UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 31 62 19.13

TIMBER MARINE PILES

11/16, CHG 2: 05/22

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USACE / NAVFAC / AFCEC / NASA	**UFGS-31 62 19.13 (November 2016)**
	Change 2 - 05/22

Preparing Activity: NAVFAC	**Superseding**
	UFGS-31 62 19.13 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 31 62 19.13

TIMBER MARINE PILES
11/16, CHG 2: 05/22

****
NOTE: This guide specification covers the requirements for furnishing all plant, labor, materials, and equipment, except material and equipment specified to be furnished by the Government, and for performing all operations in connection with the installation of round (treated) (untreated) (treated and untreated) timber piles and the testing of such piles for waterfront and other marine type structures as directed in accordance with this section of the specifications and the applicable drawings.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

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NOTE: Requirements for materials and procedures for special or unusual design should be added as necessary.
****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA A3	(2015) Standard Method for Determining Penetration of Preservatives and Fire Retardants
AWPA M2	(2019) Standard for the Inspection of Preservative Treated Wood Products for Industrial Use
AWPA M4	(2023) Standard for the Care of Preservative-Treated Wood Products
AWPA M6	(2013) Brands Used on Preservative Treated Materials
AWPA P1/P13	(2019) Standard for Creosote Preservative
AWPA P2	(2019) Standard for Creosote Solutions
AWPA P5	(2015) Standard for Waterborne Preservatives
AWPA P34	(2014) Standard for Copper Naphthenate, Waterbone (CuN-W)
AWPA T1	(2023) Use Category System: Processing and Treatment Standard
AWPA U1	(2023) Use Category System: User

	Specification for Treated Wood

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	(2021) Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A1011/A1011M	(2023) Standard Specification for Steel Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
ASTM A1023/A1023M	(2021) Standard Specification for Stranded Carbon Steel Wire Ropes for General Purposes
ASTM D25	(2012; R 2017) Standard Specification for Round Timber Piles
ASTM D1143/D1143M	(2007; R 2013) Piles Under Static Axial Compressive Load
ASTM D5643/D5643M	(2012) Standard Specification for Coal Tar Roof Cement, Asbestos Free

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FS RR-W-410	(2022; Rev J) Wire Rope and Strand

WESTERN WOOD PRESERVERS INSTITUTE (WWPI)

WWPI Mgt Practices	(1996; R 2011) Best Management Practices for the Use of Treated Wood in Aquatic and Wetland Environments

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or

complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Piles; G[, [_____]]

Pile Driving Equipment; G[, [_____]]

Submit complete descriptions of pile driving equipment, including hammers, leads, driving helmets, cushion blocks, driving blocks, collars, extractors, and other appurtenances for approval prior to commencement of work.

[Pile Caps; G[, [_____]]

][Pile Shoes; G[, [_____]]

][Jetting Equipment and Method; G[, [_____]]

][Spudding Equipment; G[, [_____]]

][Predrilling Equipment; G[, [_____]]

The Contractor must provide the Contracting Officer's Representative (COR) with the predrilling method and size.

][SD-04 Samples

Test Piles; G[, [_____]]

If approved after test completion, include properly located test piles in finished work.

] SD-06 Test Reports

[Load Tests; G[, [_____]]

Test data and results as specified in paragraph LOAD TESTS.

] Preservative Treatment - Timber Marine Piles; G[, [_____]]

The Contractor must provide the Contracting Officer's Representative (COR) with the inspection report of an independent inspection agency, approved by the Contracting Officer, that offered products comply with applicable AWPA standards.

Delivery Inspection List; G[, [_____]]

SD-07 Certificates

SDS and CIS; G[, [_____]]

Pesticide Applicator Company Self-Certification; G[, [_____]]

Best Management Practices (BMPs); G[, [_____]]

SD-11 Closeout Submittals

Pile Driving Records; G[, [_____]]

Submit pile driving records within 15 calendar days after completion of driving.

As-Driven Pile Survey; G[, [_____]]

1.3 DELIVERY, STORAGE, AND HANDLING

Handle and store piles in accordance with AWPA M4. Follow precautions identified in SDS or CIS provided by the supplier of treated wood products. Special care must be taken in supporting piles to prevent the induction of excessive bending stresses in the piles. Piles must be carefully handled without dropping, breaking of outer fibers, and penetrating the surface with tools. Peaveys, cant hooks, pikes, and other pointed tools must not be used in handling treated piles.

1.4 QUALITY ASSURANCE

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NOTE: Do not use untreated piling except for fender piles where an analysis of pile maintenance and replacement records clearly justifies its use or where plastic covered piling is specified. Special care in handling and frequent inspections of installed plastic-covered piles are required to ensure that no exposure of the untreated wood occurs.

****

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NOTE: References listed in article REFERENCES, are intended for general references only. Consult with appropriate environmental office for possible local regulations or policies that restrict either the use of treated wood in aquatic environments or the eventual disposal of treated piles. If applicable, the specifier should add those regulatory requirements.

****

1.4.1 Preservative Treatment - Timber Marine Piles

The Contractor must be responsible for the quality of treated wood products. The Contractor must provide the Contracting Officer's Representative (COR) with the inspection report of an independent inspection agency, approved by the Contracting Officer, certifying that the offered products comply with applicable AWPA standards. Identify treatment on each piece by the quality mark of an agency accredited by the Board of Review of the American Lumber Standard Committee. Inspect all preservative-treated wood visually to ensure there are no excessive residual materials or preservative deposits. Material must be clean and dry or it will be rejected because of environmental concerns.

1.4.2 SDS and CIS

Provide Safety Data Sheets (SDS) and Consumer Information Sheets (CIS) associated with timber pile preservative treatment. Contractor must comply with all safety precautions indicated on the SDS and CIS.

1.4.3 Delivery Inspection List

Field inspect and submit a verification list of each treated timber pile indicating the wording and lettering of the quality control markings, the species and the condition of the wood. Do not incorporate piles damaged in transport from plant to site. Inspect all preservative-treated piles, visually to ensure there are no excessive residual materials or preservative deposits. Material must be clean and dry or it will be rejected due to environmental concerns.

****

NOTE: Consult with appropriate environmental office for possible local regulations or policies that restrict pile installation or the use of preservative products at the project location.

****

[1.4.4 Regulatory Requirements

[_____].

]1.4.5 Pesticide Applicator Company Self-Certification

Provide the Contracting Officer, a statement signed by the responsible site supervisor or higher company representative, certifying that the contractor will comply with all pesticide label instructions. The certification should identify by name all individuals (applicators) who will be working with wood preserving pesticide products on site.

1.4.6 Best Management Practices (BMPs)

The producer of the treated wood products must provide certification that WWPI Mgt Practices for the use of Treated Wood in Aquatic and Wetland Environments were utilized including a written description and appropriate documentation of the BMPs utilized.

[As part of the BMPs for CCA treated pier timberwork, certification must be provided that documents that the Chromotropic Acid Test (AWPA A3- Methods for Determination of the Presence of Hexavalent Chromium in Treated Wood) was performed on the timber and adequate fixation of the CCA treatment has been achieved prior to installation.

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NOTE: For NAVFAC (Navy) projects, use and edit the appropriate following paragraph(s). Do not use for Army projects.

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[1.5 BASIS OF BIDS

****

NOTE: Choose one of the two following Basis of Bids methods.

****

****

NOTE: For lump sum bidding of piles. This option should be used in all projects except those where exact quantities cannot be practically determined prior to the actual work. Numbers of piles, pile capacity, pile locations, and tip and cutoff elevations must be clearly shown on the drawings.

****

[Base bids on the number, circumference, and length of piles from tip to cutoff as indicated. [Test piles must be [1.5] [_____] meter [5] [_____] feet longer than bid length piles. [Base bids on the number of load tests indicated or specified.] From the data obtained as a result of driving the test piles [and load tests] specified herein, the Government will determine and list for the Contractor the calculated minimum pile tip elevations, the driving resistance for piles, or both. The information will be given to the Contractor no later than 10 days after receipt of complete test pile data. The list must be used as the basis for ordering piles. The Contractor must not order production piles prior to receipt of the above information from the Government.] Should the total number of piles or number of each length vary from that specified as the basis for bidding, the contract price will be adjusted in accordance with Contract Clause entitled "Changes." Adjustment in contract price will not be made for cutting off piles, for any portion of a pile remaining above the cutoff elevation, disposal of piles, or for broken, damaged, or rejected piles.

]

****

NOTE: For unit price bidding of piles or NAVFAC LANT projects. Specify unit price bid items for piles only for projects where exact quantities

cannot be practically determined prior to the actual work. Lengths of piles must be determined as accurately as possible prior to bidding, since the unit price per meter foot of the pile varies as the length increases or decreases.
****

****
NOTE: For NAVFAC PAC projects: Edit contract's price schedule for inclusion in Standard Form 1442, "Solicitation, Offer and Award" and "Schedule of Bid Items."
****

[For unit price bid, see SF 1442, "Solicitation, Offer and Award" and "Schedule of Bid Items."

] Payment will be at the contract unit price for furnishing labor, materials, tools, equipment, and incidentals required for furnishing and driving piles. Work includes furnishing and driving piles including [test piles] [load test] [jetting] [spudding] [predrilling], pile cutoff, redriving, and removal and replacement of damaged, misallocated, or otherwise rejected piles. Base bids on the number of piles with pile length from tip to cutoff, as indicated, and on total length of piling from tip to cutoff, including test piles. Include in bid a unit price per [load test[s] and] unit length of piling based on the quantity stated. From data obtained as a result of driving the test piles [and load tests] specified herein, the Government will determine and list for the Contractor the calculated minimum pile tip elevations, the driving resistance for piles, or both. The information will be given to the Contractor no later than 10 calendar days after receipt of complete test pile data. The list must be used as the basis for ordering piles. The Contractor must not order production piles prior to receipt of the above information from the Government. If the Contracting Officer requires an increase or a decrease in the unit length of piles furnished and installed, the contract price will be adjusted in accordance with FAR 52.211-18 Variation in Estimated Quantity.[Adjustment in contract price will also be made for each increase or decrease in number of pile load tests.]

****
NOTE: For USACE (Army) projects, use and edit the appropriate following paragraph(s). Do not use for Navy projects.
****

][1.6 UNIT PRICES

****
NOTE: If Section 01 20 00 PRICE AND PAYMENT PROCEDURES is included in the project specifications, the paragraph UNIT PRICES should be deleted from this section and the remaining appropriately edited subparagraphs below should be inserted into Section 01 20 00 PRICE AND PAYMENT PROCEDURES.
****

1.6.1 Round Timber Piles, [Vertical] [Batter]

1.6.1.1 Payment

Payment for each acceptably driven pile will be made at the applicable contract unit price for each pile as determined by the length and type of pile specified or directed to be driven; this price includes all items incidental to furnishing and driving the piles, redriving uplifted piles, any required notching, the cutting off of all piles at the cutoff elevation, disposal of cutoffs [and the preservative treatment of the tops of treated piles which are headed] but exclusive of any capping of heads.

1.6.1.2 Measurement

Acceptably driven piles will be measured for payment based upon each pile.

1.6.1.3 Unit of Measure

Unit of measure: each.

[1.6.2 Test Piles

1.6.2.1 Payment

Payment will be made for test piles, driven as directed and not incorporated in the permanent work. Payment will be made for test piles incorporated in the permanent work.

1.6.2.2 Measurement

Test piles, driven as directed and not incorporated in the permanent work, will be measured for payment at twice the applicable contract unit price for a permanent pile of the same type and length. Test piles, incorporated in the permanent work, will be measured for payment at the contract unit price for permanent piles.

1.6.2.3 Unit of Measure

Unit of measure: each.

][1.6.3 Pile Load Tests

****

NOTE: The designer will specify the number of pile loading tests to be performed and the loading data.

****

1.6.3.1 Payment

Payment for each complete test load of a single pile will be made at the contract unit price for each pile load test. When a group of piles is required to be test loaded, payment for the load test will be made at the contract unit price for "Pile Load Test" for the first loaded pile of the group, plus 50 percent of this amount for each additional loaded pile in the group.

1.6.3.2 Measurement

Pile load test will be measured for payment based upon furnishing,

placing, and removing testing equipment and test loads.

1.6.3.3 Unit of Measure

Unit of measure: each.

][1.6.4 Pile Shoes

1.6.4.1 Payment

Payment will be made for furnishing all plant, labor, and materials for pile shoes and will be paid for at the contract unit price for each pile shoe.

1.6.4.2 Measurement

Pile shoes will be measured for payment based upon each pile shoe furnished.

1.6.4.3 Unit of Measure

Unit of measure: each.

][1.6.5 Pile Caps

1.6.5.1 Payment

Payment will be made for furnishing all plant, labor, and materials for pile caps and will be paid for at the contract unit price for each pile cap.

1.6.5.2 Measurement

Pile caps will be measured for payment based upon each pile cap furnished.

1.6.5.3 Unit of Measure

Unit of measure: each.

][1.6.6 Pulled Piles

1.6.6.1 Payment

Payment will be made for satisfactorily driven piles which are pulled at the direction of the Contracting Officer and found to be in good condition. Where piles are pulled at the direction of the Contracting Officer and found to be damaged, no payment will be made for originally furnishing and driving such piles nor for the operation of pulling, and damaged piles must be replaced by new piles for which payment will be made.

1.6.6.2 Measurement

Satisfactorily driven piles which are pulled at the direction of the Contracting Officer and found to be in good condition will be measured for payment at the applicable contract unit price for furnishing and driving the pile at its original position plus 50 percent of this amount to cover the cost of pulling. Pulled timber piles found to be sound and in a satisfactory condition by the Contracting Officer must be redriven and measured for payment at 50 percent of the applicable contract unit price

for furnishing and driving the pile. Where piles are pulled at the direction of the Contracting Officer and found to be damaged, no measurement for payment will be made for originally furnishing and driving such piles nor for the operation of pulling, and the damaged piles must be replaced by new piles which will be measured for payment at the applicable contract unit price for furnishing and driving the pile.

1.6.6.3 Unit of Measure

Unit of measure: each.

]]PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Piles

****
NOTE: For Bearing Piles specify the minimum butt circumference for a friction pile or specify the minimum tip circumference for an end-bearing pile. Clean-peeled piles should be specified where preservative treatment is required.
****

Provide Douglas fir, Southern pine, or Red pine [clean-peeled] [rough-peeled], [treated] [and] [untreated] piles in accordance with AWPA U1 Commodity Specification G and conforming to ASTM D25 and other requirements as specified. Piles must be in one piece for the length[s] [shown] [as determined from pile load tests]. Splices will not be permitted. Each treated pile must be branded by the producer, in accordance with AWPA M6. Pile circumferences must be as follows:

a. Bearing Piles: Minimum [butt circumference measured at 0.91 m 3 feet from the butt end] [tip circumference] must be [[_____] mm inches] [as indicated].

b. [Fender] [,] [and] [Cluster] [,] [and] [Dolphin] [_____] Piles: Minimum butt circumference measured at 0.91 m 3 feet from the butt end must be [[_____] mm inches] [_____].

2.1.2 Preservative Treatment

****
NOTE: Select preservative treatment of marine piles as follows (consult the nearest organizational Applied Biologist for specific requirements for specific locations):

Based on AWPA's Use Criteria System (UCS) wood and wood products exposed to salt or brackish water in U.S. Coastal Waters must fall under one of three Use Categories for Marine Use.

UC5A MARINE USE Northern Waters
UC5B MARINE USE Central Waters
UC5C MARINE USE Southern Waters

Use Category requirements are based on the presence

of specific marine organisms in the waters that require higher preservative loadings for control. Refer to AWPA's U1, Commodity Specification G to determine the approximate geographical location for each Use Category.

Recommended preservative treatment type (ACZA, CCA, and Creosote), minimum preservative penetration, and retention requirements must be as specified by AWPA U1, Commodity Specification G based on wood species and Use Category.

NOTE: Consult with appropriate environmental office for possible local regulations or policies that restrict the use of creosote at the project location.
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****
NOTE: In areas where limnoria, teredo or pholads are expected or known, pressure treated piles may be further protected by wrapping in plastic coatings. Load bearing piles not subject to excessive abrasion or severe impacts are particularly suited for this process.
****

****
NOTE: For fender piles, dolphin piles, and other piling requiring lateral load-carrying capacity, consideration should be given to increasing pile diameter because preservative pressure treatment tends to reduce lateral load-carrying capacity.
****

Treat piles based on Use Category and species in accordance with AWPA U1 and AWPA T1 to the retention and penetration for marine piling and produce in accordance with WWPI Mgt Practices. Piles preservative treatment must be [Creosote or creosote solution for marine piles in accordance with AWPA P1/P13 or AWPA P2, respectively] [Waterborne preservative for marine piles in accordance with AWPA P5 (ACZA - Ammoniacal Copper Zinc Arsenate, CCA - Chromated Copper Arsenate)] [Dual treatment of creosote or creosote solution plus waterborne preservative for marine piles in accordance with AWPA P1/P13 or AWPA P2, and AWPA P5].

2.1.3 Field Treatment

Piles must be field treated in accordance with AWPA M4. All cuts, holes and injuries such as holes from removal of spikes or nails which may penetrate the treated zone must be field treated with copper naphthenate conforming to AWPA P34 [and] [coal-tar roofing cement conforming to ASTM D5643/D5643M].

[2.1.4 Pile Shoes

****
NOTE: Pile shoes should be required only when extremely hard driving is required in upper strata for the penetration of such strata to reach the bearing stratum.

****

Pile Shoes must be a steel boot or welded-plate point shoe especially fabricated for pile driving and in accordance with ASTM A1011/A1011M. The product must be fabricated by a manufacturer regularly engaged in the manufacture of pile fittings. Welding procedures must be in accordance with a nationally recognized welding code. Provide size to fit pile tip. Fabricate boot type of 5 mm 3/16 inch carbon steel fully welded, with at least three straps, each with three 5 mm 3/16 inch nail holes. Fabricate welded-plate point type of four 5 mm 3/16 inch or 6 mm 1/4 inch steel plates, fully welded and sized to adequately cover full pointed area of pile; provide each plate with one 5 mm 3/16 inch or one 6 mm 1/4 inch nail hole. The length of the joints formed by the intersection of the sides must not be less than one half of the height of the shoe. Shoes must be cleaned and painted with at least one coat of paint. The color and paint must be the manufacturer's standard. [Shoes may be furnished without painted finish.] Provide on the point of [each pile] [each bearing pile] [each fender, cluster, and dolphin pile] [_____].

][2.1.5 Pile Caps

Marine pile caps must consist of [a permanently fixed coating of epoxy] [fiberglass or polyethylene conical caps permanently attached to the pile] [_____].

][2.1.6 Hardware

****

NOTE: Give special attention to corrosion protection of hardware used with timber preserved with water-borne salts. Specify protection ranging from simple coatings to changing of the hardware metals dependent upon the required use and critical features of the hardware. Hot-dip galvanized hardware and fasteners will usually suffice in such cases.

****

Pile hardware must consisting of bolts with necessary nuts and washers, timber connectors, drift pins, dowels, nails, screws, spikes, and other fastenings. Provide bolts with washers under nut and head. Bolts and nuts must conform to ASTM A307. Provide cast-iron ogee, malleable iron washers, or plate or cut washers where indicated. Provide bolts with washers under nut and head. Provide timber connectors and other metal fastenings of type and size indicated. Hot-dip galvanize all hardware in accordance with ASTM A123/A123M or ASTM A153/A153M, as applicable.

][2.1.7 Wire Rope and Fitting

Wire ropes must be in accordance with FS RR-W-410 [Type III, Class 2][Type III, Class 3][Type I, Class 2]. All wire ropes must be zinc coated in accordance with ASTM A1023/A1023M.[Provide staples of 10 mm 0.375 inch diameter zinc-coated steel at least 125 mm 5 inches long.][Provide clips or clamps of zinc-coated steel.]

]2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Inspection of Piles

The Contractor must provide the necessary facilities for the proper inspection of each pile. Piles to be preservative treated will be inspected prior to treatment. Piles will be inspected at the shipping point or at the work site if so decided. Pile inspection at the shipping point will not be performed for less than 100 piles in one locality. Piles with specified variations in characteristics must be placed in separate lots for inspection. Piles must be so marked or segregated into marked lots that there will be no possibility of error in assignment after they have been inspected. Piles damaged after inspection may be subsequently rejected if damage is deemed sufficient for rejection. All rejected piles must be removed as directed.

2.2.2 Inspection of the Preservative Treatment Process

Inspection of the preservative treatment process will be in accordance with AWPA M2. The Contractor must notify the Contracting Officer where preservative treatment will be done not less than 15 days prior to the start of the treatment and must provide the necessary facilities for the proper inspection of the treatment process. Allow the Contracting Officer unlimited access to the plant and inspection privileges for each facet of the treating process.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Pile Driving Equipment

Pile driving equipment must meet the following requirements.

3.1.1.1 Pile Driving Hammers

****
NOTE: If vibratory hammers should not be used, the references to vibratory hammers should be deleted from the text.
****

Pile driving hammers must be steam, air or diesel, single-action, double-acting, differential-acting [, or] [vibratory] [_____] type. [The use of vibratory hammers is dependent upon satisfactory driving and load testing of piles.] The size or capacity of hammers must be as recommended by the manufacturer for the pile weights and solid formation to be penetrated. The pile hammer must be of sufficient weight and energy to install the specified pile without damage into the soils [as indicated] [expected to be encountered]. The maximum driving energy of hammers must be [16,270] [20,330] joules [12,000] [15,000] foot-pounds for piles for any length. Test piles must be driven with the same size and type hammer, operating with the same effective energy and efficiency as that to be used in driving job piles. Diesel powered hammers must be operated at the rate recommended by the manufacturer throughout the entire driving period. Sufficient pressure must be maintained at the hammer so that:

a. For double-acting hammers, the number of blows per minute during and at the completion of driving of a pile is equal approximately to that

at which the hammer is rated;

b. For single-acting hammers, there is a full upward stroke of the ram; and,

c. For differential-type hammers, there is a slight rise of the hammer base during each upward stroke.

3.1.1.2 Leads

Leads are required and must be fixed at the top and adjustable at the bottom. Swinging leads [will] [will not] be permitted.

3.1.1.3 Driving Cap or Helmet and Cushion Block

Driving cap or helmet must be an approved design and must be capable of protecting pile heads, minimizing energy absorption, and transmitting hammer energy uniformly and consistently to piles. Place driving helmet or cap and cushion block combination between top of pile and the ram. Driving cap must fit snugly on the top of piles and must employ a cushion block to prevent impact damage to piles. The cushion block may be a solid or laminated softwood block with the grain parallel to the pile axis and enclosed in a close-fitting steel housing. The thickness of the block must be suitable for the length of pile to be driven and the character of subsurface material to be encountered. [Generally, thicker blocks are required for longer piles and softer subsurface material.] If block is damaged, split, highly compressed, charred or burned, or has become spongy or deteriorated, replace with new block. Under no circumstances will the use of small wood blocks, wood chips, rope, or other material permitting excessive loss of hammer energy be permitted.

3.1.1.4 Pile Collars

Collars or bands for protecting pile butts against splitting, brooming, and other damage while being driven must be of an approved design.

3.1.2 Pile Installation

Inspect piles when delivered and when in the leads immediately before driving. Cut piles at cutoff grade with pneumatic tools by sawing or other approved method. Where cutoff is below existing mudline elevation, complete excavation, sheeting and dewatering before pile is driven to cutoff elevation.

[3.1.2.1 Test Piles

****
NOTE: Insert the number of test piles required. Test pile locations should be shown on the drawings. The number of test piles is normally between 5 and 10 percent of the total number of piles required, dependent upon the magnitude of the project. Test piles are furnished longer than job piles to allow additional penetration if driving conditions dictate. Delete this paragraph if test piles are not required.
****

Provide [_____] test piles conforming to the same requirements as

specified for job piles. Drive test piles in the same manner as specified for job piles. Furnish test piles([1.5] [_____] m[5] [_____] feet) longer than length specified for job piles and drive the additional depth, if directed. Drive test piles in locations indicated or as directed. Record driving data as specified in paragraph entitled "Records." Confirmation of the assumed allowable working loads of single piles must be made by static loading and measuring [each] [_____] test pile[s] in the manner described below. Test piles indicated or directed to be driven in permanent locations may be incorporated into the work if, after satisfactory completion of the load test, they are approved for inclusion in the work by the Contracting Officer. Every facility must be provided by the Contractor for the Contracting Officer to inspect and measure the deflection or settlement of the pile under test. Furnishing of measuring equipment and making measurements of deflection or settlement will be the responsibility of the [Contracting Officer] [Contractor] [_____].

][3.1.2.2 Load Tests

****

NOTE: Insert the number of test piles to be load tested. The safe design capacity of a test pile as determined from the results of load test must be the lesser of the two values computed according to the following:

1. One-half the test load which causes a settlement of 0.03 mm per kN 0.01 inch per ton of test load; and

2. One-half the test load that causes a gross settlement of 25 mm one inch provided the load-settlement curve shows no sign of failure.

****

ARMY NOTE: The designer will specify the method of load testing and the specific pile driving formulas used for design.

****

Perform load tests on [_____] test piles in accordance with ASTM D1143/D1143M loading procedures, as modified herein. Perform load tests at locations shown, or as directed. Provide testing and measuring equipment, perform loading, and provide observation facilities for a registered professional engineer employed by the Contractor to inspect and record settlement and deflection of piles under test loads. Do not mobilize load test equipment until directed. Loading frames and equipment must be ready to place in operation as soon as a test pile has been driven. The loading equipment must be of sufficient capacity to apply a maximum load of not less than [_____] kN [_____] tons. The ultimate test load must be maintained for not less than [24] [_____] hours and then unloaded in accordance with ASTM D1143/D1143M.

]3.1.2.3 Driving Piles

[Drive job piles with same hammer, cushion, or cap block, and using the same operating conditions as test piles.]Piles must not be driven within 30 meters 100 feet of concrete which is less than 7 days old unless otherwise authorized. A complete and accurate record of the driving of piles must be compiled by the Contractor for submission to the Contracting Officer. When driving long piles of high slenderness ratio, special

precautions must be taken to ensure against overstressing and leading away from a plumb or true position. During driving, pile driving hammers must be operated at all times at the rate and conditions recommended by the hammer manufacturer. Each pile must be driven continuously and without interruption [to the [calculated] [indicated] tip elevation] [until the required depth of penetration and penetration rate per blow have been attained in accordance with the schedule that the Contracting Officer will prepare from the test pile driving [and test] data]. Deviation from this procedure will be permitted only in case the driving is stopped by causes which reasonably could not have been anticipated. The controlling penetration per blow will be determined by the Contracting Officer. Piles must be driven to the full penetration required where practicable to do so without damage to the piles. If found impracticable to drive any pile to the depth required, such pile must be cut off and abandoned or pulled as directed. Driven piles which have a penetration of less than [_____] meters [_____] feet [that specified for the following areas [_____]] and have not been driven to the established maximum penetration per blow are not satisfactory. Driving of piles beyond the point of refusal, as indicated by excessive bonding of the hammer or kicking of the pile, or a blow count of greater than twice the blow count required to produce the safe bearing capacity must not be attempted. Piles which have uplifted after driving must be redriven to grade after conclusion of driving in that general area. The maximum permissible penetration per blow for the last 20 blows will be established by the Contracting Officer. When the penetration per blow of any pile during the final blows exceeds that permitted or it is found that a pile is not of sufficient length to give the capacity specified, and the pile has been driven to its full depth, the Contractor must pull the pile, furnish, and drive a longer pile or take other corrective measures as directed by the Contracting Officer. The use of followers or splices must not be permitted. After driving is completed, all piles must be "headed" or cut off normal at the cutoff elevation. [Fender piles must have tops beveled outboard as indicated.] Pile heads at cutoff must be sound. Headed treated piles, including those to be capped with concrete, must be treated with copper naphthenate per AWPA M4. Piles driven in locations where they are constantly subject to water spray must be given this treatment immediately after they are cut off and before the cutoff surface has been wetted. Cutoffs must become the property of the Contractor and must be removed at his expense.

3.1.2.4 Tolerances in Driving Piles

Piles must be accurately placed in the correct location and alignments both laterally and longitudinally and to the vertical or batter lines as shown. At cutoff elevation, butts must be within([100] [_____] mm[4] [_____] inches) laterally of the location indicated. [Manipulation of piles is prohibited.] [Manipulation to move piles into position will be permitted only within the aforementioned tolerance to return the pile to the design location. [However, piles must not be manipulated more than 1.5 percent of the exposed length above the [ground] [mudline] surface.]] [[Fender] [,] [and] [Cluster] [,] [and] [Dolphin] [_____] Piles may be manipulated a maximum of 42 mm per m 0.50 inch per foot of pile length in a direction parallel to the pier face and 21 mm per m 0.25 inch per foot of pile length in a direction perpendicular to the pier face.] A variation of not more than 21 mm per m 0.25 inch per foot of pile length from the vertical for plumb piles or more than 42 mm per m 0.50 inch per foot of pile length from the required angle for batter piles will be permitted. The correct relative position of group piles must be maintained by the use of templates or by other approved means. [In addition to complying with the tolerances stated herein or otherwise specified, clear distance

between heads of piles and edges of caps must be not less than 125 mm 5 inches. With prior approval of the Contracting Officer, the Contractor may provide additional concrete and reinforcement to maintain the required minimum clear distance. Redesign of pile caps or additional work required due to improper location of piles will be the responsibility of the Contractor.] Inspect piles for heave. Piles must be driven to the depths [shown] [as directed]. Redrive heaved piles to the required tip elevation. Remove and replace with new piles those damaged, misplaced, driven below the design cutoff, or driven out of alignment, or provide additional piles, driven as directed at no additional cost to the Government.

3.1.2.5 Pile Driving Records

Keep a complete and accurate driving record of each pile driven. Indicate pile location, deviations from design location, diameter, original length, mudline elevation, tip elevation, cutoff elevation, penetration in blows per meter foot for entire length of penetration for test piles, penetration in blows per meter foot for the last 3 m 10 feet for job piles, hammer data including rate of operation, make, and size, and unusual pile behavior or circumstances experienced during driving such as redriving, heaving, weaving, obstructions, [jetting,] [spudding,] [predrilling,] and unanticipated interruptions. Preprinted forms for recording pile driving data are attached at the end of this section. Make pile driving records available to the Contracting Officer at the job site, a minimum of 24 hours after each day of pile driving. Include in the construction records the wood species, preservative type, retention, and producer of installed treated timber.

3.1.2.6 Survey Data

After the driving of each pile group is complete and before superimposed concrete is placed, provide the Contracting Officer with an As-Driven Pile Survey showing actual location and top elevation of each pile. The Contractor must not proceed with placing concrete until the Contracting Officer has reviewed the survey and verified the safe load for the pile group driven. A survey must be presented in such form that it gives deviation from plan location in two perpendicular directions and elevations of each pile to nearest 13 mm half inch. Survey must be prepared and certified by a [licensed land surveyor] [professional engineer].

[3.1.2.7 Lengths of Job Piles

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NOTE: For USACE (Army) projects, use and edit the following paragraph. When the actual required lengths of piles can be determined without test driving and loading of piles (such as when piles are to be driven to bedrock), the actual required lengths must be indicated and listed in the unit price schedule.

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[The estimated quantities of piles listed in the unit price schedule as to be furnished by the Contractor are given for bidding purposes only. The Contracting Officer will determine the actual lengths of piles required to be driven below cutoff elevation for the various locations in the work and will furnish the Contractor a quantities list which indicates lengths and

locations of all piles to be placed. This determination will be made from the results of the test pile driving and test loading.][The lengths of piles must be as indicated.]The Contracting Officer will determine the number of overlength piles, if any, to be ordered to provide for variations in subsurface conditions. Where specified bearing capacities are attainable with piles of lesser length than those specified, shorter piles may be used subject to prior approval in writing. To provide for "heading" or cutting off normal after driving, piles must be furnished in lengths at least 300 mm one foot greater than the lengths specified to be below the cutoff elevations.

]3.1.3 Framing Treated Piles

Treated piles must not be cut to permit fitting of timbers. Piles of uniform size must be selected for each bent. If necessary, treated filler blocks must be used to fill out between piles and bracing. Holes for drift bolts in the tops of piles must be drilled to a depth of 75 mm 3 inches less than the penetration of drift bolts in the piles. Drill holes for drift bolts 3 mm 1/8 inch smaller than bolt diameter. Drill holes for through bolts 2 mm 1/16 inch larger than diameter of bolt shank. Drill holes for lag screws in two parts. Make lead hole for shank the same diameter as shank. Make lead hole for the threaded portion approximately two-thirds of the shank diameter. Counterbore holes for bolt heads and washers as indicated. Holes drilled into piles must be treated with copper naphthenate and sealed with coal-tar roofing cement in accordance with paragraph ON SITE APPLICATION OF WOOD PRESERVATIVES and when not used for bolts must be tightly closed by a treated plug. Holes must not be drilled or spikes must not be driven into piles to support scaffolding.

3.1.4 Fastening

Where bolts are used to fasten timber to timber, timber to concrete, or timber to steel, bolt members together when they are installed and retighten immediately prior to final acceptance of contract. Provide bolts having sufficient additional threading to provide at least 10 mm per m 3/8 inch per foot thickness of timber for future retightening. Provide timber connectors of types indicated. Install split-ring and shear-plate connectors in pre-cut grooves of the dimensions [shown] [as recommended by the manufacturer]. Force toothed-ring and spike-grid connectors and clamping plates into the contact surfaces of timbers joined by means of proper pressure tools; at joints, embed connectors of these types simultaneously and uniformly.

3.1.5 Wrapping Pile Clusters and Dolphins

Draw piles tightly together with wire rope. Fasten each turn of the wire rope with a staple to each pile with which it is in contact. Fasten ends of wire rope with two clips or clamps. Number of turns must be as indicated. Through bolts must be in place and drawn up before wrapping is finally secured.

[3.1.6 Jetting of Piles

****

NOTE: Jetting should not generally be permitted when:

1. Piles are dependent on side friction in fine-grained, low-permeability soils (high clay or

silt content) where considerable time is required for the soil to reconsolidate around the piles;

2. Piles are subject to significant uplift;

3. Piles are adjacent to existing structures; and

4. Piles are in closely spaced clusters, unless the load capacity is confirmed by test and unless jetting is completed before final driving of any pile in the cluster.

****

Water jets [will be permitted to assist in driving] [may be used in driving only when specifically authorized by the Contracting Officer] [may be used to assist driving of the pile through strata which cannot be penetrated practicably by use of the hammer alone.

Jetting equipment must have not less than two removable or fixed, water or combination air-water type jets. Equipment must be designed so that the discharge volume and pressure are sufficient to freely erode the material under and adjacent to the piles.

After the penetration of the strata requiring jetting has been accomplished, the use of the jet must be discontinued and direct hammer driving must be resumed] [must not be permitted to assist in driving]. [Discontinue jetting when the pile tip is approximately 1.5 m 5 feet above the [calculated] [indicated] pile tip elevation. Drive pile the final 1.5 m 5 feet of penetration [to the maximum penetration per blow established by the Contracting Officer]. Jetting equipment and method must be approved by the Contracting Officer prior to commencing jetting operations.]

][3.1.7 Spudding of Piles

****

NOTE: Spudding should not generally be permitted when:

1. Piles are dependent on side friction in fine-grained, low-permeability soils (high clay or silt content) where considerable time is required for the soil to reconsolidate around the piles;

2. Piles are subject to significant uplift;

3. Piles are adjacent to existing structures; and

4. Piles are in closely spaced clusters, unless the load capacity is confirmed by test and unless spudding is completed before final driving of any pile in the cluster.

****

Spudding [will be permitted][must not be permitted]. [Discontinue driving and withdraw the spudding mandrel [approximately 1.5 m 5 feet above the [calculated] [indicated] pile tip elevation] [immediately after passing through the resistant substrate layer].] [Drive pile the final 1.5 m 5 feet of penetration [to the maximum penetration per blow established by

the Contracting Officer]. Obtain Contracting Officer's approval of spudding equipment, prior to commencing spudding operations.]

][3.1.8 Predrilling of Piles

****

NOTE: Predrilling should not generally be permitted when:

1. Piles are dependent on side friction in fine-grained, low-permeability soils (high clay or silt content) where considerable time is required for the soil to reconsolidate around the piles;

2. Piles are subject to significant uplift;

3. Piles are adjacent to existing structures; and

4. Piles are in closely spaced clusters, unless the load capacity is confirmed by test and unless predrilling is completed before final driving of any pile in the cluster.

****

Predrilling [will be permitted][must not be permitted][must be provided]. [Discontinue predrilling when pile tip is approximately 1.5 m 5 feet above the [calculated][indicated] pile tip elevation. Drive pile the final 1.5 m 5 feet of penetration [to the maximum penetration per blow established by the Contracting Officer]]. [Obtain Contracting Officer's approval of predrilling equipment prior to commencing predrilling operations.]

]3.2 PROTECTION

3.2.1 Protection of Piles

Square the heads and tips of piles to the driving axis. Laterally support piles during driving, but do not unduly restrain piles from rotation in the leads. Where pile orientation is essential, take precautionary measures to maintain the orientation during driving. [Driven batter piles of sufficient unsupported lengths to cause a measurable deflection must have free ends secured until piles are fixed in the structure to prevent excessive bending stresses.] Handle, protect, and field treat piles in accordance with AWPA M4.

3.2.1.1 Damaged Piles

Driving of piles must not subject them to damage. Piles which are damaged, split, broomed, or broken by reason of internal defects or by improper driving below cutoff elevation so as to impair them for the purpose intended must be removed and replaced; a second pile may be driven adjacent thereto at the Contractor's expense. Minor damaged areas of treated piles must be field treated in accordance with AWPA M4. [The Contracting Officer may require the Contractor to pull certain selected piles after driving for test and inspection to determine the conditions of the piles. Any pile so pulled and found to be damaged to such extent as to impair its usefulness in the completed structure must be removed from the work and the Contractor must furnish and drive a new pile to replace the damaged pile. Piles pulled and found to be sound and in a satisfactory condition, by the Contracting Officer, must be redriven.]

3.2.1.2 On Site Application of Wood Preservatives

All on site application of wood preservatives must be performed by the person identified in accordance with paragraph PESTICIDE APPLICATOR COMPANY SELF-CERTIFICATION. Field application of wood preservatives must be made in accordance with the pesticide label. All cuts, holes and injuries such as holes from removal of spikes or nails which may penetrate the treated zone must be field treated in accordance with AWPA M4.

3.3 FIELD QUALITY CONTROL

3.3.1 Inspections

When Government inspections result in product rejection, the Contractor must promptly segregate and remove rejected material from the premises. The Government may also charge the Contractor an additional cost of inspection or test when prior rejection makes reinspection or retest necessary.

-- End of Section --