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>2.0 - May 2015</td>
<td>NSP/004/112 (OHI 12) Guidance for the Inspection and testing of Wood &amp; Steel Poles</td>
</tr>
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<td>NSP/004/112</td>
<td>1.0 - July 2006</td>
<td>NSP/004/112 (OHI 12) Guidance for the Inspection and testing of Wood &amp; Steel Poles</td>
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<tr>
<td>OHI 12</td>
<td>June 1999</td>
<td>Inspection, Testing, Recording &amp; Classification Of Wood &amp; Steel Poles In Position</td>
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<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>
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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 ......................................................... 4
   3.3. Decay Level Assessment – Test Devices ..................................................................................... 6
   3.4. Condition rating of wood poles and urgency for replacement ................................................... 7
   3.5. Testing Cobra Treated Poles with Aluminium Bandages ............................................................. 8
   3.6. Boron rod treated poles – identification and replacement ......................................................... 8
   3.7. Poles suspected of being subjected to shock loading ................................................................. 8
   3.9. Making a suspect pole safe to ascend using guy ropes .............................................................. 9
   3.10. Assessment of steel poles ......................................................................................................... 10
       3.10.1. Ultrasonic testing of Steel Poles ......................................................................................... 10
       3.10.2. Painting requirements for Steel Poles .............................................................................. 11
4. References ....................................................................................................................................... 12
   4.1. External Documentation ............................................................................................................. 12
   4.2. Internal Documentation ............................................................................................................. 12
   4.3. Summary of Amendments from Previous Version .................................................................. 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 - LV Pole Depth – “Installation Depth Monitoring System” ................................................. 20
Appendix 4 - Northern Powergrid - Historical Pole Type Classification Table ..................................... 21
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 sharp tool.
(d) ADDITIONAL EXPLORATION TESTS for possible below ground level decay on Specified Increased Risk Pole Categories

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-d) or without any pole age identifier must be identified with a ‘D’ or ‘S’ notice as shown on Drawing Number 1091010228 and not climbed until the actual level of decay and remaining residual strength have been confirmed.

See clause 3.3 for further guidance on decay assessment, poles with residual strength levels of less than 80% shall be supported in accordance with clause 3.9 before being ascended or accessed using other non-climbing means e.g. MEWP’s.

Note
It shall be noted that whilst a MEWP is the preferred method pf gaining access to a suspect or decayed pole, the work that can be safely carried out from the MEWP is restricted to that which will not create any significant changes in mechanical loadings or changes in conductor tensions unless the pole has been supported or stayed against those forces.

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 Microdrill Resistograph tester or other Northern Powergrid approved tester as may become available.
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’ or ‘S’ labels, fungal growth, or evidence that suggests the pole has been “PUR” tested, i.e. nails at ground, 1M and 2M levels.
- Where a pole is encountered with an existing ‘D’ or ‘S’ label, this pole shall be re-tested using a decay level assessment device as detailed in clause 3.3 before any existing label may be removed or its status amended.
- 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 (it was not mandatory to provide a gouge mark before 1954). Where these circumstances are identified, the pole shall not be climbed without either supporting it in accordance with clause 3.9 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.
b) Hammer Test

Strike the pole with a 2lb hammer and listen to the sound produced. The pole shall be struck with a series of sharp, but moderate blows with the hammer, listening for a good ringing sound as the hammer strikes the poles indicating solid timber. Sounding should commence at ground level and continue around the circumference at not more than 25mm spacing. Repeat the process spirally round the pole at vertical spacing of not more than 300mm to a height of normal reach is achieved. 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. Note this test will rarely identify below ground level premature pole shell rot on AC500 treated poles, hence they shall automatically be subjected to the additional below ground level exploration tests.

c) Prodding Test

Prodding the surface of a pole with the point of a sharp object, such as a bradawl or a long thin bladed screwdriver with the tip ground to a sharp bit will give an indication of any decay near the surface of the pole. The test shall be carried out at intervals around the pole immediately above the ground and at points of suspected decay. An indication that the pole is sound is given by the prodding test being resisted by firm fibre (neglecting shakes in the timber). Decayed wood will offer little resistance to the insertion and withdrawal of the sharp object. Prodding the pole with a screwdriver at a 45° angle to the pole just below ground level without excavation may indicate the presence of below ground level deterioration not previously evident from the above ground tests. Where deterioration is suspected at or below ground, then the pole shall be subjected to the additional below ground level exploration tests.

d) Additional Exploration Tests for possible below ground level decay on Specified Increased Risk Pole Categories

i) AC500 treated LV poles installed in the period 2007 – 2014

ii) Poles >50 Years Old

Any poles that fall into this category shall not be climbed unless the pole has been subjected to a below ground line inspection to check for any signs of hidden decay below the ground line. This shall typically involve the area surrounding the base of the Pole being excavated to a depth of 300 mm, and the section of pole exposed tested using the normal above ground line tests.
The requirement for mandatory below ground line inspections applies equally to foot patrol inspections and where a support will be relied upon for personally support activities.

As an alternative to excavating around the base of the pole for example where the pole is located in an area with “finished ground” and this test would involve complicated excavation and re-instatement works, it is permissible to use a “Micro Drill Resistograph” tester applied at a 45° angle into the pole below ground level or other Northern Powergrid approved device that may become available.

Notes
AC500 treated LV poles - installed in this time period have been found to suffer from a high instance of below ground level softwood / outer shell decay caused by a premature failure of the protective treatment system for poles installed in this period. As such this form of decay is rarely identifiable using the standard above ground level hammer test.

As a general rule the use of AC500 treated poles ceased after 2014 with the exception of new or replacement poles installed near schools, parks and playgrounds where the REACH regulations do not allow the placement of Creosote treated poles.

Any doubts about the integrity of pre- 2014 treated AC500 treated poles located in the vicinity of these high risk sites shall be replaced with new AC500 treated poles or any modern non creosote based equivalent, as AC500 treated poles installed post 2014 do not suffer from the same high levels of premature below ground level rot due to changes in the treatment retention levels after this date.

Poles >50 Years Old
It is recognised within the industry that poles shortages in the periods 1939 to 1945, and during the rural electrification period of the 1950’s resulted in inadequate pole seasoning prior to the application of preservative treatments. As a result poles installed in these periods may have a higher incidence of below ground level decay similar to that detailed for AC500 as such we have decided to apply the same enhanced below ground level inspection activities to be applied to all poles greater than 50 years old.

3.3. Decay Level Assessment – Test Devices

Decay of pole timber is mainly caused by fungal attack at ground level or below 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.

The residual strength of a pole affected by decay depends not only on the extent of the 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 whereas conversely decay or damage in the outer ring of a pole significantly impacts its remaining residual strength. It is sometimes difficult to decide whether identified decay is sufficiently extensive to necessitate pole changing. To assist with this assessment process in terms of the remaining residual strength, then the effected poles shall be subjected to a series of further tests using an approved test device. Currently the Northern Powergrid approved tests devices include the PURL and the Micro Drill “Resistograph” test devices used in conjunction with their associated software assessment packages.

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 or stored in the Microdrill for more detailed analysis back in the office. Preferably they will be entered into a mobile device capable of providing an onsite decay assessment to allow the pole to be marked up before inspectors leave the site.
Minimum levels of residual strength

<table>
<thead>
<tr>
<th>Residual Strength</th>
<th>Condition Rating</th>
<th>Actions on Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;80%</td>
<td>3</td>
<td>Pole may be retained in service, still fit to climb but shall be marked up with an ‘S’ label.</td>
</tr>
<tr>
<td>&lt;80%</td>
<td>4</td>
<td>Pole shall be planned for replacement, not fit for climbing and marked up with a ‘D’ label.</td>
</tr>
</tbody>
</table>

Notes:
- Where practicable the results from the PURL or Resistograph testers shall be analysed and the pole graded accordingly before leaving site allowing any incorrectly previously applied ‘D’ notices to be removed from healthy poles, or new ‘D’ or ‘S’ labels to be applied to unhealthy poles. 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 to remove or install the required warning labels and apply any protective treatments to control the spread of decay.
- An assessment is currently taking place with a new Seismic Pole Test device called “Thor” which is capable of testing a pole for decay throughout its complete length above and below ground level, including the provision of residual strength levels and pole sinking depth. If sufficient evidence can be obtained to confirm the reliability of this device, it shall be applied to all poles rather than only those poles already suspected as having decay.

3.4. 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 shall be identified with an ‘S’ notice. 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 re-enforcement 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 in situ providing they are not located adjacent to high risk sites as defined in NSP/004/012 and are fitted with ‘D’ notices to stop further climbing activities. In carrying out this risk assessment to decide upon the level of immediacy for replacement, a higher level of risk must be applied to those sites where multiple decayed poles are found adjacent to each other as the consequences of failure at such a site will substantially increase the return to service period under fault conditions. Where information about a lines future up-rating requirement is not known, the replacement poles shall be replaced with stout grade poles of the equivalent height as a default.

3.5. Testing Cobra Treated Poles with Aluminium Bandages

The Cobra treatment process was a post installation site treatment that was claimed to increase the pole life by a further 10 years. The treatment involved injecting a bonded mixture of Sodium Fluoride, Dinitro-Phenol and Arsenous Acid into the pole using a hollow needle. The Injections were applied 300mm above and below the groundline. Poles treated with this process where then protected with an Aluminium Bandage to stop livestock licking the treatment and to aid the future identification of treated poles.

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 or the Micro drill, Resistograph. (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 or the Microdrill does not identify any suspect areas, 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.

3.6. 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. It is estimated that circa 60,000 were treated in the Northeast licence area and 1,000 poles in the Yorkshire area. Poles previously treated with Boron Rod preservative treatment are identifiable by a series of 3 or 4 (depending upon the pole grade) plastic 12mm angled 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. Due to the current restriction on the use of Boron Rods, then Boron Paste may be injected into the holes as an alternative, it is estimated that a typical 400ml tube of paste will protect on average 6 poles.

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 paste will expand when it gets wet forcing the treatment out of the hole instead of into the pole, negating the protective benefits given by the Boron.

3.7. Poles suspected of being subjected to shock loading

Poles suspected of being 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 tested 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.

3.8. 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. Northern Powergrid 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:

- The “Multi-Tube Repair Splice” or equivalent Northern Powergrid assessed 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.

3.9. 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.
3.10. 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. The opportunity shall be taken while this testing is taking place to ensure that all steel poles are effectively earthed. For further guidance in this area see NSP/004/041 clause 3.7.2

Note
It will be necessary to excavate at least 100mm below ground level (to the top of the concrete foundation) to carry out these tests correctly, being observant for signs of previous changes in ground level. Upon completion of the testing and before the excavated area is re-instated, the exposed below ground area and the area up to a height of 600mm above ground level shall then be repainted with two coats of Sovereign K10 polyurethane elastomer.

Should the measured thickness be less than 80% of the original thickness at any point, then the pole should be replaced. Poles showing signs of corrosion but do not require changing i.e. the remaining wall thickness is <100% but >80% of the original thickness shall be ultrasonically tested at five yearly intervals instead of ten yearly

3.10.1. Ultrasonic testing of Steel Poles

<table>
<thead>
<tr>
<th>Decision table for the identification of Steel Poles</th>
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</thead>
<tbody>
<tr>
<td><strong>Base Diameter (mm)</strong></td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>168.28</td>
</tr>
<tr>
<td>190.5</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>193.7</td>
</tr>
<tr>
<td>241.3</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>244.5</td>
</tr>
<tr>
<td>266.7</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

The table above indicates the original minimum design thickness of the various types of 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.

**Approved Ultrasonic thickness tester:**

*Meritronics Digital Ultrasonic Thickness Meter* used in conjunction with the UCA-2 couplant.

### 3.10.2. Painting requirements for Steel Poles

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 but it is anticipated that this will generally be undertaken on a 20 year cycle. Steel poles shall be painted with a two coat paint system generally in accordance with MNT/001/004 “Specification for Tower Painting” using paint systems in accordance with NPS/001/021 “Technical Specification for Overhead Line Towers and Substation Plant Paint Systems”. The colour of the finishing coat may vary depending on local authority requirements.

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.*
4. References

4.1. External Documentation

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
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<tr>
<td>ENA ER L9</td>
<td>“Structural testing of wood poles prior to climbing or use as a personal support”</td>
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4.2. Internal Documentation

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
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<tr>
<td>MNT/004</td>
<td>Policy for the Inspection and Maintenance of Overhead Systems</td>
</tr>
<tr>
<td>NPS/004/018</td>
<td>Technical specification for Steel Poles</td>
</tr>
<tr>
<td>NPS/004/021</td>
<td>Technical Specification for Overhead Line Towers and Substation Plant Paint Systems</td>
</tr>
<tr>
<td>NSP/004/012</td>
<td>Guidance on the Risk Assessment of Overhead Lines</td>
</tr>
</tbody>
</table>

4.3. Summary of Amendments from Previous Version

<table>
<thead>
<tr>
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<tr>
<td>Whole document</td>
<td>Document format updated to latest CDS format</td>
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<tr>
<td>Clause 3.1. (d)</td>
<td>Additional criteria – requiring below ground level inspections on increased risk pole categories and the re-introduction of the ‘S’ suspect pole classification – see also clause 3.3 Plus additional guidance on the limitation of work activities that can be carried out from MEWP’s when working on poles suspected of being decayed without first providing additional support.</td>
</tr>
<tr>
<td>Clause 3.2 (b)</td>
<td>Further modification to the standard hammer test wording Including changes to the sketches.</td>
</tr>
<tr>
<td>Clause 3.2 (C)</td>
<td>Further modification to the standard prodding test wording Including changes to the sketches.</td>
</tr>
<tr>
<td>Clause 3.2 (d)</td>
<td>This clause has been modified to specify AC500 treated poles and poles &gt;50 years old as specific increased risk pole groups requiring a mandatory below ground level inspection both for 10 yearly inspections and before climbing. Clause includes further background on the reasons for these new inspection requirements</td>
</tr>
<tr>
<td>Clause 3.2 (e)</td>
<td>Amended guidance provided for this test to include the use of the resistograph</td>
</tr>
<tr>
<td>Clause 3.3</td>
<td>Clause amended to detail how NPg approved test devices shall be used to assess the level of decay in a pole together with the actions to be carried out. Specifically the use of ‘S’ or ‘D’ notices and where this allows climbing activities to be carried out</td>
</tr>
<tr>
<td>Clause 3.4</td>
<td>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. i.e. where a pole can be retained or needs replacement and with what urgency.</td>
</tr>
<tr>
<td>Clause 3.5</td>
<td>Further guidance issued on the subject area of Cobra treated poles and how they should be tested.</td>
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</table>
Clause 3.6  
Boron Rod treated poles – identification and replacement  
This clause has been updated to provide further guidance on the use of boron paste as an alternative to the use of the banned boron rod.

Clause 3.7  
Poles suspected of being subjected to shock loading  
Clause re-numbered

Clause 3.8  
Reinstated Poles using Retrofitted Pole Support Systems  
This clause has been modified to include the use of any NPg assessed retrofitted pole supported system.

Clause 3.9  
Making a suspect pole safe to ascend using guy ropes  
Clause re-numbered and test/drawings re-arranged

Clause 3.10 and 3.10.1  
Assessment of Steel Poles and the ultrasonic testing of steel poles  
Further guidance issued on the testing requirements for steel poles – specifically the need for a test to be carried out a min of 100mm below ground level. Plus an updated guidance table on the identification of steel poles to determine the original wall thickness as it only from this initial assessment that the loss of steel thickness can be estimated and the necessary actions determined. Additional guidance on the need to inspect earth connections on steel poles

Clause 3.10.2  
Painting of steel poles  
Additional guidance provided on the need to repaint the below ground level area following the excavation for testing of steel poles below ground level.

Clause 4.3  
Summary of Amendments  
Summary of amendments updated.

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

Appendix 3.0  
LV Pole Installation Depth Monitoring System  
Method of installing pole sinking depth installation system and the subsequent depth measurement for use at sites that do not permit the use of MEWP’s or digging machines.

5. Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<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>
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</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>
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<tbody>
<tr>
<td>Dan Rodrigues</td>
<td>15/02/2018</td>
</tr>
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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.

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<th>Non Standard Review Period &amp; Reason</th>
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<td>Should this document be displayed on the Northern Powergrid external website?</td>
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<tr>
<td>Ged Hammel</td>
<td>15/02/2018</td>
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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>
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<td>Steven Salkeld</td>
<td>15/02/2018</td>
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6.4. Approval
Approval is granted for publication of this document.

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<td>David Gazda</td>
<td>27/02/2018</td>
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6.5. Authorisation
Authorisation is granted for publication of this document.

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<td>Greg Farrell</td>
<td>27/02/2018</td>
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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 an 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 drills 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

6. 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.
Appendix 3 – LV Pole Depth – “Installation Depth Monitoring System”

The following installation depth monitoring system was introduced in response to an incident involving the non-authorized removal of a section of pole below the 3m gouge mark on an LV Pole. It was determined that this action compromised the ability for future line staff / inspectors to determine the true sinking depth of the pole putting them at risk if climbing was attempted.

For detailed information on the required sites where this system shall be deployed please see NSP/004/041 – “COP for the Construction of LV ABC Overhead Lines” and NSP/004/041/001 – “COP for the renovation of LV Overhead Lines”.

However the basic principles for their future expected use and thus the subsequent need to carry out inspections shall be based on the following log:

The system shall be employed on all sites where new or replacement poles are being installed in “land locked” i.e. where it is not possible to gain access to the poles using MEWP’s and or it is anticipated that the poles may not have been installed using mechanical digging equipment, thus the risk of incorrect installation or interference with the normal pole sinking depth indication systems may have been compromised.

Method of installing 20mm plastic conduit onto the base of a LV pole to allow future monitoring of the pole sinking depth.

A standard 2.3m length of conduit shall be cut to length so that approx. 100mm of conduit will be left showing above the proposed finished ground level following reinstatement.

The conduit shall be secured to the pole with a minimum of 5 x 65mm Galvanized staples, making sure that the bottom end is flush with the butt of the pole and the top is accessible and will not interfere with any other required pole cables or capping.

Both ends of the conduit shall be effectively plugged to stop soil and debris filling the tubing.

To measure the pole sinking depth using this system

Removing the top cap to allow access, a non-conductive draw tape/wire, marked up with a piece of coloured tape located 3m from the end shall be slid into the conduit until the bottom of the conduit is felt. Then the draw tape shall be extended up the pole towards the pole identification gouge mark area. The coloured tape on the draw tape should align with the 3m gouge mark on the pole. If the tape marker extends beyond this point then further investigation will be required as the pole is unlikely to be installed at the correct sinking depth. Note actual sinking depth will be 3m minus the distance between the tape marker and the pole ground line.
# Appendix 4 - Northern Powergrid - Historical Pole Type Classification Table

<table>
<thead>
<tr>
<th>Length of Pole</th>
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<th>Medium</th>
<th>Medium Stout</th>
<th>Stout</th>
<th>Extra Stout</th>
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<tr>
<td>Approx. Conv. In Feet</td>
<td>Range of Pole Sink Depths (M)</td>
<td>Dia. at top (mm)</td>
<td>Min Dia 1.5m from Butt (mm)</td>
<td>Dia. at top (mm)</td>
<td>Min Dia 1.5m from Butt (mm)</td>
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Notes:

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

Information Classification – PUBLIC

CAUTION! - This document may be out of date if printed