rating of wood poles and urgency of replacement | New clause to detail the condition rating descriptions for wood poles plus addition comments added to indicate the likely actions required from a given condition rating. Ie where a pole can be
 Clause 3.6 Testing Cobra treated poles
The location of this clause has been changed to make the flow of the document clearer.

Clause 3.7 Boron Rod treated poles – identification and replacement
This clause has been re-located within the document and amended to indicate how to identify previously treated poles together with their required re-charge frequency.

Clause 3.8 poles suspected of being subjected to shock loading
Clause re-numbered

Clause 3.9 Reinstatement of poles using Retrofitted Pole Support Systems
This clause has been modified to include the use of any NPg assessed retrofitted pole supported system.

Clause 3.10 making a suspect pole safe to ascend using guy ropes
Clause re-numbered

Clause 3.11 Assessment of Steel Poles
Units of dimensions changed and further guidance provided on the corrosion protection provided by modern steel poles and when the testing and inspection cycle begins

Clause 3.11.1 Ultrasonic testing of steel poles
Notes added to require all steel poles to be tested below ground level

Clause 4.3 Summary of Amendments
New section, summary of amendments added

Clause 6.0 Authority for issue
New format for “Authority for Issue” inserted

Appendix 2 Overview of resistograph tester

Appendix 3 Table added to classify historical pole grades and heights

5. Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDS</td>
<td>Controlled Document System</td>
</tr>
<tr>
<td>PURL</td>
<td>Pole Ultrasonic Rot Locator</td>
</tr>
<tr>
<td>Cobra</td>
<td>Pole butts treated with Arsenic preservative treatment</td>
</tr>
<tr>
<td>Resistograph</td>
<td>A test device which relies on the motor force required to drill a 3mm hole into the pole with the output plotted on an electronic graph. From which a calculated residual strength is generated.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarah Phillips</td>
<td>11/05/15</td>
</tr>
<tr>
<td>CDS Administrator</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Standard CDS review of 3 years</th>
<th>Non Standard Review Period &amp; Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Period: 3</td>
</tr>
<tr>
<td></td>
<td>Reason:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sign</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>G Hammel</td>
<td>11/05/15</td>
</tr>
<tr>
<td>Senior Policy and Standards Engineer</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Salkeld</td>
<td>11/05/15</td>
</tr>
<tr>
<td>Policy and Standards Engineer</td>
<td></td>
</tr>
<tr>
<td>M Storey</td>
<td>18/05/15</td>
</tr>
<tr>
<td>Operations Assurance Manager</td>
<td></td>
</tr>
</tbody>
</table>

6.4. Approval

Approval is granted for publication of this document.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Holdsworth</td>
<td>11/05/15</td>
</tr>
<tr>
<td>Policy and Standards Manager</td>
<td></td>
</tr>
</tbody>
</table>

6.5. Authorisation

Authorisation is granted for publication of this document.

<table>
<thead>
<tr>
<th>Sign</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>M Nicholson</td>
<td>12/05/15</td>
</tr>
<tr>
<td>Head of System Strategy</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 1 - PURL Testing Wood Poles

Background

A PURL uses an ultrasonic signal to identify the presence and locate the position of decayed timber in wood poles. The transmitter of the PURL is fixed to the pole and when turned on gives out a ultrasonic signal that can only travel through sound timber. The receiver is then held against the pole at the various positions to test for the transmitter signal. When turned on the light on the receiver should flash in unison with the transmitter “clicks”. If there is decayed timber between the transmitter and the receiver then there will be an out of unison or “No Signal”.

General:

Visually inspect the pole for signs of damage such as decay fungal growth, splitting, etc. Or weakness caused by woodpeckers, vehicles, farm machinery, excessive animal rubbing, etc. Clear away any raised ground at the base of the pole to reveal the true ground level.

Before starting work check that the PURL testing kit contains one of each of the following items of equipment; Transmitter, Receiver, Ratchet drilling device, Drill 7/64", Measuring Tape, “D” marker plate, Calibration block (Go), Calibration block (No Go ), Elastic marker band (small poles), Elastic marker band (large poles). Results form 1190 4/82 and the Carrying case.

When turned on and applied to a pole the light on the receiver should flash in unison with the transmitter “clicks”. If there is decayed timber between the transmitter and the receiver then there will be no flashes or the flashes will be out of unison with the clicks from the transmitter.

Complete a “Scan test” first to determine the condition of the pole. If you fail to get a signal or you get a signal which is out of unison you must complete a “Full test” and record the results using form 1190 4/82 as shown on page 4. The transmitter and receiver must be checked for correct operation before and after use.

Checking the PURL Equipment

Stand the PURL on its end with the screw uppermost and screw on the “Go” test block.

Switch on the transmitter by turning the control switch clockwise. A series of “clicks” should be heard.

Switch on the receiver to position 1 and apply the receiver to the test block at the opposite end to the transmitter, a signal should be obtained.

Unscrew the “Go” test block and screw on the “No go” test block. Apply the receiver to the test block, a signal should not be obtained.

If either the transmitter or receiver fails to operate the batteries may need changing. Access to the batteries is obtained by unscrewing the end cap. If either device still fails to operate correctly return them to your supervisor.
Scan Test

1. Drill a pilot hole in the pole at ground level and in line with one set of conductors using the ratchet drill. Screw the transmitter into the pilot hole to the full extent of the thread and turn back half a turn. Turn on the transmitter.

2. Switch on the receiver by turning the control switch to the required sensitivity setting. The setting is determined by measuring the diameter of the pole using the tape measure at a height of 1 m from the ground. The tape gives a reading of the setting to be used. Care must be taken if there are cables fixed to the pole.

3. Apply the receiver at points 1, 2 and 3 shown on the illustration.

4. Leave the transmitter in place and test using the receiver at 600mm above ground level at points 4, 5, 6 and 7 shown in the illustration.

5. Re-position the transmitter directly above the first position at 1200mm above ground level. Test using the receiver at points 8, 9 and 10 shown on the illustration.

6. Leave the transmitter in place and test using the receiver at 600mm above the transmitter at points 11, 12, 13 and 14 shown in the illustration.

7. Leave the transmitter in place and test using the receiver at 600mm below the transmitter at points 15, 16, 17 and 18 shown in the illustration.
Full Test

1. Fix the transmitter to the pole, in line with one set of conductors at a height of 1800mm from the ground. This is the Transmitter “T1” position.

2. At the same level but 120 degrees (1/3rd) around the pole in a clockwise direction around the pole chalk mark the Transmitter “T2” position and at a further 120 degrees (1/3rd) around the pole in a clockwise direction around the pole chalk mark the Transmitter “T3” position.

3. Fix the appropriate size elastic marker band around the pole at the same height as the transmitter.

4. Using the receiver, test for signals at 9 equally spaced positions as indicated by the marker band moving in a clockwise direction around the pole.

5. Move the transmitter to the T2 position and repeat step 4.

6. Move the transmitter to the T3 position and repeat step 4 again.

7. Repeat steps 1 to 6 with the transmitter at 900mm from ground level.

8. Repeat steps 1 to 6 with the transmitter at ground level.

9. Permanently mark all T1 positions using marker nails. Use 1 nail at ground level, 2 at 900mm and 3 at 1800mm above ground level.

Recording and interpreting results

- Fill in a “Wood Pole Test Results” form 11904/82 for each pole on which you complete a Full Scan. A sample of a completed Wood Pole Test Results form is shown overleaf.
- The receiver positions are numbered 1–9 from the present transmitter position moving clockwise around the pole.
- Enter “X” for every position where you fail to get a signal or receive an out of unison signal.
- Enter “–” for any position where the receiver cannot be applied because of an obstruction or damage to the pole.
- If any of the boxes have 10 or more crosses then a red “D” marker plate must be fixed to the pole under the number plate at the highest point that can reached from ground level.
Difficult Situations

Where a pole is situated close up to an obstruction it will normally be possible to select 3 approximately equally spaced positions for the transmitter. In these situations the T1 position does not have to be in line with the conductors if it is not possible. The receiver must be used in as many of the positions as it is physically possible to reach.
Appendix 2 – Resistograph Testing Wood Poles

Test procedure

1. Measure the pole diameter.
2. Enter Pole number, feeder number and any observation notes into the drill’s electronic display together with the maximum drill length of the pole -5mm such that the drill does not exit the other side of the pole.
3. A minimum of 4 holes shall then be drilled around the circumference of the pole with the tester held 90° to the pole at a height of .05m above GL.
4. The tests in point 3 shall then be repeated at 1.2m above GL and then again at GL but with the drill at 45° downwards below ground level.
5. After each test is completed the device creates an electronic graph together with a pass/failure result.

To calculate the remaining residual strength in the pole, the readings are then entered into a hand held device which takes the worst reading and provides a calculated residual strength as shown below. From this reading the pole condition can then be provided with its condition rating as detailed in clause 3.5.

---

**NCW**

The factor of safety is a minimum of 2.1 KN.

<table>
<thead>
<tr>
<th>Standard pole values</th>
<th>0.000</th>
<th>0.025</th>
<th>0.050</th>
<th>0.075</th>
<th>0.100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of pole in metres</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
<td>12.00</td>
</tr>
<tr>
<td>Diameter at top of pole</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
<td>0.13</td>
</tr>
<tr>
<td>Diameter at 1.5m from butt</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Plant depth</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Angle of drilling</td>
<td>90°</td>
<td>90°</td>
<td>90°</td>
<td>90°</td>
<td>90°</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Factor of safety</th>
<th>2.10</th>
</tr>
</thead>
</table>

---

**CAUTION!** - This document may be out of date if printed.
## Appendix 3 - Northern Powergrid - Historical Pole Type Classification Table

<table>
<thead>
<tr>
<th>Length of Pole</th>
<th>Light</th>
<th>Medium</th>
<th>Medium Stout</th>
<th>Stout</th>
<th>Extra Stout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approx. Conv. In Feet</td>
<td>Range of Pole Sink Depths (M)</td>
<td>Dia. at top (mm)</td>
<td>Dia. at top (mm)</td>
<td>Min Dia 1.5m from Butt (mm)</td>
<td>Dia. at top (mm)</td>
</tr>
<tr>
<td>8.5</td>
<td>28</td>
<td>1.5 - 1.8</td>
<td>127</td>
<td>152</td>
<td>177</td>
</tr>
<tr>
<td>9.0</td>
<td>30</td>
<td>1.5 - 1.8</td>
<td>127</td>
<td>152</td>
<td>184</td>
</tr>
<tr>
<td>10.0</td>
<td>32</td>
<td>1.5 - 1.8</td>
<td>127</td>
<td>158</td>
<td>184</td>
</tr>
<tr>
<td>10.5</td>
<td>34</td>
<td>1.5 - 1.8</td>
<td>127</td>
<td>158</td>
<td>184</td>
</tr>
<tr>
<td>11.0</td>
<td>36</td>
<td>1.5 - 1.8</td>
<td>127</td>
<td>165</td>
<td>196</td>
</tr>
<tr>
<td>11.5</td>
<td>38</td>
<td>1.8</td>
<td>127</td>
<td>165</td>
<td>196</td>
</tr>
<tr>
<td>12.0</td>
<td>40</td>
<td>1.8</td>
<td>127</td>
<td>165</td>
<td>8.0</td>
</tr>
<tr>
<td>13.0</td>
<td>42</td>
<td>2.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>14.0</td>
<td>45</td>
<td>2.1</td>
<td>133</td>
<td>171</td>
<td>203</td>
</tr>
<tr>
<td>16.0</td>
<td>50</td>
<td>2.4</td>
<td>133</td>
<td>177</td>
<td>241</td>
</tr>
<tr>
<td>17.0</td>
<td>55</td>
<td>2.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>18.0</td>
<td>60</td>
<td>2.4</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>20.0</td>
<td>65</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Notes:**

1. This table shall only be used where poles are not already classified with pole scarings to determine the modern equivalent pole grade and height.