Section 4165. Timber Piles

4165.01 GENERAL REQUIREMENTS.

A. Furnish timber piles fabricated from round sections of the trunks of trees trimmed, peeled, and with or without preservative treatment. Meet the requirements for the class of piles specified in the contract documents. Unless otherwise specified, timber piles shall meet the requirements of ASTM D 25.

B. Arrange inspection according to with Materials I.M. 462. Include the cost of inspection in the unit price bid for the material specified.

4165.02 CLASSIFICATION.

Piles are classified as follows according to their intended use:

A. Untreated Timber Piles.
May be used for falsework or temporary construction.

B. Treated Timber Foundation Piles.
Use for permanent foundations and permanent wood substructures above ground water level, unless treated timber trestle piles are specified in the contract documents.

C. Treated Timber Trestle Piles.
Use for permanent wood trestle. May be specified for piers and abutments of substructures, where the more restrictive straightness requirements of this class are desirable.

4165.03 UNTREATED TIMBER PILES.

Allowable materials included: White Oak, Burr Oak, Cypress, Tamarack, Douglas Fir, Southern Pine, or other wood which will satisfactorily withstand driving. Ensure the piles meet the following requirements:

A. General Quality.

1. Cut above the ground swell from live, sound, solid trees.

2. A gradual taper from point of butt measurement to tip.

3. Free from ring shakes, decay or rot, unsound knots, soft red heart, splits, and other defects which will impair their strength or durability.

4. Cypress piles showing "peck" more than a single spot equal to 3% of the area of the end will not be accepted.

5. Free from excessive checks at the tip which would cause splits in driving.

B. Knots.

1. No unsound knots.

2. Sound knots permitted provided the diameter of any single knot is no larger than 4 inches (100 mm) or one sixth the circumference of the pile at the point where it occurs, whichever is smaller. Cluster knots will be considered a single knot, and the sum of all knots in the cluster shall not be greater than the permitted size for a single knot.

3. The sum of diameters of all knots in any 1 foot (0.3 m) length of pile not to exceed 2 times the diameter of the allowable knot.

4. Diameters of knots measured in a plane perpendicular to the long axis of the pile.

C. Rate of Growth.

1. When measured at the tip, over the outer 50% of a radial line from the pith, no less than the number of annual rings and percentage of summerwood specified in Table 4165.03-1 for the respective species:

Table 4165.03-1: Summerwood

Species	Rings per Inch (25 mm)	Minimum
Douglas Fir	6 or More	33%
Douglas Fir	less than 6	50%
Southern Pine	6 or More	33%
Southern Pine	less than 6	50%
Other species	6	33%

2. When the number of annual rings varies along different radii, use the average of two or more measurements along representative radii.

D. Holes and Scars.

Permitted if:

- Less than 1/2 inch (13 mm) in average diameter,
- They do not penetrate more than 20% the diameter at the point where they occur, and
- The sum of the average diameters of all holes in any square foot (0.1 m^2) of pile surface does not exceed 1 1/2 inches (38 mm).
- Turpentine scars undamaged by decay or insect attack will be permitted provided the depth of the scar is not more than one fifth the diameter of the pile at the location of the scar.

E. Twist of Grain.

Free of twist in grain exceeding 50% the average circumference in a 20 foot (6 m) length.

F. Length.

Furnish in the length specified in the contract documents or as directed by the Engineer. A variation of 6 inches (150 mm) in length will be permitted. Average length for piles of any one lot at least equal to the specified length.

G. Straightness.

1. Free from sweep in two planes (double sweep).

2. Free of short crooks. In measuring for short crooks in any 5 foot (1.5 m) section, verify the distance from the center of the pile at the point of greatest deviation to a line stretched from the center of the pile above the bend to the center of the pile below the bend does not exceed 4% of the length of the bend, or a maximum of 2 1/2 inches (65 mm).

3. Sweep in one direction and in one plane: the center of the pile not to deviate from a straight line connecting the center of butt with the center of the tip by more than 1.0% of the length of the pile, or 4 inches (100 mm), whichever is greater, with a maximum deviation of 6 inches (150 m) for lengths over 50 feet (15 m).

4. Piles with sweep in two directions in the same plane (reverse sweep): may be accepted, provided the reversal is within the middle half of the length, and provided the deviation of the center of the pile from a straight line connecting the center of the butt with the center of the tip does not exceed 2 inches (50 mm).

5. Within 25% of the length of the pile, but not less than 10 feet (3 m) nearest the tip, the center of the pile not to deviate more than 1 inch (25 mm) from a line drawn from the center of the pile above this length to the center of the tip.

H. Dimensions.

1. At least 95% of the pieces of one length in any one shipment to comply with the dimensions in Table 4165.03-2 for the species of wood specified. The remaining 5% of the pieces may be deficient in diameter at tip or 3 feet (1 m) from butt by not more than 1/2 inch (13 mm).

Table 4165.03-2: Dimensions

	Min. Diameter 3 Feet (1 m) From Butt		
Length feet (m)	**Fir & Pine inches (mm)**	**Other Species inches (mm)**	**Min. Tip Diameter inches (mm)**
20 and shorter (6.0)	10[(a)] (250[(a)])	10[(a)] (250[(a)])	8 (200)
25 to 30 (7.5 to 9.5)	11 (275)	11 (275)	8 (200)
35 (10.5)	12 (300)	13 (325)	8 (200)

40 (12.0)	12 (300)	13 (325)	7 (175)
40 to 60 (13.5 to 18.0)	13 (325)	14 (350)	7 (175)
over 60 (18.0)	13 (325)	14 (350)	6 (150)
(a) Measured at the butt.			

2. The diameter of the piles, at the butt, not to exceed 20 inches (500 mm). When oversize piles are specified, verify the diameters 3 feet (1 m) from the butt and at the tip are 2 inches (50 mm) larger than the dimension listed above for the length of piles specified, unless other diameters are specified.

I. Quality of Work and Finish.

1. The tips and butts of all piles cut square with the axis of the piece.

2. All knots and limbs trimmed smoothly and cut flush with the surface of the piles.

3. On all species, all of the outer bark removed.

4. All piles marked plainly on the butt with the length in feet (meters).

J. Inspection and Acceptance.

1. Inspection and acceptance according to Materials I.M. 462. The inspector will make a thorough examination of each pile. Each pile will be judged without regard to decisions on others of the same lot. Piles too muddied for ready examination will be rejected. Piles turned over as inspected. The producer is to furnish, at no additional cost, the necessary tools and labor to turn piles.

2. The diameter of tip and butt will be determined by measuring the circumference of each and dividing by 3.14 respectively.

3. If the piles indicate there is a possibility of deterioration, the inspector may require that each pile be re-cut on both butt and tip, no less than 2 inches (50 mm) from the original end, to provide a freshly cut section for examination. The appearance of any incipient decay on a fresh section is sufficient cause for rejection of the pile.

4165.04 TREATED TIMBER FOUNDATION PILES.

Meet the requirements for untreated timber piles, Article 4165.03, and the following additional requirements:

A. Species.
Either Southern Pine or Douglas Fir (coast region).

B. Peeling.

1. Peel all piles by removing all rough bark and at least 80% of the inner bark.

2. Ensure no strip of inner bark remaining on the pile is over 3/4 inch (20 mm) wide or over 8 inches (200 mm) long.

3. Verify there is at least 1 inch (25 mm) of clean wood surface between any two such strips.

4. Verity at least 80% of the surface of any circumference is clean wood.

C. Sapwood Requirement.

1. **Douglas Fir piles:** no less than a 3/4 inch (20 mm) ring of sapwood at the butt end

2. **Southern Pine piles:** no less than a 2 inch (50 mm) ring of sapwood at the butt end.

D. Preservative Treatment.
Creosote, pentachlorophenol, or copper naphthenate treatment complying with Section 4161. Ring shakes, checks, water bursts, or similar defects which develop during the treating process, will be considered cause for rejection.

E. Inspection and Acceptance.
According to Materials I.M. 462.

4165.05 TREATED TIMBER TRESTLE PILES.
Meet the requirements for treated timber foundation piles, Article 4165.04, for piles to be used in construction of permanent wood trestles, and when specified for piers or abutments with wood backing plank, except meet the following requirements for the straightness of pieces:

A. Free of sweep in two directions in one plane (reverse sweep) and in two planes (double sweep).

B. Free of short crooks. In measuring short crooks, verify the distance from the center of the pile at the point of greatest deviation to a line stretched from the center of the pile above the bend to the center of the pile below the bend does not exceed 4% of the length of the bend, or a maximum of 2 inches (50 mm).

C. In sweep in one direction in one plane, verify the center of the pile does not deviate from a straight line connecting the center of the tip with the center of the butt by more than 3 inches (75 mm) for lengths 30 feet (9 m) and less, and by more than 0.8% of the length of the piles for lengths over 30 feet (9 m), with a maximum of 5 inches (125 mm) for lengths over 50 feet (15 m). Within 25% of the length of the pile, but no less than 10 feet (3 m) nearest the tip, verify the center of the pile does not deviate more than 1 inch (25 mm) from a line drawn from the center of the pile above this length to the center of the tip.