



Designation: D 1760 – 01

Standard Specification for Pressure Treatment of Timber Products¹

This standard is issued under the fixed designation D 1760; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This specification covers treatment of timber products by pressure processes in closed vessels with preservative materials and solutions.

1.2 This specification is divided into two general sections. Sections 1-9 cover requirements relating to all species and commodities, while Tables 1-7 show requirements relating to specific species and commodities. The purchaser should note that these individual requirements vary widely and, consequently, great care must be used in applying them in specific instances.

1.3 The values stated in inch-pound units are to be considered as standard.

2. Referenced Documents

2.1 ASTM Standards:

- D 347 Tables for Volume and Specific Gravity Correction for Creosote and Coal Tar²
- D 390 Specification for Coal-Tar Creosote for the Preservative Treatment of Piles, Poles, and Timbers for Marine, Land, and Fresh Water Use²
- D 391 Specification for Creosote-Coal Tar Solution²
- D 1272 Specification for Pentachlorophenol²
- D 1325 Specification for Ammoniacal Copper Arsenate and Ammoniacal Copper Zinc Arsenate²
- D 1326 Methods for Chemical Analysis of Ammoniacal Copper Arsenate and Ammoniacal Copper Zinc Arsenate²
- D 1624 Specification for Acid Copper Chromate²
- D 1625 Specification for Chromated Copper Arsenate²
- D 1627 Methods for Chemical Analysis of Acid Copper Chromate²
- D 1628 Test Methods for Chemical Analysis of Chromated Copper Arsenate²
- D 1858 Specification for Creosote-Petroleum Solution²

- D 1860 Test Method for Moisture and Creosote-Type Preservative in Wood²
- D 2085 Test Method for Determining Chloride Used in Calculating Pentachlorophenol in Solutions or Wood (Lime Ignition Method)²
- D 2604 Specification for High-Boiling Hydrocarbon Solvent for Preparing Oil-Borne Preservative Solutions²
- D 2605 Specification for Volatile Petroleum Solvent (LPG) for Preparing Pentachlorophenol Solutions²
- D 3225 Specification for Low-Boiling Hydrocarbon Solvent for Oil-Borne Preservatives²
- D 5584 Test Methods for Chemical Analysis of Ammoniacal Copper Quat Type B (ACQ-B)²
- D 5653 Specification for Copper bis (Dimethyldithiocarbamate)²
- D 5654 Specification for Ammoniacal Copper Quat Type B (ACQ-B)²
- D 5655 Test Method for Analysis of Copper Dimethyldithiocarbamate (CDDC) Treated Wood by Colorimetry²

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

- 3.1.1 *preservative materials and solutions*—materials that when injected into wood protect it from the destructive action of fungi, insects, and marine borers.
- 3.1.2 *timber products*—include round, sawn, and otherwise fabricated materials of various species. Examples are utility poles, piles, posts, crossties, lumber, timbers, glued laminated timbers, plywood, and so forth.

ALL TIMBER PRODUCTS

4. General Requirements

4.1 The following requirements, except as modified, or supplemented by Tables 1-7, for the various species and types of material, apply to each of the treating processes and to all species and types of material. If these requirements are to be otherwise modified to meet special conditions, complete detailed instructions shall be given by the purchaser or specifier.

4.1.1 Maximum time duration (total elapsed time of a treating phase), maximum temperature, and maximum pressure limits shall not be exceeded. A phase shall begin when a change in conditions within the cylinder is initiated and shall end when either new conditions are imposed, or the cylinder is emptied of preservative.

¹ This specification is under the jurisdiction of ASTM Committee D07 on Wood and is the direct responsibility of Subcommittee D07.06 on Treatments for Wood Products.

Current edition approved April 10, 2001. Published June 2001. Originally published as D 1760 – 60. Last previous edition D 1760 – 96.

Some requirements in this specification are similar to those in the Commodities Standards of the American Wood-Preservers' Association for treatment of timber products by pressure processes in closed vessels with preservative materials and solutions. Acknowledgment is made to the American Wood-Preservers' Association for its development of subject matter used in this specification.

² *Annual Book of ASTM Standards*, Vol 04.10.

TABLE 1 Treatment of Lumber, Timbers, Bridge Ties, and Mine Ties by Pressure Processes

	Southern Pine and Ponderosa Pine			Hemfir, ^A Pacific Coast Douglas Fir, ^B Western Hemlock and Western Larch ^C		
Conditioning	air seasoning, kiln drying, Boulton drying, heating in preservative or a combination			air seasoning, kiln drying, Boulton drying, steaming (water-borne treatments only), heating in preservative or a combination		
Steaming: ^D						
Temperature, max, °F (°C)	245 (120)			240 (117)		
Duration, max, h	17			6		
Vacuum, min, in. (mm) at sea level	22 (558.8)			22 (558.8)		
Heating in preservative:						
Temperature, max, °F (°C)	220 (104)			210 (99)		
Duration, max, h	optional			6 if seasoned, optional if green		
Incising	not required			required		
Treatment:						
Pressure, psig (kPa)						
min	75 (517)			50 (345)		
max	200 (1379)			150 (1034)		
Expansion bath: temperature, max, °F (°C)	220 (104)			220 (104)		
Final steaming:						
Temperature, max, °F (°C)	240 (117) (not permitted for service in coastal waters)			240 (117) (not permitted for service in coastal waters)		
Duration, max, h	2			2		
	<i>Above Ground</i>	<i>Ground Contact</i>	<i>Coastal Waters</i>	<i>Above Ground</i>	<i>Ground Contact</i>	<i>Coastal Waters</i>
Results of treatment:						
Retention, min, lb/ft ³ (kg/m ³): (sampling zone for assay 0 to 0.60 in. (0 to 15.2 mm) from surface):						
Creosote and creosote solutions—by assay:						
Creosote	6 (96)	8 (128)	20 (320) full cell	8 (128)	10 (160)	20 (320) full cell
Creosote-coal tar solution	6 (96)	8 (128)	20 (320) full cell	8 (128)	10 (160)	20 (320) full cell
Creosote-petroleum solution	6 (96)	8 (128)	not recommended	8 (128)	10 (160)	not recommended
Oil-borne preservatives—by assay						
Pentachlorophenol using Specifications D 2604, D 2605, or D 3225 solvents	0.30 (4.81)	0.40 (6.4)	not recommended	0.40 (6.4)	0.50 (8.0)	not recommended
Water-borne preservatives—by assay:						
ACC	0.25 (4.0)	0.50 (8.0)	not recommended	0.25 (4.0)	0.50 (8.0)	not recommended
ACA and ACZA	0.25 (4.0)	0.40 (6.4)	2.50 (40.0)	0.25 (4.0)	0.40 (6.4)	2.50 (40.0) ^E
ACQ-Type B	0.25 (4.0)	0.40 (6.4)	not recommended	0.25 (4.0)	0.40 (6.4)	not recommended
CCA, Types A and C	0.25 (4.0)	0.40 (6.4)	2.50 (40.0)	0.25 (4.0)	0.40 (6.4)	not recommended
CDDC ^H (as copper metal)	0.10 (1.6)	0.20 (3.2)	not recommended			
Penetration	2.5 in. (64 mm) unless 85 % of sapwood			0.40 in. (10.2 mm) and 90 % of sapwood less than 5 in. (127 mm) in thickness, 0.50 in. (12.7 mm) and 90 % of sapwood thicker than 5 in. and for coastal waters service		
Determination of penetration	^F			A borer core shall be taken from the incised faces of 20 pieces in each charge. If 80 % of the borings meet the penetration requirements the charge shall be accepted. Borings not meeting the penetration requirements shall show evidence of preservative penetration.		
	Jack Pine, Lodgepole Pine, and Red Pine					
Conditioning	air seasoning, kiln drying, Boulton drying, steaming (water-borne treatments or ice-coated or frozen materials with oil treatments only), heating in the preservative or a combination					
Steaming: ^G						
Temperature, max, °F (°C)	240 (117)					
Duration, max, h	6					
Vacuum, min, in. (mm) at sea level	22 (558.8)					
Heating in preservative:						
Temperature, max, °F (°C)	210 (99)					
Duration, max, h	6 h seasoned, green optional					
Incising	required					

TABLE 1 *Continued*

Jack Pine, Lodgepole Pine, and Red Pine	
Treatment:	
Pressure, psig (kPa):	
min	75 (517)
max	175 (1207)
Expansion bath: temperature, max,	
°F (°C)	220 (104)
Final steaming ^C :	
Temperature, max, °F (°C)	240 (117) (not permitted for service in coastal waters)
Duration, max, h	2

	Jack Pine, Lodgepole Pine, and Red Pine		
	<i>Above Ground</i>	<i>Ground Contact</i>	<i>Coastal Waters</i>
Results of treatment:			
Retention, min, lb/ft ³ (kg/m ³) (sampling zone for assay 0 to 0.60 in. (0 to 15.2 mm) from surface):			
Creosote and creosote solutions—by assay:			
Creosote	6 (96)	8 (128)	refusal
Creosote-coal tar solution	6 (96)	8 (128)	refusal
Creosote-petroleum solution	6 (96)	8 (128)	not recommended
Oil-borne preservatives—by assay:			
Pentachlorophenol using Specifications D 2604, D 2605, or D 3225 solvents	0.30 (4.81)	0.40 (6.4)	not recommended
Water-borne preservatives—by assay:			
ACC	0.25 (4.0)	0.50 (8.0)	not recommended
ACA and ACZA	0.25 (4.0)	0.40 (6.4)	not recommended
CCA, Types A and C	0.25 (4.0)	0.40 (6.4)	not recommended

Penetration	Less than 5 in. (127 mm) thick, 0.40 (10.2 mm), and 90 % of sapwood. 5 in. thick and thicker and coastal water service, 0.50 in. (12.7 mm) and 90 % of sapwood.
Determination of penetration	A borer core shall be taken from each of 20 pieces in each charge. If 80 % of the borings meet the penetration requirement the charge shall be accepted.

	Northern White Pine, Sugar Pine, and Western White Pine	Redwood
	Conditioning	air seasoning, kiln drying, Boulton drying, steaming (water-borne treatments and ice-coated or frozen material with oil treatments only), heating in preservative or a combination
Steaming: ^D		
Temperature, max, °F (°C)	240 (117)	240 (117)
Duration, max, h	6	4.5
Vacuum, min, in. (mm) at sea level	22 (558.8)	22 (558.8)
Heating in preservative:		
Temperature, max, °F (°C)	210 (99)	210 (99)
Duration, max, h	6 h seasoned, green optional required	6 h seasoned, green optional required
Incising		
Treatment:		
Pressure, psig (kPa):		
min	50 (345)	50 (345)
max	150 (1034)	125 (861)
Expansion bath: temperature, max, °F (°C)	220 (104)	220 (104)
Final steaming:		
Temperature, max, °F (°C)	240 (117) (not permitted for service in coastal waters)	240 (117) (not permitted for service in coastal waters)
Duration, max, h	1	1
	<i>Above Ground</i>	<i>Above Ground</i>
	<i>Ground Contact</i>	<i>Ground Contact</i>
	<i>Coastal Waters</i>	<i>Coastal Waters</i>

Results of treatment:

Retention, min, lb/ft³ (kg.m³) (sampling zone for assay 0 to 0.60 in. (0 to 15.2 mm) from surface):

Creosote and creosote solutions—by assay:

TABLE 1 Continued

	Above Ground	Ground Contact	Coastal Waters	Above Ground	Ground Contact	Coastal Waters
Creosote	6 (96)	8 (128)	refusal	8 (128)	10 (160)	20 (320) full cell
Creosote-coal tar solution	6 (96)	8 (128)	refusal	8 (128)	10 (160)	20 (320) full cell
Creosote-petroleum solution	6 (96)	8 (128)	not recommended	8 (128)	10 (160)	not recommended
	Northern White Pine, Sugar Pine, and Western White Pine			Redwood		
	Above Ground	Ground Contact	Coastal Waters	Above Ground	Ground Contact	Coastal Waters
Oil-borne preservatives—by assay: Pentachlorophenol using Specifications D 2604, D 2605, or D 3225 solvents	0.30 (4.81)	0.40 (6.4)	not recommended	0.60 (9.6)	0.50 (8.0)	not recommended
Water-borne preservatives—by assay: ACC	0.25 (4.0)	0.50 (8.0)	not recommended	0.25 (4.0)	0.50 (8.0)	not recommended
ACA and ACZA	0.25 (4.0)	0.40 (6.4)	not recommended	0.25 (4.0)	0.40 (6.4)	not recommended
CCA, Types A and C	0.25 (4.0)	0.40 (6.4)	not recommended	0.25 (4.0)	0.40 (6.4)	not recommended
Penetration	Less than 5 in. (127 mm) thick, 0.40 (6.4 mm) and 90 % of sapwood. 5 in. and thicker and for service in coastal waters, 0.50 in. (8.0 mm) and 90 % of sapwood			Less than 5 in. (127 mm) thick, 0.40 (6.4 mm), and 90 % sapwood. 5 in. and thicker and coastal waters service, 0.50 (8.0 mm) and 90 % of sapwood		
Determination of penetration	F			A borer core shall be taken from each of 20 pieces in each charge. If 80 % of the borings meet the penetration requirement, the charge shall be accepted. Borings not meeting the penetration requirements shall show evidence of preservative penetration.		
	Black Gum and Red Gum			Oak		
Conditioning	air seasoning, kiln drying, Boulton drying, steaming, heating in preservative or a combination			air seasoning, kiln drying, Boulton drying, heating in preservative or a combination		
Steaming: ^D Temperature, max, °F (°C)	240 (117)			not permitted		
Duration, max, h	6					
Vacuum, min, in. (mm) at sea level	22 (558.8)					
Heating in preservative: Temperature, max, °F (°C)	220 (104)			220 (104)		
Duration, max, h	optional			optional		
Incising Treatment: Pressure, psig (kPa): min	125 (861)			125 (861)		
max	200 (1379)			250 (1724)		
Expansion bath: temperature, max, °F (°C)	220 (104)			220 (104)		
Final steaming: Temperature, max, °F (°C)	240 (117) (not permitted for service in coastal waters)			240 (117) (not permitted for service in coastal waters)		
Duration, max, h	1			1		
	Above Ground	Ground Contact	Coastal Waters	Above Ground	Ground Contact	Coastal Waters
Results of treatment: Retention, min, lb/ft ³ (kg/m ³) (by gage): Creosote and creosote solutions: Creosote	6 (96)	8 (128)	refusal	6 (96)	7 (112)	refusal min 10 (160)
Creosote-coal tar solution	6 (96)	8 (128)	12 (192) minimum	6 (96)	7 (112)	refusal min 10 (160)
Creosote-petroleum solution	6 (96)	8 (128)	not recommended	6 (96)	7 (112)	not recommended
Oil-borne preservatives: Pentachlorophenol using Specifications D 2604, D 2605, or D 3225 solvents	0.30 (4.81)	0.40 (6.4)	not recommended	0.30 (4.81)	0.40 (6.4)	not recommended
Water-borne preservatives: ACC	0.25 (4.0)	0.50 (8.0)	not recommended	0.25 (4.0)	0.50 (8.0)	not recommended
ACA and ACZA	0.25 (4.0)	0.40 (6.4)	not recommended	0.25 (4.0)	0.40 (6.4)	not recommended
CCA, Types A and C	0.25 (4.0)	0.40 (6.4)	not recommended	0.25 (4.0)	0.40 (6.4)	not recommended

TABLE 1 Continued

Penetration	1.5 in. (38 mm) unless 85 % of sapwood	White oaks, 90 % of sapwood. Red oaks, 65 % of annual rings to center of cross section. Charges of recalcitrant wood with less penetration may be accepted if the wood is properly conditioned before treatment and if treatment is continued to refusal.
Determination of penetration	A,B,C,D,E,F,G,H,I	F

^A The species grouping, Hemfir, includes Western hemlock (*Tsuga heterophylla*), California red fir (*Abies magnifica*), grand fir (*Abies grandis*), noble fir (*Abies procera*), Pacific silver fir (*Abies amabilis*), and white fir (*Abies concolor*).

^B Pacific Coast Douglas fir includes Douglas fir from west of the crest of the Cascade Mountains in Oregon, Washington, and Northern California and west of the crest of the Sierra Nevada Mountains in the rest of California. Interior Douglas fir is Douglas fir grown anywhere else.

^C Interior Douglas fir and Western larch are not suitable species to be used for lumber or timbers in coastal waters.

^D Steam-conditioning southern pine, ponderosa pine, red pine, or black or red gum lumber before treatment with ACC or CCA preservatives is prohibited except when the lumber is ice-coated or frozen.

^E Retentions apply to red oak only. White oak of all sizes shall be treated to refusal.

^F A borer core shall be taken from each of 20 pieces in the charge. If 80 % of the cores meet the penetration requirements, the charge shall be accepted. Borings not meeting the penetration requirements shall show evidence of preservative penetration.

^G This retention applies to Pacific Coast Douglas Fir and is not recommended for Hemfir, Western Hemlock, or Western Larch.

^H Treatment of Pacific Coast Douglas fir and Western larch with CCA, Type A or C, shall only be valid when the material is chosen from permeable wood selected by treatment trials.

^I Southern pine only.

TABLE 2 Treatment of Land and Fresh-Water Piles and Foundation Piles by Pressure Processes

	Southern Pine and Ponderosa Pine	Pacific Coast Douglas Fir ^{B,C}	Oak	Lodgepole Pine
Conditioning	air seasoning, kiln drying, steaming, heating in preservative, or a combination thereof	air seasoning, kiln drying, Boulton drying, heating in preservative, or a combination thereof	air seasoning, kiln drying, heating in preservative, or a combination thereof	air seasoning, kiln drying, steaming (for ice-coated or frozen piles only) Boulton drying, heating in preservative, or a combination thereof
Steaming:				
Temperature, max, °F (°C)	245 (120)	not permitted	not permitted	240 (117)
Duration, max, h	southern pine: 15 ^A ponderosa pine: 6			6
Vacuum, min, in. (mm) at sea level	22 (558.8)			22 (558.8)
Heating in preservative:				
Temperature, max, °F (°C)	220 (104)	seasoned 210°F (99 °C) and 6 h	220 (104)	220 (104)
Duration, max, h	optional	green or partially seasoned 220°F (104° C) and optional	optional	optional
Treatment:				
Pressure, psig (kPa)				
min	125 (861)	75 (517)	150 (1034)	100 (689)
max	200 (1379)	150 (1034)	200 (1379)	150 (1034)
Expansion bath: temperature, max, °F (°C)	220 (104)	220 (104)	not permitted	220 (104)
Final steaming:				
Temperature, max, °F (°C)	245 (120)	240 (117)	not permitted	24 (117)
Duration, max, h	3	3		3
Results of treatment:				
Number of borings per charge	20	20	20	20
Retention, min, lb/ft ³ (kg/m ³) (sampling zone for assay, in. (mm) from surface)	0 to 3.0 (0 to 76.2)	0 to 1.00 (0 to 25.4)	0 to 2.00 (0 to 50.8)	0 to 1.00 (0 to 25.4)
Creosote and creosote solutions:				
Creosote	12 (192)	17 (272)	6 (96)	17 (272)
Creosote-coal tar solution	12 (192)	17 (272)	6 (96)	17 (272)
Creosote-petroleum solution	12 (192)	17 (272)	6 (96)	17 (272)
Oil-borne preservatives:				
Pentachlorophenol using Specification D 2604 solvent	0.60 (9.6)	0.85 (13.6)	0.30 (4.81)	0.85 (13.6)
Water-borne preservatives:				
ACA and ACZA	0.80 (12.8)	1.00 (16.0)	not recommended	1.00 (16.0)
CCA, Types A and C	0.80 (12.8)	1.00 (16.0)	not recommended	1.00 (16.0)
Penetration	3.5 in. (89 mm) unless 90 % of sapwood ^D	0.75 in. (19 mm) and 85 % of sapwood unless 1.60 in. (41 mm) ^D	100 % of sapwood	0.75 (19 mm) and 85 % of sapwood unless 1.60 in. (41 mm)

TABLE 2 *Continued*

	Southern Pine and Ponderosa Pine	Pacific Coast Douglas Fir ^{B,C}	Oak	Lodgepole Pine
Determination of penetration	A borer core shall be taken midway between the butt and the top of each pile in the charge. Only the piles that meet the penetration requirements shall be accepted.	A borer core shall be taken midway between the butt and the top of each pile in the charge. Only the piles that meet the penetration requirement shall be accepted.	A borer core shall be taken midway between the butt and the top of each pile in the charge. Only the piles that meet the penetration requirement shall be accepted.	A borer core shall be taken midway between the butt and the top of each pile in the charge. Only the piles that meet the penetration requirement shall be accepted.
	Red Pine	Western Larch	Jack Pine	
Conditioning	air seasoning, kiln drying, steaming (ice-coated or frozen piles only), heating in preservative, or a combination thereof	air seasoning, kiln drying, Boulton drying, heating in preservative, or a combination thereof	air seasoning, kiln drying, steaming (ice-coated or frozen piles only), heating in preservative, or a combination thereof	
Steaming:				
Temperature, max, °F (°C)	240 (117)	not permitted	240 (117)	
Duration, max, h	6		6	
Vacuum: min, in. (mm) at sea level	22 (558.8)		22 (558.8)	
Heating in preservative:				
Temperature, max, °F (°C)	220 (104)	seasoned 210°F (99 °C) and 6 h	220 (104)	
Duration, max, h	optional	partially seasoned or green 220°F (104 °C) and optional	optional	
Treatment:				
Pressure, psig (kPa)				
min	100 (689)	75 (517)	100 (689)	
max	150 (1034)	150 (1034)	150 (1034)	
Expansion bath: temperature, max, °F (°C)	220 (104)	220 (104)	220 (104)	
Final steaming:				
Temperature, max, °F (°C)	240 (117)	240 (117)	240 (117)	
Duration, max, h	3	0.5	3	
Results of treatment:				
Number of borings per charge	20 0 to 2.00 (0 to 50.8)	20 0 to 1.00 (0 to 25.4)	20 0 to 2.00 (0 to 50.8)	
Retention, min, lb/ft ³ (kg/m ³) (sampling zone for assay, in. (mm) from surface)				
Creosote and creosote solutions— by assay:				
Creosote	12 (192)	17 (272)	12 (192)	
Creosote-coal tar solution	12 (192)	17 (272)	12 (192)	
Creosote-petroleum solution	12 (192)	17 (272)	12 (192)	
Oil-borne preservatives—by assay:				
Pentachlorophenol using Specification D 2604 solvent	0.60 (9.6)	0.85 (13.6)	0.60 (9.6)	
Water-borne preservatives—by assay:				
ACA and ACZA	0.80 (12.8)	1.00 (16.0)	0.80 (12.8)	
CCA, Types A and C	0.80 (12.8)	1.00 (16.0)	0.80 (12.8)	
Penetration	2.5 (64 mm) in. unless 85 % of sapwood	0.75 (19 mm) and 85 % of sapwood unless 1.60 in. (41 mm)	1.50 (38 mm) in. unless 85 % of sapwood	
Determination of penetration	A borer core shall be taken midway between the butt and top of each pile in the charge. Only the piles that meet the penetration requirements shall be accepted.	^{A,B,C,D,E}	^E	

^A Piles shall be steamed at 240 to 245°F for not more than 1 h/in. of the average midpoint diameter of the piles in the charge. Total steam conditioning time shall include all steaming time during which the temperature exceeds 200°F.

^B Pacific Coast Douglas fir is Douglas fir grown west of the crest of the Cascade Mountains in Oregon, Washington, and Northern California and west of the crest of the Sierra Nevada Mountains in the rest of California. Interior Douglas fir is Douglas fir grown elsewhere.

^C Treatment of Pacific Coast Douglas fir and Western larch with CCA, Type A or C, shall only be valid when the material is chosen from permeable wood selected by treatment trials.

^D Effective penetration must be continuous with both earlywood and latewood in each ring penetrated. Certain grain configurations or defects may make it difficult to determine actual depth of penetration in a core and shall be excluded from constituting a skip. These defects include but are not limited to pitch, pitch pockets, ingrown bark, and knots. A core of this type shall be disregarded and a new core taken from another location on the same member.

^E A borer core shall be taken midway between the butt and the top from each pile in the charge. Only the piles that meet the penetration requirement shall be accepted.