BELL SYSTEM PRACTICES
Outside Plant Construction and Maintenance

SECTION G21.317
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POLE LINES

INSPECTION OF CREOSOTED PINE POLES

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1. GENERAL

1.01 Pine poles, the sapwood of which has been thoroughly treated with creosote, can be expected to show high resistance to attack by decay organisms and insects. Pine sapwood that has not been treated by a preservative will usually show low resistance if exposed to such attack. The heartwood of pine is much more resistant than untreated sapwood to common decay, but is not so resistant as treated sapwood. Generally, the decay of creosoted pine poles does not start on the outside and progress inward. The decay usually starts in untreated sapwood, some distance behind the surface. There is little probability of decay starting early in the service life of a pole, unless the penetration by creosote is shallow. Decay, if started in a pine pole, is likely to progress fairly rapidly through any untreated sapwood, leaving the treated wood and usually the heartwood, practically undamaged. The methods of inspecting creosoted pine poles are, therefore, directed toward detecting the presence and extent of any decay and untreated sapwood existing behind the surface of the pole. Under average conditions, a detailed inspection of a creosoted pine pole within the first 10 years of its life is not required. In making a periodic inspection of a line, however, it is advantageous to include a detailed examination of all the pine poles that are at least

o years old and will have reached an age of 10 years before the next inspection. In connection with periodic inspections of pole lines it is desirable to include a visual inspection of all poles, regardless of age.

1.02 As a means of detecting faulty conditions that may exist in creosoted pine poles, certain tools and methods, as described later, have been found effective and are recommended. In general, the inspection consists of:

(a) A visual examination of the pole from the roof to the ground line.

(b) A sounding test by means of a tool, such as a hammer, all around the pole, from the ground line to the highest point that can conveniently be reached from the ground, and also any higher points, such as around knot holes, and woodpecker holes, that may appear questionable, to determine the presence of hollow sections or decay pockets. These will usually be evidenced by differences in the sounds of the hammer blows.

(c) One or more borings by means of an increment borer at points where the hammer test indicates a faulty condition and also at questionable points. If no such points are found, it may be desirable to make one increment boring at a convenient height on the face or back of the pole to determine, for record purposes, the depth of penetration of the creosote and, if practicable, the thickness of sapwood. This boring should be made only if the supervisor issues instructions to that effect. When any borings are made and the pole is not condemned, a record should be made of the depth of creosote penetration and thickness of sapwood if it can readily be determined. A recommendation should also be included in regard to when the pole should be reinspected. Part 6 describes the basis for making these recommendations.

(d) An examination below the ground line in those cases where there is any reason to suspect that a faulty condition exists in that portion of the pole. A mud-filled check close to the ground line or an unusual sound at that section might indicate the presence of decay or termites below ground. In general, creosoted pine poles set in firm clay or wet soil are less likely to decay below the ground line than those which are set in loose gravel or dry sand. If an excavation is made, an increment boring should also be made in the below-ground section to determine the interior condition of the pole. All excavations should be backfilled and thoroughly tamped to the original ground line level.

2. TOOLS REQUIRED

2.01 The inspector will require the following tools in addition to the digging and measuring equipment generally required in pole inspection work:

(a) Lineman's body belt, safety strap and climbers, in those cases where the inspector will have occasion to climb poles to determine their condition.

(b) Increment borer, handle, extractor, and borer extension.

(c) Six-inch scale. (Obtain locally.)

(d) Drilling hammer or other equivalent sounding tool.

(e) A wedge-shaped or square-pointed pole prod.

2.02 The use and maintenance of some of the pole inspection tools are described in other sections of the Practices. The use of the increment borer, however, is described in this section.

3. METHOD OF INSPECTION

3.01 Inspect the surface of the pole from all sides, paying particular attention to such details as woodpecker holes, lightning damage, light streaks, season checks, and damage such as might be caused by road machinery or cultivating machinery. Whenever necessary, climb to the level of any damage that is out of reach from the ground. Explore the region of the damage both internally and externally to ascertain its extent and appraise its probable later effect on the condition of the pole.

Note: In examining a treated pole, do not strike the pole with a heavy pointed bar or similar tool that might cause damage to sound wood or perforate the treated wood to the extent that decay organisms may gain entrance.

3.02 Test each pole from the ground line to the maximum convenient height within arm's reach, striking the pole lightly but sharply, at closely spaced intervals. A decaying pole sounds dull or hollow, and in some cases, the wood gives, under the impact of the blow. A pole free from decay sounds clear and solid, and the hammer usually rebounds noticeably when the pole is struck sharply and squarely. Other conditions, such as a wet surface due to recent rains, a wet interior near the ground line due to high soil moisture, shakes in the pole near the surface, wide checks, and heavy concentrated loads, as of large cables and loading coil case fixtures, may change the sound of a solid pole. Care must be taken not to mistake the altered sound due to these or other causes for the sound asso-

ciated with internal decay. The increment borer should be used in all cases where testing with the hammer indicates the pole is not solid.

3.03 When the increment boring indicates that the pole is decaying, determine the circumferential and lengthwise extent of the decay by further testing with the hammer. In some poles, the decay will be confined within relatively narrow limits, for example, pockets of decay. In other poles, the decay may be very extensive. Fig. 1 represents a pole in which a sounding test has revealed a decay pocket and indicates the locations at which borings should be made to obtain information in regard to the extent of decay and depth of creosote penetration in the adjacent timber. Fig. 1(a) represents a cross-section of the pole through the decay pocket. The use to be made of the measurements of shell thickness and creosote penetration is given in Part 6.

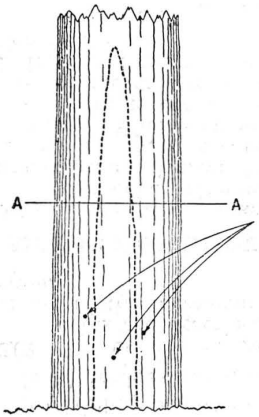
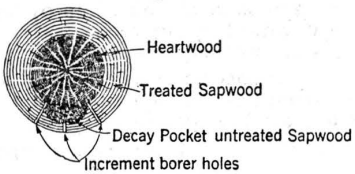


Fig. 1
The dotted line represents the limit of the decaying portion as determined by striking the pole with a hammer

Represents borings to determine thickness of solid wood over the decaying portion and depth of penetration in the solid wood surrounding the decaying portion.

Fig. 1a
Section through AA



3.04 Decay in knot holes and woodpecker holes may be explored by means of the pole prod and by borings. Borings, if made, should include one directly below the center ot the damage.

3.05 Where it is desired to examine the condition of poles below the ground line, sufficient earth should be removed from around the pole to permit examination on all sides. In order to make an increment boring, remove sufficient additional earth where the boring is to be made to permit the handle of the borer to be turned. The use of a borer extension will enable a boring to be made without removing as much earth. The boring may be made at a slight angle with the horizontal. If the pole is surrounded by concrete, and it is desired to examine the below-ground condition without breaking away the concrete, use a pole prod for exploring around the pole. This will indicate the presence of any exposed pockets close to the ground line. Internal decay or hollow heart may be found by making a boring downward at an angle close to the ground line. This method is not as satisfactory as a below-ground examination.

3.06 All increment borer holes in poles that are not condemned should be plugged with standard wooden plugs.

4. USE OF INCREMENT BORER

4.01 Under ordinary careful usage, the cutting edge of the increment borer will rarely need sharpening. If the bit becomes dull or damaged, it should be exchanged for one in good condition and the inspector should make no attempt to sharpen it.

4.02 Starting the borer is sometimes difficult in exceptionally hard-surfaced poles. If difficulty is experienced, it will usually be found helpful to start the hole at a spur mark. If the boring is taken for measurement purposes, allowance should be made for the depth of the spur mark. In all cases the surface at which the boring is started should be brushed clear of sand or dirt that might damage the cutting edge of the borer. Do not start boring in a check or at a point where the boring will intersect a knot.

4.03 In boring, the borer should be directed as nearly as practicable in a horizontal plane and toward the center of the pole. The boring should usually be made at least four inches long. It is unnecessary to bore beyond the center of the pole in any case. After boring to the full desired depth, the extractor should be inserted alongside the boring. The preferred position for inserting the extractor is along the upper

side of the boring. If, however, the extractor cannot easily be inserted at that point, it may be inserted at any other point where it can be pushed in more easily. The bit should then be given a back turn of ½ revolution or more so as to break off the core at the cutting end of the bit and so that the position of the extractor will be on the under side of the core. The core can then easily be removed on the extractor. The core should be examined and such measurements as may be necessary made while the core is still on the extractor. Remove the borer after the core examination has been completed.

4.04 If the borer becomes plugged, do not attempt to drive the plug out from the cutting end. The plug can be forced loose by making a boring in sound wood and can then be removed by means of the extractor.

4.05 Ordinary care in oiling the bit and extractor will prevent rust and is desirable, but it will not otherwise be of practical value in the use of the tool.

5. GENERAL RECOMMENDATIONS

5.01 The following paragraphs may be used in connection with making recommendations concerning decaying pine poles in line. They supplement the general Recommendations contained in Section G21.315.

5.02 The recommendations will depend on the location of the decay and the extent of it, both at the time of inspection and as it is likely to develop. As to location of the decay, the pole should be considered in three sections:

(a) Below a point one-fourth the distance from the ground line to the top of the pole.

(b) From the quarter point referred to in (a) and the midpoint of the pole.

(c) From the midpoint to the top of the pole.

The strength required in the upper portion of the pole is less than in the lower portion as discussed in Paragraph 6.04. The present extent of decay is determined as described in Part 3. The probable development is assumed to be limited by the amount of treated wood.

5.03 Poles in which the internal decay extends more than half way around the pole, but which have a continuous shell of treated wood, should be considered as having hollow heart, regardless of the presence of a core of solid heartwood.

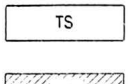
5.04 Poles in which internal decay extends less than one-half of the circumference shall be considered as having a decay pocket. In general, small decay pockets will not warrant prompt removal of a pole, unless associated with other

strength-reducing defects, such as numerous or large woodpecker holes, exceptionally large and numerous season checks, splintering or shattering by lightning, etc., or unless the pole is in an exceptionally exposed location. The future service life, in so far as decay is concerned, will depend on depth of creosote penetration and the extent of sound wood at other points in the same cross-section. If the examination shows the presence of untreated, but still sound, sapwood in the cross-section, it is probable that the decay will progress fairly rapidly through the untreated wood and the condition should be considered as hollow heart, if the final decay is likely to extend more than half way around the pole.

6. TYPICAL CROSS-SECTIONS OF POLES AND EFFECTS OF DEFECTS ON STRENGTH

6.01 Where decay occurs in creosoted pine poles it is usually the result of decay organisms reaching untreated wood through checks, woodpecker holes, or other damaged points in the treated layer of wood. The location and extent of the decay have a direct bearing on the strength of the pole. Decay pockets on the field or road side of a pole reduce its strength against cross winds more than a similar pocket in the face or back of the pole. The deductions for pockets recommended in Section G21.315 are for pockets in the worst location, that is, on the road or field side. The deductions for pockets in line may be taken as one-half the values shown in the table for pockets of a given size. For pockets at other locations, deduct a proportional amount. For example, if the centre of the pocket is found approximately half way between the face and the field side, and the deduction found in the table in Section G21.315 for a pocket is 6 inches, then the deduction for a pocket in line would be 3 inches and for a pocket half way between the face and field side would be half way between 3 and 6, or 4½ inches. Typical cross-sections of decay and methods of estimating the effects on the pole strength are discussed later.

6.02 For convenience, the various details of the cross-section are indicated by abbreviations, and codes, as follows:



Treated Sapwood

Untreated Sapwood

Heart Wood

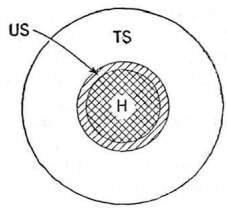
Decay

Direction of Line, where Direction is Important

6.03 **Typical cross-sections of treated pine poles and methods** of estimating the effects of decay or woodpecker damage on pole strength are discussed below.

No Hollow Heart, No Decay Pockets

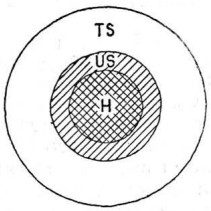
(a)



Depth of penetration of creosote uniform and in excess of 2½ inches or 85% of sapwood.

Pole should last indefinitely, probably in excess of 20 years, in so far as decay is concerned.

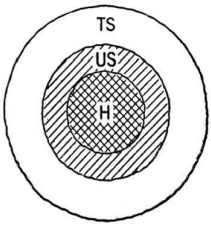
(b)



Depth of penetration from 2 inches to 2½ inches or approximately 75% of the sapwood treated, with no decay at the time of inspection.

These poles can be expected to remain in good condition for at least two additional inspection periods, in so far as decay is concerned.

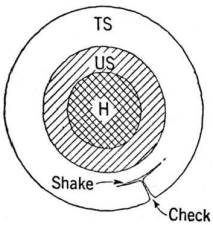
(c)



Depth of penetration less than 2 inches or less than 75% of sapwood treated.

These poles are likely to have a shorter life than those described in (b) and should be reinspected at the time of the next inspection of the line.

(d)

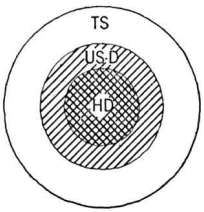


In some cases sounding may indicate a hollow condition, but the boring will show no decay. The hollow sound will usually be found to be due to a shake in the pole and will often be accompanied by a check.

Observe these poles closely for deep checks extending to untreated sapwood, unsound knot holes, and woodpecker damage. If any is found, the pole should be thoroughly reinspected at the time of the next inspection of the line.

Hollow Heart

(e)

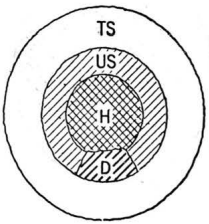


Hollow heart with shell of approximately uniform thickness.

If the treated shell thickness is less than 2 inches average around the pole, replacement is usually indicated. In making a decision, however, consider local conditions. For example, a 25-foot or shorter pole carrying a small number of less important circuits and with adjacent poles in good condition, might be retained if the shell thickness is 1½ inches or more of treated wood. If, however, the pole carries a heavy cable or wire load, or is exposed to sleet and heavy cross-winds, or is at an important location, it should be replaced if the thickness of shell is less than 2½ inches of treated wood. If the thickness of treated wood is in excess of the above values, the allowance for the hollow heart condition can be determined from Section G21.315. Reinspect these poles at the time of the next inspection of the line.

Decay Pockets

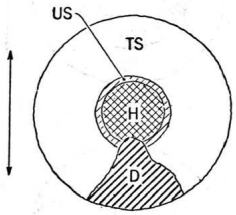
Note: All poles having decay pockets should, if not condemned, be reinspected at the time of the next inspection of the line.



Enclosed decay pocket.

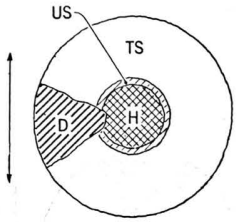
Determine extent of pocket by careful sounding and increment boring. Determine also depth of penetration of creosote and amount of untreated sapwood in sound portion of pole. If several borings are made they should be made at different levels. In view of the probability that decay will progress through the untreated wood, it may be expected that the condition described here will later be similar to that described in (e), and the recommendations should be similar to those covered in (e).

(g)



Exposed decay pocket in face or back of pole. Remaining sapwood well treated. If there is a thin shell (1/2 inch or less) over a decay pocket, consider the pocket as exposed.

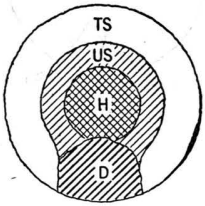
Measure width and depth of pocket and make deduction from measured circumference as recommended in Paragraph 6.01.



Exposed decay pocket on side of pole. Remaining sapwood **well treated. If there is a** thin shell (1/8 inch or less) over a decay pocket, consider the pocket as exposed.

Measure width and depth of pocket and determine deduction as recommended in Paragraph 6.01.

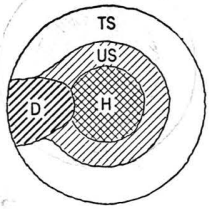
(i)



Exposed decay pocket in face or back of pole and remaining sapwood poorly treated. **If there is a thin shell** (1/8 inch or less) over a decay pocket, consider the pocket as exposed.

Measure decay pocket and assume decay will extend through untreated sapwood. Add allowances for the pocket as described in Paragraph 6.01 and hollow heart condition, and deduct the total from the measured circumference.

(j)



Exposed decay pocket on side of pole and remaining sapwood poorly treated. If there is a thin shell (1/8 inch or less) over a decay pocket, consider the pocket as exposed.

Make allowances for decay pocket as described in Paragraph 6.01 and in addition for hollow heart and deduct the total from the measured circumference.

0.04 The required ground line circumferences for various conditions are included in the sections covering Pole Line Inspection Tables or in the Pole Inspection Rule. The circumferences required for sections of poles above the ground line are less. If the section of maximum decay is at a point above the ground line, the required circumferences at that point may be obtained as follows:

(a) If the section is below a point one-fourth the distance from the ground line to the top of the pole, the required circumference is that shown in the Pole Line Inspection Tables or Pole Inspection Rule for the ground line.

(b) If the section is between the quarter point referred to in (a) and the midpoint of the pole, the required circumference is 10% less than that shown in the tables, but not less than 14 inches, except for poles in rural lines. For example, if the required ground line circumference is 30 inches, the circumference required at the higher point is 30 inches—3 inches, or 27 inches.

(c) If the section is between the midpoint and the top of the pole, the required circumference is 20% less than that shown in the tables, but not less than 14 inches, except for poles in rural lines. For example, if the required ground line circumference is 30 inches, the circumference required at the higher point is 30 inches—6 inches, or 24 inches.