

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

SUMMARY

This utility procedure provides instructions for intrusively inspecting, testing, restoring, reinforcing, treating, and reusing wood poles. It applies to PG&E-owned and maintained poles and may also apply to new or used poles provided by third parties.

Level of Use: Informational Use

TARGET AUDIENCE

This procedure targets employees who maintain or intrusively inspect wood distribution or transmission poles.

SAFETY

Personal injury may result from performing the actions described in this procedure improperly. When testing wood poles, perform all work as described in [Utility Procedure TD-2325P-02, "Testing Wood Poles Before Climbing."](#)

Potential hazards associated with intrusive pole inspections and treatment include, but are not limited to, the following conditions and situations:

- Underground/overhead utilities
- Overhead obstructions
- Noise
- Insects (bees, wasps, spiders)
- Snakes
- Vegetation, including poison oak
- Heat illness
- Vehicular and pedestrian traffic
- Tripping hazards, uneven ground, or hidden objects
- Chemicals
- Operating aerial lifts

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BEFORE YOU START

USE the following personal protective equipment (PPE) when performing the tasks described in this procedure:

- Gloves
- Hard hat
- Safety glasses
- Hearing protection
- Traffic or high visibility vest
- Proper work footwear

Tools and equipment: USE only PG&E-approved tools and equipment to perform the work described in this procedure. Required tools and equipment include, but are not limited to, the following items:

1. Intrusively Inspecting and testing:
 - Framing hammer
 - Tools to excavate around poles
 - Tools to scrape poles
 - Power drill
 - Ship auger bits
 - Pole thickness gauge
 - Boron rods
 - Plastic plugs
 - Tape measure
2. Stubbing:
 - Steel trusses and bands
 - Tools to drive trusses
 - Step plates ([Numbered Document 022616, "Stepping of Poles"](#)) and visibility strips

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Before You Start (continued)

3. Remedial treatment:
 - Preservatives
 - Tools to apply preservatives
4. Marking and tagging:
 - Pole reject tags
 - Deteriorated pole tags
5. Recording data:
 - PG&E personnel, USE [Form TD-2325P-01-F01, "Pole Inspection/Test Report,"](#) to record data.
 - Pole test and treat contractors, USE mobile electronic data recording equipment as required by pole test and treat personnel.

Preservatives: Preservatives used in pole remedial treatments are classified as hazardous materials. The following requirements apply:

- Only contractors possessing valid California agricultural pest control business licenses can apply preservatives.
- APPLY approved fumigants at rates described in the manufacturer's Environmental Protection Agency- (EPA-) issued label.
- OBTAIN AND MAINTAIN Material Safety Data Sheets (MSDS) for all preservatives used.
- Properly LABEL vehicles AND chemicals.
- HANDLE AND DISPOSE of preservatives or preservative containers as described in applicable regulations.

NOTE

Intrusive inspection cycle: PG&E performs an intrusive inspection for each pole on an approximate 10-year cycle, intrusively inspecting roughly 10% of wood poles annually.

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PROCEDURE STEPS

1 General

1.1 This procedure contains seven sections. PERFORM the procedure in the order shown.

1. [General](#)
2. [Intrusively Inspecting and Testing Wood Poles](#)
3. [Special Procedures for Previously Stubbed Poles](#)
4. [Evaluating Poles for Reinforcement](#)
5. [Reinforcing Poles with Steel Trusses \(Stubbing\)](#)
6. [Marking and Tagging Poles](#)
7. [Reusing Wood Poles](#)

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- 1.2 RECORD AND STORE all data obtained while intrusively inspecting AND testing poles for future use AND retrieval.
 1. PG&E personnel must RECORD the data on [Form TD-2325P-01-F01, "Pole Inspection/Test Report,"](#) (Attachment 1), AND STORE the completed form with any associated maintenance notifications.
 2. Pole test and treat contractors must RECORD AND STORE data electronically.
- 1.3 MAINTAIN records for intrusive inspection activities for the life of the pole.
- 1.4 SEE [Appendix 1, "Pole Test and Evaluation Flow Chart,"](#) on Page 41 for information on testing and evaluating procedures.
 1. REVIEW the flow chart carefully, AND NOTE the following information:
 - a. Exceptions for the following poles:
 - Center-bored streetlight poles
 - Poles set in concrete, asphalt, or brick
 - Gas-treated poles that have one of the following original treatments:
 - B (butane)
 - G (Cellon® gas)
 - MP (methane propane)
 - PB (Penta in liquid petroleum gas)
 - PD (Penta in chlorinated hydrocarbon solvent)
 - b. Differences between distribution and transmission poles.
 - c. Decision points.
 2. APPLY the procedures in this document to all wood distribution AND transmission poles unless noted by exceptions, difference, OR decision points.

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2 Intrusively Inspecting and Testing Wood Poles



CAUTION

The intrusive inspection and testing procedures in [Section 2](#) do not replace the requirements in the [Code of Safe Practices](#), Rules 414 and 417, or in [Utility Procedure TD-2325P-02](#).

Before climbing, TEST poles as described in [Utility Procedure TD-2325P-02](#).

NOTE

Cedar poles require a larger circumference than Douglas fir poles to meet the same strength requirements.

2.1 General Information

1. USE the intrusive inspection and testing procedures in this section to determine the serviceability AND structural integrity of wood poles.
2. PERFORM the following procedures in the order shown to determine the serviceability AND structural integrity of wood poles:
 - a. Visual inspection
 - b. Sound inspection (hammer test)
 - c. Below-ground external inspection (excavation)
 - d. Intrusive inspection (bore and probe tests)
 - e. Effective circumference evaluation
 - f. Alternative pole evaluation

2.2 Visual Inspection

1. Visually INSPECT all poles from the pole top to the groundline before testing or treating.
2. DOCUMENT all pertinent pole information, including:
 - a. Address/physical location.

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2.2.2 (continued)

- b. The following brand information (SEE [Figure 1](#)," below.)
- Manufacturer
 - Year manufactured
 - Pole class
 - Pole height
 - Wood species
 - Original treatment type
 - Year installed from date nail
 - Pole number (barcode)
 - Surface conditions
 - Circumference at groundline
 - Existing reinforcement (wood stubs or steel trusses)



Figure 1. Manufacturer Pole Brand

3. IDENTIFY above-ground damage, as described below:
- a. Vehicular, mechanical, or fire damage.
 - b. Bird (avian) or insect damage.
 - c. Breaks or checks (cracks).

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2.2.3 (continued)

- d. Above-groundline shell rot.
 - e. Woodpecker holes and size (use the following sizes):
 - Small – golf ball size
 - Medium – baseball size
 - Large – softball size or bigger
 - f. Other conditions that could render the structure non-serviceable.
4. CAPTURE photographs of the pole:
- a. One photo of the pole number (barcode).
 - b. One photo of the inspection tags (previous and newly installed).
 - c. One or two photos of the pole brand and date nail.
 - d. One photo of the entire pole.
 - e. One photo of the bottom $\frac{1}{3}$ of the pole including surface conditions at the base of the pole.
 - f. One photo of the existing reinforcement (if pole is reinforced).
 - g. One photo of the area exposed by removed obstruction (if obstruction was removed).
 - h. One or two photos of the below ground health of the pole, to be taken once excavated.
5. IF, for safety reasons, the pole is non-serviceable due to severe avian, fire, or insect damage, or other serious mechanical damage or defect,
THEN EVALUATE the pole for reinforcement (SEE [Section 4](#) on Page 27).
6. RECORD the data, as appropriate.

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2.3 Sound Inspection (Hammer Test)

1. PERFORM a sound inspection (hammer test) for all poles.
2. STRIKE the pole on all sides (all four quadrants) with a metal framing hammer (20-ounce minimum) from the groundline to a height of seven feet, or as high as the inspector can reach, whichever is greater.
3. ENSURE that marks from the crosshatched face on the strike plate of the hammer are visible on the pole.
4. LISTEN for the sound produced when the hammer strikes the pole to identify the location of possible internal voids or hollows.
 - a. IF the pole produces a hollow sound or other sounds that indicate pole defects, such as internal ruptures, cross breaks, or ring separation at one or more locations,

THEN INVESTIGATE these locations by performing below-ground excavation, bore testing AND probing.

- (1) SEE [Section 2.4, "Below-Ground External Inspection \[Excavation\]."](#) below, AND [Section 2.5, "Intrusive Inspection – Boring Inspection Holes."](#) on Page 12.

2.4 Below-Ground External Inspection (Excavation)

1. Exception: IF a pole is set in asphalt, concrete, or brick,
THEN DO NOT REMOVE the asphalt, concrete, or brick unless necessary.
2. Assess Obstruction Removal
 - a. Wherever safely possible, REMOVE any feasible above ground obstruction to ensure a complete assessment and excavation.
 - b. Obstructions should be removed in a two-foot distance from the circumference of the pole, if possible.
 - c. Typical removable obstructions include, but are not limited to, the following obstructions:

- (1) Vegetation

- a) IF manicured garden,

THEN REQUEST permission from property owner(s) to remove vegetation.

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2.4.2 (continued)

- b) IF permission is granted,

THEN REMOVE as much vegetation as required to ensure complete access.
 - c) IF permission is unknown or not granted,

THEN USE boards or other means to push vegetation out of the way to enable excavation.

AND USE guidance in [Section 2.6](#) to inspect around obstruction.
 - d) IF wild vegetation,

THEN REMOVE as much vegetation as required to ensure complete access.
- d. CAPTURE one photo of the area exposed by removed obstruction.
 - e. DO NOT REMOVE the following obstructions, USE guidance in [Section 2.6](#) to inspect around obstruction.
 - Fences
 - Risers
 - Pole key and foam
 - Mud seal
 - Ground molding
 - Buddy pole butt
3. Partial Excavation
- a. LOCATE the largest seasoning check near the groundline area.
 - b. EXCAVATE the soil adjacent to the check down to a minimum depth of 20 inches.
 - c. ENSURE the excavation is a minimum of six inches wide at the bottom AND at least 12 inches wide at the groundline.

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2.4.3 (continued)

- d. IF it is evident that 7/8-inch plastic plugs were used during a past inspection, THEN initially EXCAVATE on the side of the pole necessary to expose the existing below-ground plug.
 - e. REMOVE any previously installed backing paper completely.
 - f. CAPTURE one or two photos of the below ground health of the pole.
4. Full Excavation
- a. IF any of the following conditions apply:
 - The pole is a gas pole (SEE [Definitions](#) on Page 34).
 - The partial excavation inspection reveals external decay.
 - The bore and probe test reveals internal decay at or below the groundline.THEN:
 - (1) EXCAVATE the soil completely around the pole (full 360°) to a minimum depth of 20 inches.
 - (2) ENSURE the excavation is a minimum of six inches wide at the bottom to allow sufficient room to drill inspection holes below the groundline.
 - (3) REMOVE any previously installed backing paper completely.
 - (4) CAPTURE one or two photos of the below ground health of the pole.
5. DETERMINE the soundness of the wood below the groundline by brushing and scraping the excavated pole.
- a. DO NOT REMOVE good or visually sound wood from the pole.
 - b. REMOVE all below-ground exterior decayed wood AND surface rot from the pole.
 - (1) REMOVE below-ground external decay to a point eight inches above the groundline.
 - (2) CLEAN OUT external decay pockets.
 - c. PERFORM a sound inspection (hammer test) below ground.

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2.4.5 (continued)

- d. Exception: IF the pole is a gas pole,
THEN LOOK FOR AND REMOVE soft-rot shell deterioration.

NOTE

A gas pole is particularly susceptible to soft-rot shell deterioration of the outer surface caused by brown rot fungi.

- e. CAPTURE one or two photos, in different locations, of the below ground health of the pole.

2.5 Intrusive Inspection – Boring Inspection Holes

1. CONDUCT an intrusive inspection using the following boring inspection holes AND probing inspection holes procedures.
2. Exception: IF the pole is a through-bore,
THEN SEE [Section 2.8](#) for inspection instructions.



WARNING

When drilling into a center-bored wood streetlight pole, the drill bit could nick an electric wire inside the pole.

3. Exception: IF the pole is a center-bored wood streetlight pole,
THEN an intrusive inspection USING the boring inspection holes AND probing inspection holes procedures is not required.
4. Boring Inspection Holes
 - a. BORE $\frac{7}{8}$ -inch or 9/16-inch holes at an angle of between 45° and 60° to the vertical axis of the pole.
 - b. EXTEND each bore beyond the center of the pole.
 - c. BORE with a long-shank ship auger to allow observation of the wood shavings exiting the bore.
 - (1) PG&E personnel must USE a ship auger with a 9/16-inch bit (Code 200958).

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2.5.4 (continued)

- (2) Pole test and treat contractors typically USE ship augers with a $\frac{7}{8}$ -inch bit.
- d. BORE to a slant depth at least nine inches for poles with groundline circumference less than 32 inches.
- e. BORE to a slant depth at least 15 inches for poles with a groundline circumference greater than 32 inches.
- f. DO NOT BREAK through to the other side of the pole.
- g. DO NOT BORE into seasoning checks.
- h. EXAMINE the shavings for wood decay.

5. Locating Inspection Holes

NOTE

SEE [Section 2.8, "Exception: Through-Bored Douglas Fir Penta Pole."](#) on Page 18, for instructions to inspect through-boring Douglas fir Penta poles.

- a. BORE OR INSPECT a minimum of three holes.
- b. IF the pole has been tested previously and plugged, AND the previous bores are in the proper locations,
THEN:
 - (1) For wooden plugs, BORE a new hole approximately two inches below and to the left or right of existing wooden plugs.
 - (2) For plastic plugs, RE-INSPECT the previous bore holes by removing the plastic plug(s) to facilitate the probe test.
- c. IF the pole either has not been bore-tested previously, OR if removable plastic plugs were not used during a previous inspection,
THEN:
 - (1) START the first bore adjacent to the largest seasoning check 12 inches below the groundline.
 - (2) START the second bore 120° to the right of the first at the groundline.
 - (3) START the third bore 120° to the right of the second at no less than 12 inches above the groundline.

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2.5 (continued)

6. Exception: IF a pole is set in asphalt, concrete, or brick, OR if a pole otherwise cannot be excavated,

THEN:

- a. START the first bore adjacent to the largest seasoning check at the groundline.
- b. BORE the inspection holes deeply AND across as much of the pole cross-section as possible.
- c. LOOK carefully for any signs of decay, enclosed pockets, or voids.
 - (1) IF any decay, enclosed pockets, OR voids are found,

THEN REJECT the pole AND EVALUATE the pole for reinforcement (SEE [Section 4](#) on Page 27).

2.6 Intrusive Inspection – Boring Required New Inspection Hole(s)

1. DETERMINE location of new 9/16-inch inspection hole.
 - a. IF pole has NO obstructions,

THEN BORE 9/16-inch inspection hole 12-inches below groundline approximately three inches to the left OR right of the previous inspection hole.
 - b. IF pole has removable obstructions,

THEN BORE 9/16-inch inspection hole 12-inches below groundline at the approximate middle of the previously obstructed area.
 - c. IF pole has non-removable obstructions,

THEN BORE 9/16-inch inspection holes at groundline and 12-inches below groundline so that the hole forms a secant with the obstructed surface and crosses the pole a minimum of two inches inward (to ensure that it is bored into untreated wood).
 - d. IF pole is set in asphalt, concrete, or brick, OR if a pole otherwise cannot be excavated,

THEN BORE 9/16-inch inspection hole at groundline approximately three inches to the left or right of the previous inspection hole.

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2.6 (continued)

2. BORE new 9/16-inch inspection hole.
 - a. BORE hole at an angle of between 45° and 60° to the vertical axis of the pole.
 - b. EXTEND each bore beyond the center of the pole.
 - c. BORE with a long-shank ship auger to allow observation of wood shavings exiting the bore.
 - (1) USE a ship auger with a 9/16-inch bit (Code 200958).
 - d. BORE to a slant depth at least nine inches for poles with groundline circumference less than 32 inches.
 - e. BORE to a slant depth at least 15 inches for poles with a groundline circumference greater than 32 inches.
 - f. DO NOT BREAK through the other side of the pole.
 - g. DO NOT BORE into seasoning checks.
 - h. EXAMINE the shavings for wood decay.

2.7 Intrusive Inspection – Probing Inspection Holes

1. PROBE each bored hole to inspect for internal voids or pockets.
 - a. PROBE both previously bored AND new inspection holes.
2. USE an approved shell-thickness gauge with a calibrated scale that converts the measurement taken at an angle (usually 45°) to the actual thickness measurement perpendicular to the pole axis.
3. MEASURE the thickness of the exterior pole casing (i.e., the outside of the pole, the shell).
4. MEASURE the depths of any enclosed pockets.
5. INSERT the shell thickness gauge into a hole made by boring. (SEE Figure 2. Shell Thickness Gauge (Code 204908),” AND Figure 3. Using a Shell Thickness Gauge,” on Page 16.)

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2.7 (continued)

NOTE

When pushing a tight-fitting shell-thickness indicator into a pole, the inspector can feel the tip of the hook pass from one growth ring to another in solid wood, but not in decayed wood.

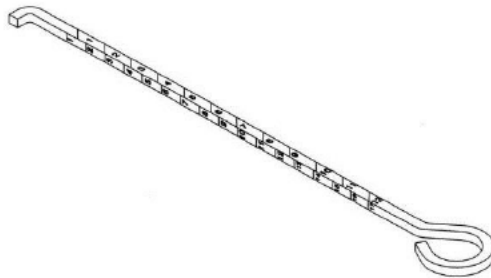


Figure 2. Shell Thickness Gauge (Code 204908)

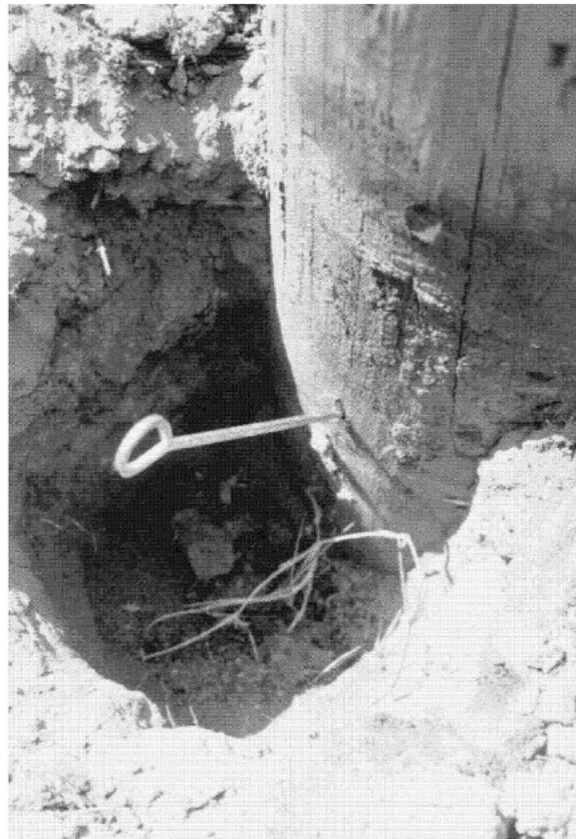


Figure 3. Using a Shell Thickness Gauge

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2.7 (continued)

6. PULL the shell-thickness gauge back while turning it AND pressing it against the side of the hole, until the side wall is identified.

NOTE

The hook on the end of the shell-thickness gauge should catch on the edge of sound wood inside the decay pocket as it is pulled back.

7. For a western red cedar or pine pole:
 - a. There is a well-defined transition from sound to decayed wood.
 - b. USE the shell-thickness gauge reading without compensation.
8. For a Douglas-fir pole:
 - a. There is no well-defined demarcation between advanced decay and sound wood.
 - b. MEASURE only sound wood.
 - c. DEDUCT ½ inch from the shell thickness gauge reading to allow for the lack of a well-defined transition AND the effects of incipient decay.
9. Decision: IF decayed wood or a void is found when probing inspection holes,
THEN:
 - a. PERFORM a full excavation of the pole down to 20 inches below groundline.
 - b. BORE additional inspection holes as described in [Subsection 2.9, "Intrusive Inspection – Boring Additional Inspection Holes,"](#) on Page 18.
 - c. PROBE the inspection holes as described in [Subsection 2.7, "Intrusive Inspection – Probing Inspection Holes,"](#) on Page 15.
10. Decision: IF decayed wood or a void is not found,
THEN:
 - a. PROCEED without boring any additional inspection holes.
 - b. PERFORM an effective circumference evaluation as described in [Subsection 2.17, "Effective Circumference Evaluation,"](#) on Page 22.

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2.8 Exception: Through-Bored Douglas Fir Penta Pole

1. IF the pole is a through-bored Douglas fir Penta pole,
THEN:
 - a. BORE a single inspection hole.
 - b. START the hole 18 inches above the top row of through-bore holes.
 - c. DO NOT BORE into the through-bored zone.
2. Decision: IF the probe test reveals an internal void above the through-bored zone,
THEN:
 - a. PERFORM an additional sound inspection (hammer test).
 - b. BORE a single inspection hole at any suspect location.
 - c. RECORD the shell thickness data from the inspection holes to use in evaluating the pole later.
3. Decision: IF the probe test reveals that there is not an internal void above the through-bored zone,
THEN TAKE the following actions:
 - a. PROCEED without boring any additional inspection holes.
 - b. RECORD the shell thickness data from the inspection holes to use in evaluating the pole later.

2.9 Intrusive Inspection – Boring Additional Inspection Holes

1. Procedure for Boring Inspection Holes
 - a. For areas at or below groundline, BORE 9/16-inch holes at an angle of between 45° and 60° to the vertical axis of the pole.
 - b. For areas above groundline, BORE 9/16-inch holes at an angle of 90° to the vertical axis of the pole.
 - c. EXTEND each bore beyond the center of the pole.
 - d. BORE with a long-shank ship auger to allow observation of the wood shavings exiting the bore.

(1) USE a ship auger with a 9/16-inch bit (Code 200958).

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2.9.1 (continued)

- e. For inspection holes at or below groundline, BORE to a slant depth of at least nine inches for poles with less than 32 inches of groundline circumference.
- f. For inspection holes at or below groundline, BORE to a slant depth of at least 15 inches for poles with greater than 32 inches of groundline circumference.
- g. DO NOT BREAK THROUGH to the other side of the pole.
- h. DO NOT BORE into seasoning checks.
- i. IF boring inspection holes are at the same level of the pole as a previous inspection,

THEN REMOVE OR DRILL THROUGH existing test plugs at that level to fully identify AND locate the presence of voids.

2. Location of Intrusive Inspection Holes

NOTE

BORE the necessary holes required to properly evaluate the extent of decay in the software. BORE holes at the appropriate levels for inspection.

- a. BORE a minimum of two holes at each level required for inspection.
 - b. SPACE the holes evenly around the circumference of a pole.
 - c. BORE three holes at other levels, as needed, for evaluating the pole for feasibility of reinforcement (SEE [Section 4](#)).
 - d. BORE additional holes, as needed, to determine the extent of the decay.
- 3. PROBE the inspection holes as described in [Subsection 2.7](#) on Page 15.
 - 4. RECORD the shell thickness data from the inspection holes to use in evaluating the pole later.

2.10 Application of Internal Preservatives (Fumigant Treatment)

- 1. Employees who inspect poles using the bore and probe test should TREAT the poles with internal fumigants as described below:
 - a. POUR the fumigant through the $\frac{7}{8}$ -inch holes bored for the inspection.
 - b. POUR the fumigant only into sound wood above and/or below internal voids (if present).

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2.10.1 (continued)

- c. DO NOT PLACE fumigant into voids and/or checks.
- d. APPLY approved fumigants at the rates described on the manufacturer's EPA-issued label.
- e. POUR fumigant treatment into the inspection hole bored in a through-bored Douglas fir pole.
- f. INSERT boron rod (Code 140037) into 9/16-inch inspection hole.

2.11 Plug Inspection Holes

1. PLUG all 7/8-inch or 9/16-inch inspection holes with removable plastic plugs.
2. REUSE existing plastic plugs, where possible.
3. PLUG 9/16-inch inspection holes with 9/16-inch movable plastic plugs (Code 140038).
4. OBTAIN additional plastic plugs for 7/8-inch inspection holes from pole test and treat personnel.

2.12 Application of External Preservatives

NOTE

Pole test and treat contractors normally APPLY external preservatives.

1. A contractor possessing a valid California agricultural pest control business license must properly TREAT the following poles with approved preservatives:
 - Poles that remain in service.
 - Poles that are candidates for reinforcement.
 - Gas treated poles that are scheduled for replacement.

2.13 External Treatment

1. IF the pole is a gas pole, OR if the pole is excavated fully and found to be serviceable, THEN:
 - a. APPLY an approved preservative paste from the bottom of the excavation to three inches above the groundline.

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2.13.1 (continued)

- b. BRUSH the paste liberally into checks and exposed pockets.
- c. APPLY the preservative paste to meet the minimum coating thickness recommended on the manufacturer's EPA-issued label.
- d. COVER the treated area with a 16-pound, polyethylene-backed kraft paper.
- e. WRAP the pole for 24 inches (from 20 inches below the groundline to 4 inches above the groundline).
- f. APPLY any previously removed paper to the outside of the new paper.
- g. STAPLE OR NAIL the wrapping in place.

2.14 Worksite Clean-Up

1. REPLACE the soil previously excavated around pole.
2. ENSURE all foreign materials (i.e., gloves) are removed from the worksite.

2.15 Calculate Average Shell Thickness

1. To calculate the average shell thickness at a specific level on the pole, PERFORM the following actions:
 - a. TOTAL the shell-thickness measurements taken at that level.
 - b. DIVIDE by the number of measurements taken.
2. CALCULATE AND RECORD the average shell thickness at 12 inches below groundline.
3. CALCULATE AND RECORD the average shell thickness at groundline.
4. DETERMINE the minimum-average shell thickness as the lesser of the average shell thickness at 12 inches below groundline AND the average shell thickness at groundline.
5. Decision: IF a pole is not set in concrete, asphalt, or brick, AND the probing inspection locates internal voids, AND the minimum average shell thickness is two inches or less,
THEN:
 - a. REJECT the pole as non-serviceable.
 - b. EVALUATE the pole for reinforcement.

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2.16 Exceptions:

1. IF a pole has one or more of the following defects (visual rejects),
 - a. Cracks and breaks consequent to mechanical damage, such as automobile contact.
 - b. Compression wood determined to be deeper than 1 inch.
 - c. Insect or avian damage estimated to be larger than one third of the pole's circumference.
 - d. Insect or avian damage with a 9-inch hole width, located within a one-foot vertical section.
 - e. Excessive checks, cracks, and/or splits through the pith (center of the pole).
 - f. Pole-top crown damage or split tops extending downward more than 6 inches from the pole top.
 - g. Any other valid reason such as fire, insect, or mechanical damage that would make the structure non-serviceable.

THEN:

- a. REJECT the pole as non-serviceable.
 - b. EVALUATE the pole for reinforcement.
2. IF a pole is set in concrete, asphalt, or brick,
AND the probing inspection locates internal voids,

THEN:

- a. REJECT the pole as non-serviceable.
 - b. EVALUATE the pole for reinforcement.
3. IF a pole has a minimum shell thickness of less than one inch,
THEN:
 - a. REJECT the pole as non-serviceable.
 - b. SCHEDULE the pole for replacement.

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2.17 Effective Circumference Evaluation

1. MEASURE the circumference of the pole at groundline.
2. IF the pole has mechanical, shell, or burn damage,
THEN:
 - a. REMOVE as much damaged wood at or near the groundline as feasible.
 - b. MEASURE the resulting effective groundline circumference.
 - c. MEASURE the original circumference at a point below the mechanical damage that best approximates the original nondamaged circumference of the pole.
3. USE the measurements from inspection holes for calculating reductions.
4. CALCULATE the resultant effective groundline circumference by reducing the circumference measurement for any of the following defects found from 12 inches below groundline to 66 inches above groundline:
 - a. Hollow Hearts ([Appendix 2](#))
 - b. Enclosed Pockets ([Appendix 3](#))
 - c. Exposed Pockets ([Appendix 4](#))
5. IF any combination of defects is occurring on the pole,
THEN MAKE separate reductions to the effective circumference for each defect.
6. COMPARE the result of subtracting the reductions from the measured effective groundline circumference with the minimum effective groundline circumference in [Appendix 1](#).
7. Decision: IF the resultant effective groundline circumference is equal to or less than the minimum effective groundline circumference required by [Appendix 1](#),
THEN:
 - a. REJECT the pole as non-serviceable.
 - b. EVALUATE the pole for reinforcement.
8. Decision: IF the resultant effective groundline circumference is greater than the minimum effective groundline circumference required by [Appendix 1](#),
THEN ACCEPT the pole as serviceable (further evaluation is not required).
9. RECORD the resultant effective groundline circumference, as appropriate.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

2.18 Alternative Pole Evaluation Method (Optional to Section 2.17)

1. IF voids are found OR the pole is rejected as non-serviceable, AND the minimum shell thickness is greater than one inch,

THEN CALCULATE the pole strength (percent [%] strength) using approved software.

2. The software calculates % strength as:

$$\% \text{ Strength} = \frac{\text{Remaining pole strength}}{\text{Pole strength at the original circumference of the pole}} \times 100$$

3. ASSUME pole is fully loaded AND % Load = 100%.

4. CALCULATE the safety factor as:

$$\text{Safety Factor} = \frac{\% \text{ Strength}}{\% \text{ Load}}$$

5. Decision: IF the safety factor is equal to or greater than 75%,

THEN ACCEPT the pole as serviceable (further evaluation is not required).

6. Decision: IF the safety factor is less than 75%,

THEN:

- a. REJECT the pole as non-serviceable.
- b. EVALUATE the pole for reinforcement.

7. Exception: IF the pole is a gas pole,

THEN:

- a. Decision: IF performed full (360°) excavation AND safety factor is 100%,

THEN ACCEPT the pole as serviceable (further evaluation is not required).
- b. Decision: IF performed full (non-360°) excavation AND safety factor is 100%,

THEN:
 - (1) REJECT the pole as non-serviceable.
 - (2) EVALUATE the pole for reinforcement.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

2.18.7 (continued)

- c. Decision: IF pole is set in asphalt, concrete, or brick, OR if a pole otherwise cannot be excavated,
- THEN:
- (1) REJECT the pole as non-serviceable.
 - (2) SCHEDULE the pole for replacement.
- d. Decision: IF performed full (360° OR non-360°) excavation AND safety factor is equal to or greater than 75%, but less than 100%,
- THEN:
- (1) REJECT the pole as non-serviceable.
 - (2) EVALUATE the pole for reinforcement.
- e. Decision: IF performed full (360° OR non-360°) excavation AND safety factor is less than 75%,
- THEN:
- (1) REJECT the pole as non-serviceable.
 - (2) SCHEDULE the pole for replacement.

NOTE

Transmission line asset strategy or maintenance personnel PROVIDE a list of transmission circuits AND wood structures in high-wind areas.

8. Exception: IF a transmission pole in a high-wind area has any deterioration or damage,
- THEN:
- a. CALCULATE the pole strength (% strength) using approved software.
 - b. ASSUME a pole is fully loaded and % load = 100%.
 - c. CALCULATE the safety factor.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

2.18.8 (continued)

- d. Decision: IF the safety factor is equal to or greater than 80%,
THEN ACCEPT the pole as serviceable (further evaluation is not required).
- e. Decision: IF the safety factor is less than 80%,
THEN:
 - (1) REJECT the pole as non-serviceable.
 - (2) EVALUATE the pole for reinforcement.

3 Special Procedures for Previously Stubbed Poles

3.1 This section applies to a pole previously stubbed using either a wood stub or a steel structural support (steel truss) and steel bands, regardless of age or original treatment of the stubbed pole.

3.2 Wood Stub

- 1. IF the pole was previously stubbed using a wood stub,
THEN SCHEDULE the pole for replacement.

3.3 Steel Truss

- 1. IF the pole was previously reinforced using steel structural supports and steel bands (steel truss),
THEN:
 - a. PERFORM both a visual inspection AND a sound inspection (hammer test) of the wood in the banding areas.
 - b. CAPTURE one photo of the existing reinforcement.
 - c. PROBE inspection holes at the banding levels on the pole to confirm the following shell thickness requirements for reinforcement (SEE [Section 4](#)).
 - (1) Average shell thickness at 66 inches above groundline on the pole is 4 inches or greater.
 - (2) Average shell thickness at the upper banding level on the pole is 4 inches or greater.
 - (3) Average shell thickness at the lower banding level on the pole is 2 inches or greater.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

3.3.1 (continued)

- d. ENSURE that the reinforcement bands meet the following conditions:
 - (1) The bands are installed properly at the correct heights.
 - (2) The bands are tight enough that they cannot be moved by hand.
- e. Decision: IF the pole DOES NOT meet the shell thicknesses requirements for reinforcement,

THEN SCHEDULE the pole for replacement.
- f. Visually INSPECT steel stubs/trusses for rust.
 - (1) IF rust is evident on the steel stub,

THEN INSPECT it 12 inches below the groundline for corrosion.
 - (2) IF corrosion has not penetrated more than $\frac{1}{3}$ of the stub's perimeter across its width,

THEN TAP it with a hammer.
 - (3) IF the steel stub is solid,

THEN the steel stub is strong enough to support the pole.
- g. Decision: IF it appears that corrosion has deteriorated the stub's strength,

THEN SCHEDULE the pole for replacement.
- h. Decision: IF the stubbed pole passes all inspections,

THEN ACCEPT the pole as serviceable (further evaluation is not required).

4 Evaluating Poles for Reinforcement

- 4.1 IF a minimum shell thickness of less than one inch is observed at any level on the pole,

THEN SCHEDULE the pole for replacement.
- 4.2 IF a pole is rejected as non-serviceable,

THEN EVALUTE the pole to determine whether it meets the structural requirements necessary to obtain suitable strength from an ancillary structural member such as a steel truss.
- 4.3 DO NOT USE steel trusses to alleviate an overload condition not caused by groundline deterioration.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

- 4.4 Crossings – DO NOT USE steel trusses in any of the following circumstances:
1. Crossings over major railroads.
 2. Crossings over communication lines not attached to the same pole(s).
 3. Conflicting lines where Grade “A” construction is required. Conflicting lines are defined in [California Public Utilities Commission \(CPUC\) General Order \(G.O.\) 95, “Rules for Overhead Electric Line Construction,”](#) Rule 22.1A, “Conflicting Lines.”
 4. Crossings over a major freeway, expressway, or controlled access highway.
 - a. FIND definitions for freeway, expressway, and controlled access highway in [Caltran’s Highway Design Manual](#).
- 4.5 BORE AND PROBE inspection holes at 66 inches above groundline AND at the banding levels shown in [Subsection 4.6, “Check at Banding Levels,”](#) below to determine the average shell thickness at each level.
- 4.6 CHECK at 66 inches.
1. BORE AND PROBE inspection holes at 66 inches above groundline.
 2. DETERMINE the average shell thickness at 66 inches above groundline.
 3. Decision: IF the average shell thickness at 66 inches above groundline is less than 4 inches,

THEN the pole is NOT a candidate for reinforcement with a steel truss. SCHEDULE the pole for replacement.
 4. Decision: IF the average shell thickness at 66 inches above groundline is four inches or more,

THEN EVALUATE the shell thickness at the banding levels.
- 4.7 Check at Banding Levels
1. EVALUATE the shell thickness at the banding levels using criteria described below.
 2. Decision: IF the thickness at the banding levels meets criteria,

THEN the pole is a candidate for reinforcement with a steel truss.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

4.7 (continued)

3. Decision: IF the thickness at the banding levels fails criteria,

THEN the pole is NOT a candidate for reinforcement with a steel truss, SCHEDULE the pole for replacement.
4. Criteria
 - a. BORE AND PROBE inspection holes at 54 inches AND 26 inches above groundline.
 - b. DETERMINE the average shell thickness at 54 inches above groundline.
 - c. DETERMINE the average shell thickness at 26 inches above groundline.
 - d. IF the average shell thickness at 54 inches is four inches or greater, AND the average shell thickness at 26 inches is two inches or greater,

THEN the pole meets criteria requirements.

4.8 Exposed Pockets

1. IF the pole has an exposed pocket between the bottom of the lowest band and 66 inches above the groundline that is greater than 4 inches wide and 4 inches deep,

THEN the pole is NOT a candidate for reinforcement with a steel truss. SCHEDULE the pole for replacement.

4.9 Enclosed Pockets

1. IF the pole has an enclosed pocket that meets all the following criteria:
 - a. The pocket is located between the band locations.
 - b. The pocket is more than 6 inches wide and 2 inches high.
 - c. The minimum shell thickness closest to the pocket is less than one inch.
THEN the pole is NOT a candidate for reinforcement with a steel truss, SCHEDULE the pole for replacement.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

4.10 Obstructions to Placing Trusses

1. IF either of the following two conditions prevent locating the steel truss within 9 inches of the preferred position (its strong X-axis parallel to the pole line):
 - Presence of below-ground (or buried) facilities
 - Facilities attached to the surface of the pole (ground wires, risers, power or communication equipment, water or gas pipes, fences, etc.)

THEN the pole is NOT a candidate for reinforcement with a steel truss. SCHEDULE the pole for replacement.

5 Reinforcing Poles with Steel Trusses (Stubbing)

NOTE

Pole reinforcement (stubbing) contractors, not PG&E employees, usually reinforce poles with steel trusses.

5.1 Design Criteria

1. ENSURE that after the steel truss is installed, the pole's strength meets OR exceeds the original strength of the pole.
2. SIZE AND PLACE the trusses as described in [Numbered Document 063418, "Wood Pole Reinforcement Using Steel Trusses."](#)
3. USE additional steel sizes not listed in [Numbered Document 063418](#) if they meet strength requirements AND are previously approved.
4. SIZE AND ORIENT trusses to provide the required groundline strength against wind loading AND to support the bending loads on the pole.
5. ENSURE that the expected life of the steel truss is at least 25 years.
6. PLACE the steel truss system only on poles with sufficient remaining wood necessary to meet strength requirements for a minimum of seven years.

5.2 RECORD the presence of previous remedial treatment tags.

1. IF the pole qualifies for reinforcement with a steel truss, AND if the pole has not been remedially treated with internal preservative within 2 years of the date indicated on the tag,

THEN remedially TREAT the pole as described in [Section 5](#) on Page 30.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

5.2 (continued)

2. IF the pole does NOT qualify for reinforcement with a steel truss,
THEN DO NOT TREAT the pole.

5.3 Installing Trusses

1. NOTIFY underground service alert (USA) of all poles to be reinforced either by going to their website (<https://usanorth811.org/>) or by calling **1-800-227-2600**.
2. ENSURE that USA personnel MARK the areas where poles will be reinforced before driving trusses.
3. ENSURE that PG&E personnel OBTAIN any other required permits before installation (e.g., street opening permits).
4. DO NOT REMOVE attachments to the pole, such as risers or ground wires when installing a truss.
5. IF the pole is a riser pole greater than 600 volts (primary),
THEN a qualified electrical worker (QEW) must PERFORM the following tasks:
 - a. VERIFY the riser is safe to work around before installing the steel truss.
 - b. BE PRESENT AND OBSERVE the steel truss installation process.
6. DO NOT DISCONNECT ground wires.
7. IF it becomes necessary to relocate a ground to avoid interference when installing the truss,
THEN ARRANGE the ground wire's relocation before installation.
8. IF ground molding is found to be broken or is damaged during the truss installation,
THEN REPLACE the first 8 feet from groundline.
9. DRIVE the trusses with a power hammer (either air or hydraulic) with sufficient power to ensure the truss is buried to its specified depth within a reasonable time. (SEE [Numbered Document 063418](#).)
10. USE a 500-pound drop-weight system, if necessary, to complete the installation in difficult soils or rock.
11. INSTALL step plates ([Numbered Document 022616](#)) on all stubbed poles.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

5.3 (continued)

12. INSTALL visibility strips as required by [Numbered Document 022168](#) on stubbed poles.
13. IF old step plates OR pole steps are removed,
THEN PLUG the holes.

6 Marking and Tagging Poles

NOTE

Pole reinforcement and pole test and treat contractors usually MARK AND TAG poles.

- 6.1 TAG all poles that have either been inspected, tested, treated, OR are unsuitable for treatment.
- 6.2 PLACE the tag(s) approximately 6 feet above groundline AND above the pole brand.
- 6.3 TAG all poles that have been treated by a contractor with aluminum tags that show the following information:
 - Contractor's name
 - Year of inspection
 - Type of tests performed
 - Type of treatments applied
- 6.4 PLACE treatment tags adjacent to, and not over, any tags applied by previous pole contractors.
- 6.5 CAPTURE one photo of the inspection tags (previous and newly installed).

7 Reusing Wood Poles

NOTE

Cedar poles require a larger circumference than Douglas fir poles to meet the same strength requirements.

- 7.1 DETERMINE the pole's age from either the brand or the date nail.
- 7.2 DETERMINE the species AND treatment from the brand.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

- 7.3 DO NOT REUSE the pole if any of the following conditions are true:
1. The pole is a ponderosa pine.
 2. The pole is gas-treated.
 3. The pole is older than 20 years.
- 7.4 SALVAGE AND REUSE poles that are 10 years old or less, if possible.
- 7.5 CONSIDER reusing poles up to 20 years old if they are tested and proved to be sound as described in this procedure.
- 7.6 CONSULT the wood-pole product engineer with questions about inspecting wood poles being considered for reuse.
- 7.7 SEE [Numbered Document 025055, "Requirements for Customer-Owned Poles,"](#) located in the [Electric and Gas Service Requirements \(Greenbook\)](#) for additional information.
- 7.8 PERFORM the following tasks as described in this procedure:
- Visual inspection
 - Sound inspection (hammer test)
 - Intrusive inspection (bore and probe test)
- 7.9 ASSESS the pole.
1. IF there is less than four inches of average shell thickness at 6 feet from the butt,
THEN DO NOT REUSE OR ACCEPT the pole.
- 7.10 SCRAPE AND REMOVE any external decay or damage, AND MEASURE the resulting circumference six feet from the butt and at the pole top to determine the class of pole.
1. SEE [Appendix 5](#) for American National Standards Institute (ANSI) criteria for pole dimensions.
- 7.11 IF checks in the climbing area of the pole (groundline and within 5 feet from the top) meet either of the criteria below,
1. Exceeds $\frac{3}{4}$ -inch in width.
 2. Exceed 3 feet in length measured downwards from the point where the check is at its maximum (i.e., the point where it exceeds $\frac{3}{4}$ -inch).
- THEN DO NOT REUSE the pole.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

- 7.12 IF knots on the pole meet any of the criteria below,
1. Exceed 2½ inches in diameter for poles less than or equal to 45 feet.
 2. Exceed 3 inches in diameter for poles greater than 50 feet.
 3. The sum of the knot diameters in any knot cluster exceeds nine inches in any one foot vertical section of the pole.
- THEN DO NOT REUSE the pole.
- 7.13 IF the poles have significant avian, fire, or other damage,
- THEN DO NOT REUSE the pole.
- 7.14 IF the pole has a split top down to the intended crossarm level,
- THEN DO NOT REUSE the pole.
- 7.15 PLUG all inspection holes with a boron rod (Code 140037) and plastic plug (Code 140038).
- 7.16 PLACE a new date nail adjacent to the existing date nail, if any, to denote the pole is used.
- 7.17 TREAT all “cut” surfaces (i.e., poles topped, gains, drilled holes) either with copper naphthenate (Code 490718), OR with a PG&E-approved wood preservative before reusing the wood pole.

END of Instructions

DEFINITIONS

Average shell thickness: The sum of one or more shell thickness measurements taken at evenly spaced intervals around the circumference of a pole at a common elevation divided by the number of measurements taken. Whenever possible, take three measurements spaced 120° apart at each elevation.

Bore: The process of using a manual or power drill to breach the exterior of a pole primarily to provide access for the internal examination of the pole and secondarily to create a reservoir for remedial chemical application.

Decayed wood: Wood that has lost its strength due to insect infestation or decomposition caused by fungi. Decayed wood shavings are discolored, crumble easily, and do not maintain wood structure and fiber strength.

Effective circumference: The resultant effective circumference of sound wood of the pole at or near the groundline. It may be less than the original circumference because of surface decay (shell rot), fire, mechanical, or insect damage, or reductions taken because of internal decay. Estimators use the effective circumference to reassess/evaluate pole loading or to reclassify poles.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Definitions (continued)

Enclosed pocket: An enclosed area of deterioration within the heartwood of the pole.

Exposed pockets: The absence of wood on the outside surface of a pole typically caused by decay fungi or other wood deteriorating processes.

Exterior pole casing: The outside of a pole.

External preservative treatment: The application of an approved wood preservative to the exterior surface of the pole from 2–3 inches above groundline to the bottom of a groundline excavation, intended to serve as a barrier to decay in the groundline area of the pole.

Excavation: The removal of soil that exposes the pole from the groundline to an area between 20 and 30 inches below ground, thereby providing access for visual inspection, application of external preservative treatment, and below ground boring. The excavation may be completely around the circumference of the pole or partially exposing the pole, depending on the condition of the pole and its original treatment type.

Feasibility of reinforcement: Determination of whether the pole meets the structural requirements necessary to obtain suitable strength from an ancillary structural member.

Internal fumigation: The application of an approved volatilizing chemical formulated to kill decay causing organisms or fungi spores within the wood.

Intrusive inspection (bore and probe test): The act of drilling a hole and using an approved shell thickness gauge to determine the internal condition of the pole.

Minimum average shell thickness: The lesser of the average shell thickness at 12 inches below groundline and the average shell thickness at groundline.

Minimum safety factor: [G.O. 95](#) requires that poles be replaced before safety factors have been reduced (due to deterioration) to less than 67% of the safety factors required for the grade of construction.

Original circumference: The circumference of the pole measured at the groundline or directly below any mechanical damage. Use the original circumference to determine the pole's original class and original strength.

Original pole treatment types are grouped as follows:

- **Gas poles:** B (butane), G (Cellon® gas), MP (methane propane), PB (Penta in liquid petroleum gas), PD (Penta in chlorinated hydrocarbon solvent)
- **Penta poles:** A (Penta in creosote), P (Penta), and PA (Penta in petroleum)
- **Creosote poles:** C (creosote), N (copper naphthenate)
- **Salt poles:** SB (salts bouldiden), SK (chromated copper arsenate), SZ (ammonical copper zinc arsenate), and ZMA (zinc metal arsenate)

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Definitions (continued)

Probe: A process in which a shell thickness gauge is inserted into a pole which has been bored to determine the condition of the wood inside of the pole.

Qualified electrical worker (QEW): By regulatory definition, a qualified person who has a minimum of two years training and experience with high-voltage circuits and equipment and has demonstrated by performance familiarity with the work to be performed and the hazards involved.

Reinforcement: Mechanical technique(s) to restore the strength of a pole decayed at or near the groundline to serviceable condition.

Safety Factor: The pole strength divided by the pole load. Both the bending moment at groundline and the vertical load are considered.

Seasoning check or check: The natural lengthwise separation of the wood fibers that usually extends across the rings of annual growth normally caused by the changes in the moisture content of the wood.

Serviceable: A pole with sufficient mechanical strength or a pole that can be reinforced to sufficient mechanical strength to remain in service.

Shell: The measurement of solid wood from the outer surface of a wood pole to the outer edge of an internal void if one exists.

Shell-thickness gauge: A tool used to detect internal decay pockets in poles by “feeling” growth rings in sound, but not decayed, wood when inserted through or removed from snug-fitting holes bored in the pole.

Sound test (hammer test): The act of striking a framing hammer on the surface of the pole from the groundline to as high as can be reached to identify possible internal voids or hollows in the pole. A framing hammer has a cross-hatched face on the strike plate, which leaves marks on the wood.

Sound wood: Wood that has no decay. Sound wood shavings are light in color and maintain wood structure and fiber strength.

Stub: A short length of steel truss or wood pole driven or set into the ground and attached to the existing pole by suitable fastenings. A stub provides the support originally afforded by the pole butt.

Suitable for reinforcement: A pole with damage or decay at or near the groundline that can be reinforced to extend the pole life.

Through-bored pole: Douglas-fir wood poles which have a series of $\frac{3}{8}$ -inch or $\frac{1}{2}$ -inch holes bored completely through the intended groundline area of the pole to ensure complete penetration of the original preservative treatment.

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IMPLEMENTATION RESPONSIBILITIES

Area electric superintendents communicate these procedures to electric compliance supervisors in their areas.

Compliance supervisors ensure all compliance inspectors are adequately trained on this procedure.

Service planning and estimating supervisors communicate this procedure to service planning and estimating personnel.

Pole test and treat personnel communicate these procedures to pole test and treat contractors.

GOVERNING DOCUMENT

[Utility Standard TD-2325S, "Wood Pole Inspection, Testing, and Maintenance"](#)

COMPLIANCE REQUIREMENT / REGULATORY COMMITMENT

[North American Electric Reliability Corporation \(NERC\) Standard FAC-501-WECC-2, "Transmission Maintenance"](#)

Records and Information Management:

Information or records generated by this procedure must be managed in accordance with the Enterprise Records and Information (ERIM) program policy, standards, and Enterprise Records Retention Schedule (ERRS). Refer to [GOV-7101S, "Enterprise Records and Information Management Standard,"](#) and related standards. Management of records includes, but is not limited to:

- Integrity
- Storage
- Retention and Disposition
- Classification and Protection

REFERENCE DOCUMENTS

Developmental References:

NA

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Supplemental References:

[Caltran's Highway Design Manual](#)

California Public Utilities Commission (CPUC) General Orders (G.O.s):

- [95, "Rules for Overhead Electric Line Construction"](#)
- [165, "Inspection Requirements for Electric Distribution and Transmission Facilities"](#)

[Code of Safe Practices](#)

[Electric and Gas Service Requirements](#) (Greenbook) (TD-7001M)

Numbered Documents:

- [015203, "Construction Requirements for Wood Poles"](#)
- [022168, "Marking, Numbering, and Identification of Line Structures"](#)
- [022616, "Stepping of Poles"](#)
- [025055, "Requirements for Customer-Owned Poles"](#)
- [063418, "Wood Pole Reinforcement Using Steel Trusses"](#)

Utility Procedures:

- [TD-2325P-02, "Testing Wood Poles Before Climbing"](#)
- [TD-2923P-01, "Climbing Wood Poles"](#)

[Utility Standard SAFE-1001S, "PG&E Injury & Illness Prevention Plan \(IIPP\)"](#)

APPENDICES

[Appendix 1, "Pole Test and Evaluation Flow Chart"](#)

[Appendix 2, "Required Groundline Circumference"](#)

[Appendix 3, "Poles with Hollow Hearts"](#)

[Appendix 4, "Poles with Enclosed Pockets"](#)

[Appendix 5, "Poles with Exposed Pockets"](#)

[Appendix 6, "ANSI Pole Dimension Criteria"](#)

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ATTACHMENTS

[Attachment 1, Form TD-2325P-01-F01, "Pole Inspection/Test Report"](#)

DOCUMENT REVISION

This utility procedure cancels and supersedes the following documents:

1. Utility Procedure TD-2325P-01, "Inspecting, Reinforcing, and Reusing Wood Poles," revision 2, dated 11/15/2019.
2. Utility Bulletin TD-2325P-01-B001, "Enhanced Cellon Pole Intrusive Inspection," revision 0, dated 10/01/2021.

DOCUMENT APPROVER

██████ Director, Standards and Work Methods

██████ Director, System Inspections

██████ Senior Director, Asset Strategy

DOCUMENT OWNER

██████ Senior Director, Asset Strategy

DOCUMENT CONTACT

██████ Electric Distribution Engineer, Senior

██████ Supervisor of Pole Test & Treat

██████ Consulting Electric Standards Engineer, Senior

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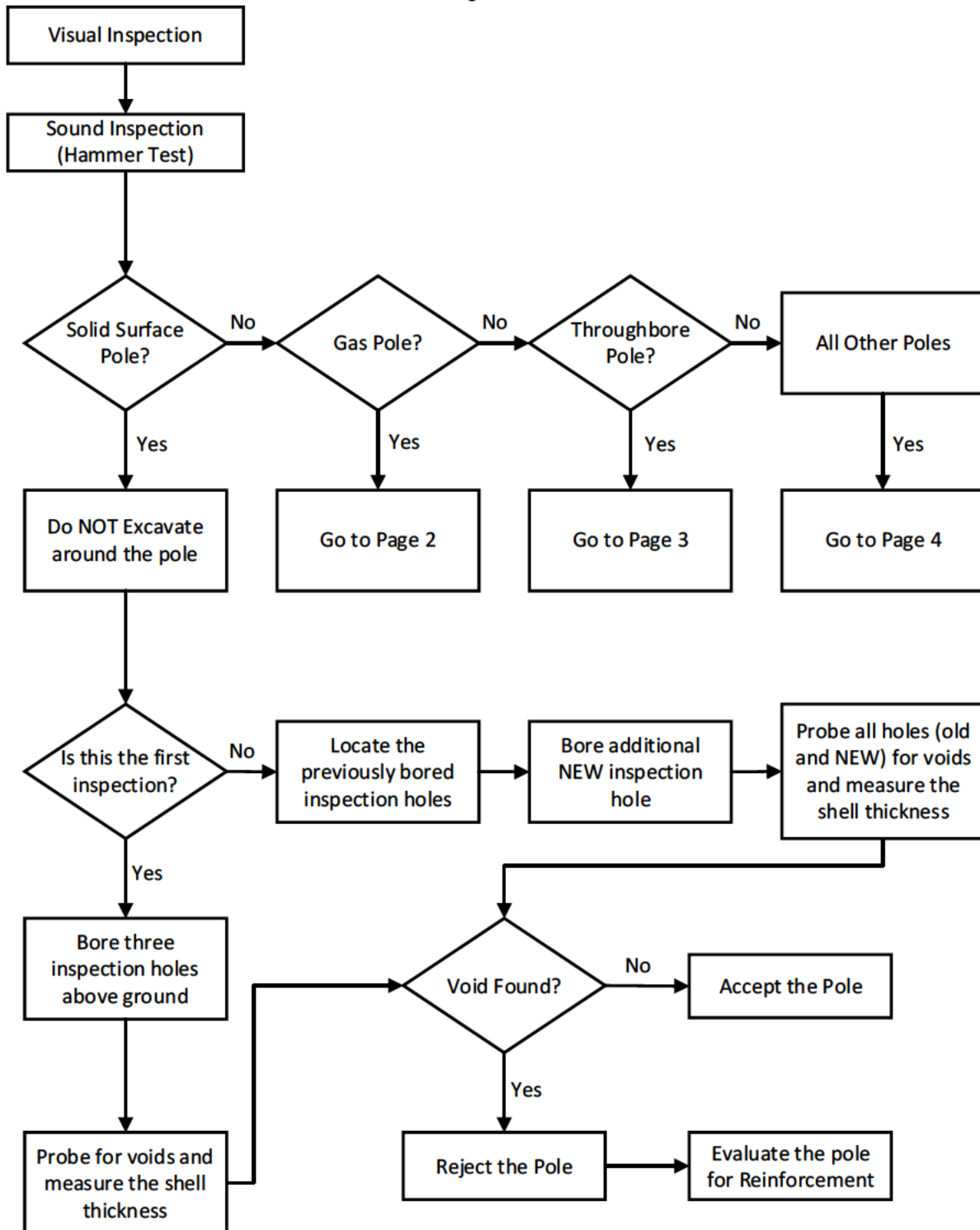
REVISION NOTES

| Where? | What Changed? |
|---|---|
| Entire document | <ul style="list-style-type: none"> • Verified and updated hyperlinked references. • Incorporated Bulletin TD-2325P-01-B001 and all its content. • Made minor edits to content based on new PTT inspection application that is rolling out in 2022. |
| Before You Start section | <ul style="list-style-type: none"> • Edited NOTE regarding inspection cycles. |
| Section 1.4 | <ul style="list-style-type: none"> • Added gas-treated pole original treatments. |
| Section 2.2 | <ul style="list-style-type: none"> • Removed instructions regarding pole degradation tags and markers. • Added photo requirements. |
| Section 2.4 | <ul style="list-style-type: none"> • Removed option to perform visual only inspection if pole is less than 10-years old. • Added instructions for assessing obstructions for removal to excavate around the base of the pole. |
| Section 2.10 | <ul style="list-style-type: none"> • Moved instructions for application of internal preservatives to be discussed in Section 2. |
| Section 2.13 | <ul style="list-style-type: none"> • Moved instructions for application of external preservatives to be discussed in Section 2. |
| Section 2.14 | <ul style="list-style-type: none"> • Added instructions for worksite clean-up. |
| Section 3.2 | <ul style="list-style-type: none"> • Changed requirements to replace poles that have wood stubs. |
| Section 4 | <ul style="list-style-type: none"> • Removed Criteria 1 testing, as it is no longer performed and only Criteria 2 is used. Relabeled Criteria 2 as Criteria. |
| Section 6 | <ul style="list-style-type: none"> • Removed instructions regarding pole degradation tags and markers. |
| Definitions section | <ul style="list-style-type: none"> • Changed “groundline excavation” to be “excavation” to match the wording in the procedure. |
| Document Approvers, Owner, Contacts section | <ul style="list-style-type: none"> • Updated per current workforce. |
| Appendix 1 | <ul style="list-style-type: none"> • Updated flow charts to match revised procedure steps. |

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 1, Pole Test and Evaluation Flow Chart

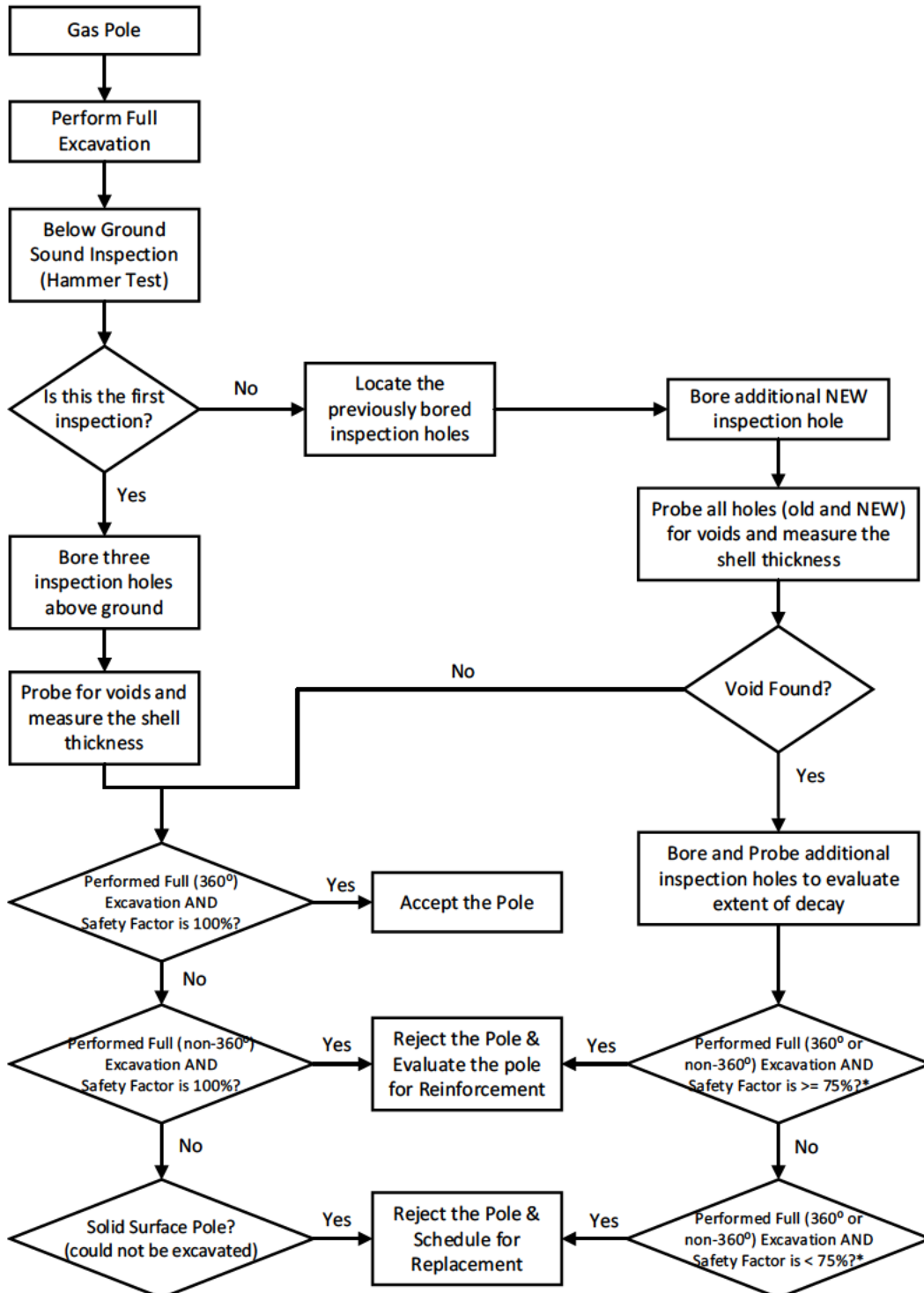
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Appendix 1, Pole Test and Evaluation Flow Chart

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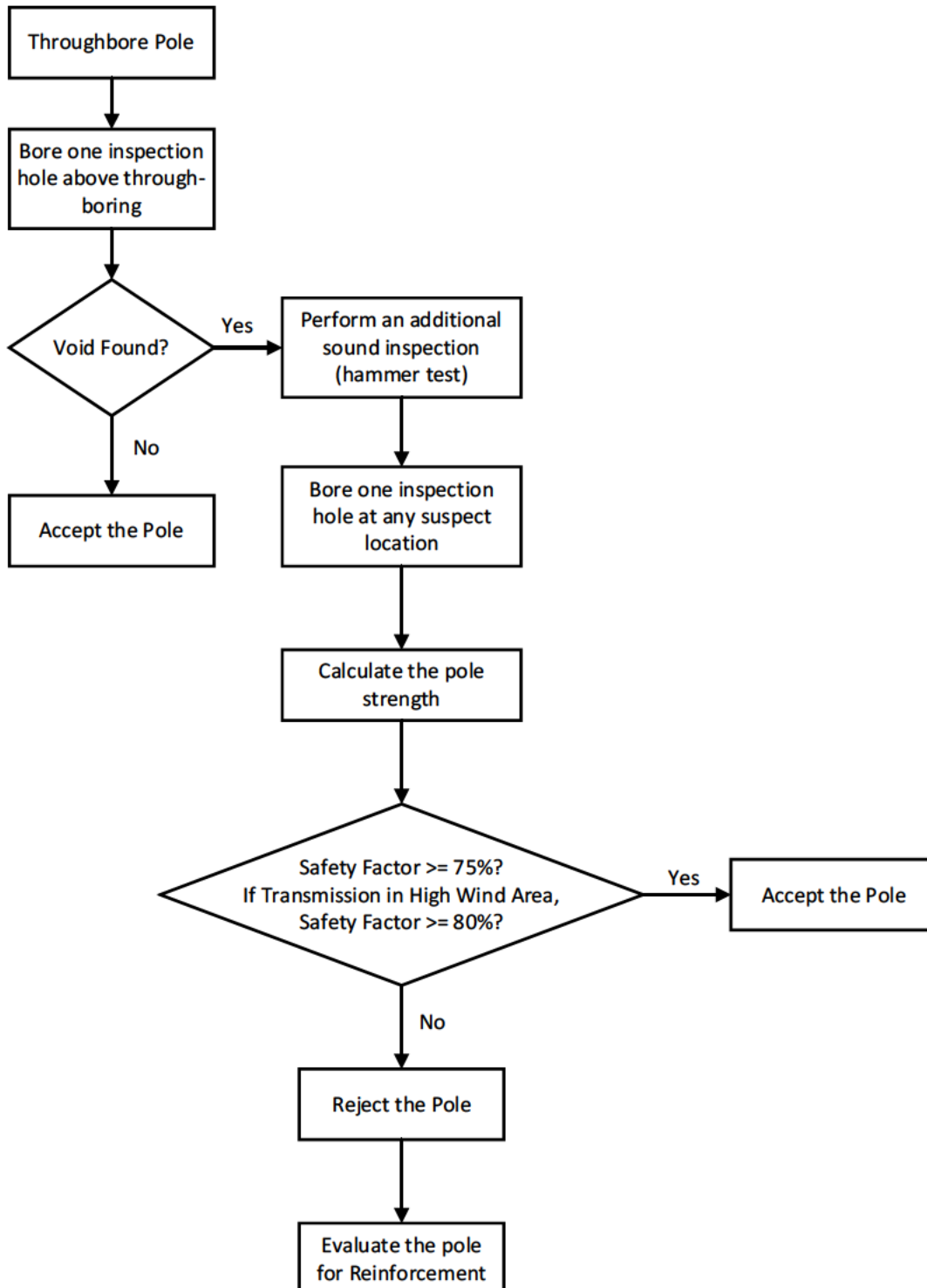


* If Transmission in High Wind Area, Safety Factor >= 80%?

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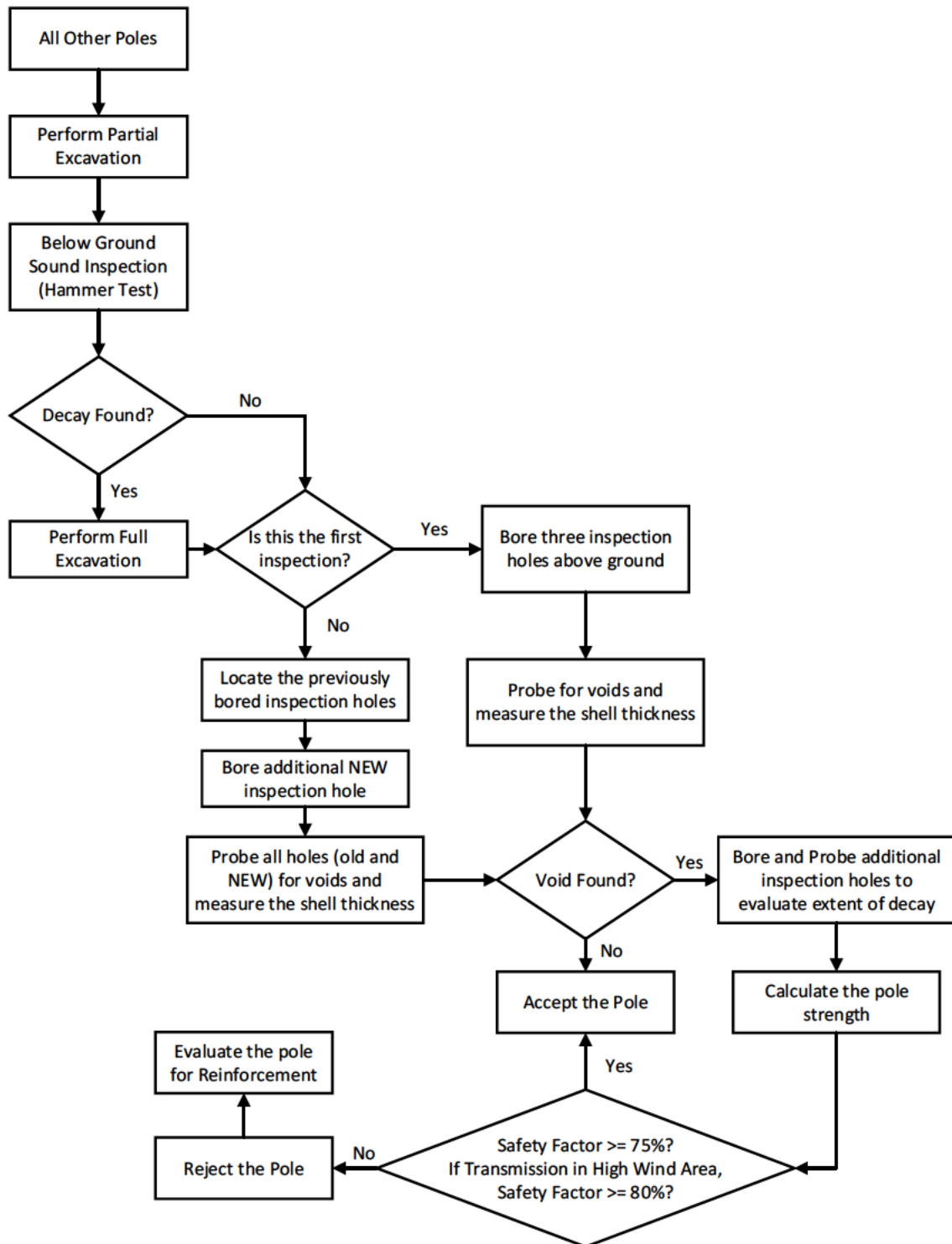
Appendix 1, Pole Test and Evaluation Flow Chart

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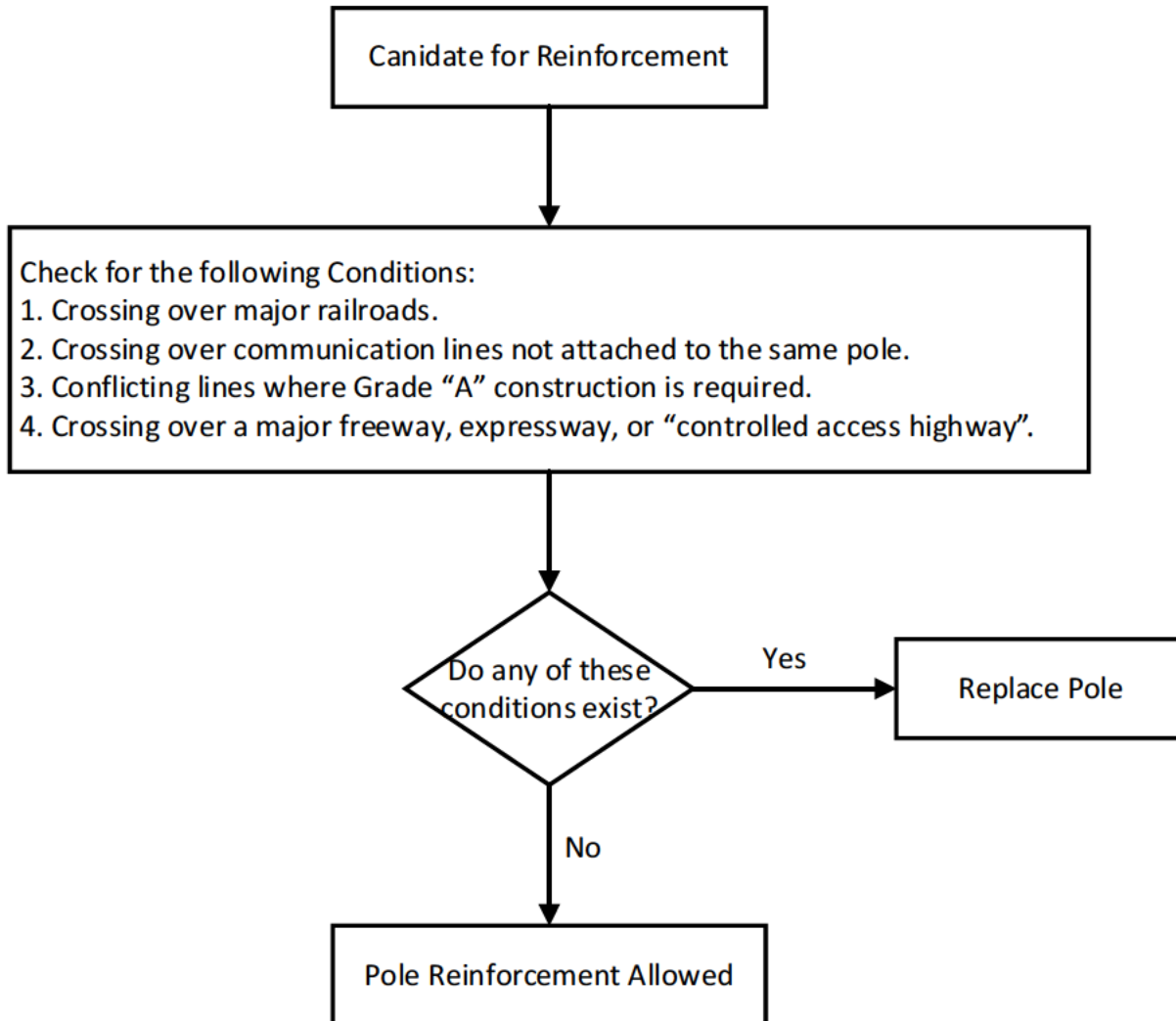
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Appendix 1, Pole Test and Evaluation Flow Chart
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Appendix 1, Pole Test and Evaluation Flow Chart
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Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 2, Required Groundline Circumference

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1. MEASURE the minimum effective circumference (inches) at groundline at the point of maximum decay.
2. For pole circumferences greater than 60 inches, MULTIPLY the original circumference by 0.87 to get the resulting minimum effective circumference.

| Original Circumference of Pole (Inches) | Minimum Effective Circumference Allowed (Inches) | Original Circumference of Pole (Inches) | Minimum Effective Circumference Allowed (Inches) |
|---|--|---|--|
| 24 | 21 | 43 | 37½ |
| 25 | 21¾ | 44 | 38½ |
| 26 | 22¾ | 45 | 39¾ |
| 27 | 23½ | 46 | 40 |
| 28 | 24½ | 47 | 41 |
| 29 | 25¼ | 48 | 41¾ |
| 30 | 26¼ | 49 | 42¾ |
| 31 | 27 | 50 | 43½ |
| 32 | 28 | 51 | 44½ |
| 33 | 28¾ | 52 | 45¼ |
| 34 | 29¾ | 53 | 46¼ |
| 35 | 30½ | 54 | 47 |
| 36 | 31½ | 55 | 48 |
| 37 | 32¼ | 56 | 49¾ |
| 38 | 33¼ | 57 | 49¾ |
| 39 | 34 | 58 | 50½ |
| 40 | 35 | 59 | 51½ |
| 41 | 35¾ | 60 | 52¼ |
| 42 | 36¾ | | |

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 3, Poles with Hollow Hearts

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1. MEASURE the effective circumference (inches) of sound wood at groundline.
2. MEASURE the shell thickness (inches) at the groundline inspection holes AND USE the smallest thickness found.
3. FIND the table entry corresponding to the measurements from Steps 1 and 2. Entry is in inches.
4. DEDUCT the entry from the table from the measured circumference to obtain the circumference of an equivalent solid pole.

| Measured Circumference of Sound Wood (Inches) | Minimum Thickness of Shell (Inches) | | | | | | |
|---|-------------------------------------|-----|-----|-----|-----|-----|-----|
| | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
| 22 | 1 | 1 | | | | | |
| 23 | 1 | 1 | | | | | |
| 24 | 1 | 1 | | | | | |
| 25 | 1 | 1 | | | | | |
| 26 | 1 | 1 | | | | | |
| 27 | 1 | 1 | 1 | | | | |
| 28 | 1 | 1 | 1 | | | | |
| 29 | 1 | 1 | 1 | | | | |
| 30 | 2 | 1 | 1 | 1 | | | |
| 31 | 2 | 1 | 1 | 1 | | | |
| 32 | 2 | 1 | 1 | 1 | | | |
| 33 | 2 | 1 | 1 | 1 | 1 | | |
| 34 | 2 | 1 | 1 | 1 | 1 | | |
| 35 | 3 | 2 | 1 | 1 | 1 | | |
| 36 | 3 | 2 | 1 | 1 | 1 | | |
| 37 | 3 | 2 | 1 | 1 | 1 | | |
| 38 | 3 | 2 | 1 | 1 | 1 | 1 | |
| 39 | 3 | 2 | 1 | 1 | 1 | 1 | |
| 40 | 4 | 2 | 2 | 1 | 1 | 1 | |
| 41 | 4 | 3 | 2 | 1 | 1 | 1 | |

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 3, Poles with Hollow Hearts
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| Measured Circumference of Sound Wood (Inches) | Minimum Thickness of Shell (Inches) | | | | | | |
|---|-------------------------------------|-----|-----|-----|-----|-----|-----|
| | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 |
| 42 | 4 | 3 | 2 | 1 | 1 | 1 | |
| 43 | 4 | 3 | 2 | 1 | 1 | 1 | |
| 44 | 5 | 3 | 2 | 1 | 1 | 1 | |
| 45 | 5 | 3 | 2 | 2 | 1 | 1 | 1 |
| 46 | 5 | 4 | 3 | 2 | 1 | 1 | 1 |
| 47 | 6 | 4 | 3 | 2 | 1 | 1 | 1 |
| 48 | 6 | 4 | 3 | 2 | 1 | 1 | 1 |
| 49 | 6 | 4 | 3 | 2 | 1 | 1 | 1 |
| 50 | 6 | 4 | 3 | 2 | 1 | 1 | 1 |

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 4, Poles with Enclosed Pockets

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1. MEASURE the effective circumference (inches) of sound wood at groundline.
2. MEASURE the shell thickness (inches) at the groundline inspection holes AND USE the smallest thickness found.
3. MEASURE depth (inches) of any enclosed pocket.
4. FIND the table entry corresponding to the measurements from Steps 1, 2, and 3. (Entry is in inches.)
5. DEDUCT the entry from the table from the measured circumference to obtain the circumference of an equivalent solid pole.

| Measured Circumference of Sound Wood (Inches) | Thickness of Shell on Thin Side (Inches) | Maximum Depth of Pocket (Inches) | | |
|---|--|----------------------------------|-----|-----|
| | | 3.0 | 4.0 | 5.0 |
| 22 – 30 | 1.0 | 2 | 2 | 3 |
| 22 – 30 | 2.0 | - | 1 | 1 |
| 22 – 30 | 3.0 | - | - | - |
| 31 – 38 | 1.0 | 2 | 2 | 3 |
| 31 – 38 | 2.0 | 1 | 1 | 2 |
| 31 – 38 | 3.0 | 1 | 1 | 1 |
| 9 – 50 | 1.0 | 2 | 3 | 4 |
| 39 – 50 | 2.0 | 1 | 2 | 2 |
| 39 – 50 | 3.0 | 1 | 1 | 1 |

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 5, Poles with Exposed Pockets

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1. MEASURE the effective circumference (inches) of sound wood at groundline.
2. MEASURE the depth (inches) of the exposed pocket at groundline.
3. MEASURE the width (inches) of the exposed pocket.
4. FIND the table entry corresponding to the measurements from Steps 1, 2, and 3. (Entry is in inches.)
5. DEDUCT the entry from the table from the measured circumference to obtain the circumference of an equivalent solid pole.
5. REDUCE these deductions by 50% for pockets in line-of-lead (face or back of pole).

| Measured Circumference of Sound Wood (Inches) | Depth of Pocket (Inches) | Width of Pocket (Inches) | | | | | | | | | | | |
|---|--------------------------|--------------------------|---|---|---|---|----|----|----|----|----|----|----|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 22 – 30 | 1 | 1 | 2 | 3 | 4 | 5 | 7 | 8 | 9 | | | | |
| 22 – 30 | 2 | 2 | 3 | 4 | 5 | 7 | 9 | | | | | | |
| 22 – 30 | 3 | 2 | 3 | 4 | 6 | 8 | | | | | | | |
| 22 – 30 | 4 | 2 | 3 | 4 | 6 | 9 | | | | | | | |
| 22 – 30 | 5 | 2 | 3 | 4 | 6 | 9 | | | | | | | |
| | | | | | | | | | | | | | |
| 31 – 40 | 1 | 1 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 31 – 40 | 2 | 1 | 2 | 3 | 4 | 5 | 6 | 8 | 10 | 11 | 12 | | |
| 31 – 40 | 3 | 1 | 2 | 4 | 5 | 6 | 8 | 10 | 12 | 13 | 14 | | |
| 31 – 40 | 4 | 2 | 3 | 4 | 5 | 7 | 9 | 11 | 13 | 14 | 15 | | |
| 31 – 40 | 5 | 2 | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 15 | 16 | | |
| | | | | | | | | | | | | | |
| Over 40 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 | 5 | 6 | 7 |
| Over 40 | 2 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 10 | 12 |
| Over 40 | 3 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 11 | 13 | 15 |
| Over 40 | 4 | 2 | 2 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 13 | 15 | 17 |
| Over 40 | 5 or Deeper | 2 | 3 | 4 | 5 | 7 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 6, ANSI Pole Dimension Criteria

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| Douglas Fir (DF) Poles | | | | | | | | |
|---|---|------|------|------|------|------|------|------|
| Pole Class | 6 | 5 | 4 | 3 | 2 | 1 | H1 | H2 |
| Minimum Pole-Top Circumference (Inches) | 17 (19) | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| Pole Length (Feet) | Minimum Circumference 6 Feet from the Butt (Inches) | | | | | | | |
| 20 | 21.0 | 23.0 | 25.0 | 27.0 | 29.0 | 31.0 | | |
| 25 | 23.0 | 25.5 | 27.5 | 29.5 | 31.5 | 33.5 | | |
| 30 | 25.0 | 27.5 | 29.5 | 32.0 | 34.0 | 36.5 | | |
| 35 | 27.0 | 29.0 | 31.5 | 34.0 | 36.5 | 39.0 | | |
| 40 | 28.5 | 31.0 | 33.5 | 36.0 | 38.5 | 41.0 | | |
| 45 | 30.0 | 32.5 | 35.0 | 37.5 | 40.5 | 43.0 | | |
| 50 | | 34.0 | 36.5 | 39.0 | 42.0 | 45.0 | 47.5 | 50.5 |
| 55 | | | 38.0 | 40.5 | 43.5 | 46.5 | 49.5 | 52.0 |
| 60 | | | 39.0 | 42.0 | 45.0 | 48.0 | 51.0 | 54.0 |
| 65 | | | 40.5 | 43.5 | 46.5 | 49.5 | 52.5 | 55.5 |
| 70 | | | 41.5 | 45.0 | 48.0 | 51.0 | 54.0 | 57.0 |
| 75 | | | | 46.0 | 49.0 | 52.5 | 55.5 | 59.0 |
| 80 | | | | 47.0 | 50.5 | 54.0 | 57.0 | 60.0 |
| 85 | | | | 48.0 | 51.5 | 55.0 | 58.5 | 61.5 |
| 90 | | | | 49.0 | 53.0 | 56.0 | 59.5 | 63.0 |
| 95 | | | | | 54.0 | 57.0 | 61.0 | 64.5 |
| 100 | | | | | 55.0 | 58.5 | 62.0 | 65.5 |
| 105 | | | | | 56.0 | 59.5 | 63.0 | 67.0 |

Note 1: Purchase Class 6 poles in lengths of 35 feet, 40 feet, and 45 feet with Class 5 (19-inch minimum) tops.

Intrusively Inspecting, Reinforcing, and Reusing Wood Poles

Appendix 6, ANSI Pole Dimension Criteria
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| Western Red Cedar (WC) Poles | | | | | | | | |
|--|--|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Pole Class | 6 | 5 | 4 | 3 | 2 | 1 | H1 | H2 |
| Minimum Pole-Top Circumference (Inches) | 17 (19) | 19 | 21 | 23 | 25 | 27 | 29 | 31 |
| Pole Length (Feet) | Minimum Circumference 6 Feet from the Butt (Inches) | | | | | | | |
| 20 | 23.0 | 25.9 | 27.0 | 29.5 | 31.5 | 33.5 | | |
| 25 | 25.5 | 28.0 | 30.0 | 32.5 | 34.5 | 37.0 | | |
| 30 | 28.0 | 30.0 | 32.5 | 35.0 | 37.5 | 40.0 | | |
| 35 | 30.0 | 32.0 | 34.5 | 37.5 | 40.0 | 42.5 | | |
| 40 | 31.5 | 34.0 | 36.5 | 39.5 | 42.5 | 45.0 | | |
| 45 | 33.0 | 36.0 | 38.5 | 41.5 | 44.5 | 47.5 | | |
| 50 | | 37.5 | 40.0 | 43.5 | 46.5 | 49.5 | 52.5 | 55.5 |
| 55 | | | 42.0 | 45.0 | 48.5 | 51.5 | 54.5 | 57.5 |
| 60 | | | 42.5 | 46.5 | 50.0 | 53.5 | 56.5 | 59.5 |
| 65 | | | 45.0 | 48.0 | 51.5 | 55.0 | 58.5 | 61.5 |
| 70 | | | 46.0 | 49.5 | 53.0 | 56.5 | 60.0 | 63.5 |
| 75 | | | | 51.0 | 54.5 | 58.0 | 61.5 | 65.0 |
| 80 | | | | 52.0 | 56.0 | 59.5 | 63.0 | 67.0 |
| 85 | | | | 53.5 | 57.0 | 61.0 | 64.5 | 68.5 |
| 90 | | | | 54.5 | 58.5 | 62.5 | 66.0 | 70.0 |
| 95 | | | | | 59.5 | 63.5 | 67.5 | 71.5 |
| 100 | | | | | 61.0 | 65.0 | 69.0 | 72.5 |
| 105 | | | | | 62.0 | 66.0 | 70.0 | 74.0 |

Note 1: Purchase Class 6 poles in lengths of 35 feet, 40 feet, and 45 feet with Class 5 (19-inch minimum) tops.