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USACE / NAVFAC / AFCEC / NASA **UFGS-31 63 26 (August 2008)**

Preparing Activity: USACE **Superseding**
UFGS-31 63 26.00 10 (April 2006)
UFGS-31 63 26.16 20 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023

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08/08

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SECTION 31 63 26

DRILLED CAISSONS
08/08

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NOTE: This guide specification covers the requirements for the procurement, installation, and testing of drilled foundation caissons including reinforcing and cast-in-place concrete.

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).

****

PART 1 GENERAL

****

NOTE: Use the following specifications in conjunction with this section:

SECTION 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS

On the drawings, show:

1. Subsurface-soil-data logs.

2. Top and bottom elevation of each caisson.

3. Size (diameter in mm inches, bearing capacity,

and total number of each size of caissons.

4. Dimensions of the bell, if required.

5. Dimensions of the casing.

6. Reinforcing steel details, if required.

7. Location of caissons to be penetration tested, if required.

8. Location of caisson to be proof tested, if required.

9. Locations, size, bell dimensions, and installation sequence of load testing caisson, if required.

****

[1.1 UNIT PRICES

****

NOTE: Delete this subpart for NASA projects.

****

a. Requirements for price breakdown of Drilled Caisson work are specified in Section 01 20 00 PRICE AND PAYMENT PROCEDURES. Requirements for construction scheduling related to Drilled Caisson work are specified in Section 01 32 17.00 20 COST-LOADED NETWORK ANALYSIS SCHEDULES.

****

NOTE: If requirements for price breakdown of drilled caissons work are specified in Section 01 20 00 PRICE AND PAYMENT PROCEDURES, use the following paragraph and delete subparts 1.1.1 through 1.1.4.

****

b. Requirements for price breakdown of Drilled Caisson work are specified in Section 01 20 00 PRICE AND PAYMENT PROCEDURES.

****

NOTE: This paragraph anticipates bids on a lump sum price for an entire project including caisson work with directed changes being in accordance with the CONTRACT CLAUSES or in accordance with unit prices as defined in paragraph "Separate Unit Prices."

Delete "in accordance with the CONTRACT CLAUSES" or paragraphs "Tests" and "Separate Unit Prices" for lump sum projects.

****

[1.1.1 Basis of Bids

Base the bid on the number and total length of caissons, established by top and bottom elevations and diameters, as indicated and specified. Adjustment of the contract will be made [in accordance with the CONTRACT

CLAUSES], should the total length of caissons installed and approved be greater or less than the total length shown. The Contractor will not receive payment for rejected caissons or for those not conforming to specifications.

][1.1.2 Tests

1.1.2.1 Load Test

The Contract includes [_____] load tests rated at [_____] metric ton ton per caisson. The Contracting Officer reserves the right to increase or decrease the number of load tests. Adjustments in the contract price will be made for each such increase or decrease by the amount bid for "Additional Caisson Load Test" or "Omitted Caisson Load Test".

1.1.2.2 Penetration Test

The Contract includes [_____] penetration tests. The Contracting Officer reserves the right to increase or decrease the number of penetration tests. Adjustments in the contract price will be made for each such increase or decrease by the amount bid for "Additional Penetration Test" or "Omitted Penetration Test".

1.1.2.3 Proof Test Hole

The Contract includes [_____] proof test holes. The Contracting Officer reserves the right to increase or decrease the number of proof test holes. Adjustments in the contract price will be made for each such increase or decrease by the amount bid for "Additional Proof Test Hole" or "Omitted Proof Test Hole".

][1.1.3 Separate Unit Prices

1.1.3.1 Additional Caisson Lengths

Additional caisson lengths will be paid for at the contract unit price for "Additional Caisson Length" for each diameter of caisson installed as approved.

1.1.3.2 Omitted Caisson Lengths

The contract price will be reduced by the amount bid for "Omitted Caisson Length" for each diameter of caisson omitted as directed.

1.1.3.3 Casings Permanently Left in Place

Steel casings permanently left in place due to contract conditions:

a. Total pounds of steel beyond casings indicated will be paid for at the contract unit price per pound for "Additional Steel Casing."

b. Omitted Casing Steel: The contract price will be reduced by the amount bid for "Omitted Casing Steel" omitted as directed.

1.1.3.4 Reinforcing Steel for Additional Caisson

Reinforcing steel for additional caisson lengths will be paid for at the contract unit price for "Additional Caisson Reinforcing Steel" installed as approved.

1.1.3.5 Reinforcing Steel for Caissons Omitted

The contract price will be reduced by the amount bid for "Omitted Caisson Reinforcing Steel" omitted as directed.

1.1.3.6 Removal of Rock

Removal of rock within the limit of caissons will be paid for at the contract unit price for "Removal of Rock" per linear meter foot, for each diameter of caisson installed. Rock excavation is defined as any hard dense material that cannot be removed with caisson drilling equipment having the specified capacity and could only be removed by hand, air tools, blasting, or other specialized methods.

1.1.3.7 Removal of Obstructions Other Than Rock

Removal of obstructions other than rock within the limits of the caissons which cannot be removed using standard caisson drilling equipment with the specified capacity will be paid for at the contract unit price per linear meter foot for "Removal of Obstructions" for each diameter of caisson installed.

][1.1.4 Basis of Payment

****
NOTE: Where the basis for bidding is based entirely on unit price, subpart 1.1.1 through 1.1.3 should be deleted and the subparts 1.1.4.1 through 1.1.4.5 substituted.
****

1.1.4.1 Unit Price

The Contracting Officer has the right to increase or decrease the total length linear footage of drilled foundation caissons to be furnished and installed by changing the foundation caisson elevations, by requiring the installation of additional caissons, or omission of caissons from the requirements shown and specified. Whether or not such changes are made, the Contractor will be paid at the contract unit price per linear meter foot (including test caissons) multiplied by the total linear meters feet of acceptable caissons actually installed provided, however, that in the event the Contracting Officer requires an increase or decrease in the total length linear footage of caissons furnished and installed, the contract unit price will be adjusted in accordance with the CONTRACT CLAUSES.

1.1.4.2 Full Compensation

Payment in accordance with the above paragraph Unit Price constitutes full compensation for furnishing, delivering, handling, and/or installing (as applicable) all material, labor and equipment necessary to meet contract requirements applicable to the foundation caissons. The Contractor will not be allowed payment for rejected caissons.

1.1.4.3 Load Tests

The Contract includes [_____] [_____] -ton caisson load tests. The Contracting Officer reserves the right to increase or decrease the number

of load tests. Adjustments in the contract price will be made for such increases or decreases by the amounts bid for "Additional Caisson Load Test" or "Omitted Caisson Load Test." Submit results of all tests performed.

1.1.4.4 Penetration Tests

The Contract includes [_____] penetration tests. The Contracting Officer reserves the right to increase or decrease the number of penetration tests. Adjustments in the contract price will be made for such increases or decreases by the amounts bid for "Additional Penetration Test" or "Omitted Penetration Test."

1.1.4.5 Proof Test Holes

The Contract includes [_____] proof test holes. The Contracting Officer reserves the right to increase or decrease the number of proof test holes. Adjustments in the contract price will be made for such increases or decreases by the amounts bid for "Additional Proof Test Hole" or "Omitted Proof Test Hole."

]]1.2 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 WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A36/A36M	(2019) Standard Specification for Carbon

	Structural Steel
ASTM A123/A123M	(2017) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A615/A615M	(2022) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM D1143/D1143M	(2007; R 2013) Piles Under Static Axial Compressive Load
ASTM D1586/D1586M	(2018) Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2023) Structural Engineering

1.3 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-02 Shop Drawings

Caissons; G[, [_____]]

Survey of Caisson Locations; G[, [_____]]

SD-04 Samples

Test Caissons; G[, [_____]]

SD-06 Test Reports

Load Tests; G[, [_____]]

Penetration Tests; G[, [_____]]

Proof Test Holes Report; G[, [_____]]

SD-07 Certificates

Caissons

Qualifications; G[, [_____]]

Records for Each Qualified Welding Operator; G[, [_____]]

SD-11 Closeout Submittals

Records

1.4 QUALITY ASSURANCE

1.4.1 Survey of Caisson Locations

Submit a certified survey meeting the requirements specified herein.

1.4.2 Specialty Subcontractor Qualifications

NOTE: Select applicable paragraph for agency requirements. 3 to 5 years should be required for qualifying experience.

Submit Contractor Qualifications for foundation systems, proving its engagement in the successful installation of similar drilled foundation caissons for at least [_____] years.

1.4.3 Welding

Perform all detail and field welding in accordance with AWS D1.1/D1.1M. Qualification of welding procedures, welders, and welding operators must be in accordance with AWS D1.1/D1.1M, Section 4. Keep and make available, for examination by the Contracting Officer, all records of test results of welding procedures not prequalified, copies of records for each qualified welding operator, and records on positions of welding and types of electrode qualifications. Submit records for each qualified welding operator.

[1.4.4 Pre-installation Conference

[Within [30][15] calendar days of notice to proceed][At the Pre-installation conference] provide, for approval, the following schedule of submittals: Preliminary detailed drawings in an approved form, for each caisson, showing shaft and bell diameters, depths of test holes, top and bottom elevations, bearing strata description, casing description, water conditions, concrete strength, concrete volume, rock elevations, dates of excavation and concrete placement, and other pertinent information.

]1.4.5 Contractor Supervision

Provide for the supervision of all phases of drilled pier construction. Supervision is the Contractor's responsibility as outlined in Quality Control provisions of the Specialty Subcontractor Requirements. Check each drilled pier excavation for its depth, water removal, cleanup, workmanship, and for all tolerance requirements before any concrete is placed.

1.4.6 Government Inspection

The Contracting Officer will inspect each drilled pier excavation. Do not place concrete until the excavation has been approved by the Contracting Officer. Furnish the Contracting Officer all necessary equipment required for proper inspection of drilled pier excavations.

1.4.7 Safety Precautions for Workmen and Inspectors

1.4.7.1 Life Line

Provide each person, entering a drilled pier excavation, with a life line suitable for instant rescue, securely fastened to a shoulder harness, separated from any line used to remove excavated materials, and rigged so that the person can be immediately hoisted out of the excavation in an emergency. Do not lower any person into a drilled pier excavation prior to casing the shaft through the overburden.

1.4.7.2 Ventilation

Provide each drilled pier excavation with a ventilating device of sufficient capacity to ensure a safe and healthy atmosphere before workmen and inspectors are permitted to enter the drilled pier excavation and during all work periods.

1.5 DELIVERY, STORAGE, and HANDLING

****
NOTE: Insert the appropriate Section number and title in the blank below using proper format per UFC 1-300-02.
****

Deliver casings and appurtenant equipment to the job site in an undamaged and ready to place condition. Deliver concrete in accordance with requirements of [_____].

1.6 PROJECT/SITE CONDITIONS

1.6.1 Subsurface Data

****
NOTE: Include location of available samples.

Section 00 31 32.13 Subsurface Drilling and Sampling Information is not a UFGS. CSI MasterFormat prescribes this section for inclusion of this data.
****

Subsurface soil data logs are [included in the drawings] [appended to the SPECIAL CONTRACT REQUIREMENTS] [found in Section 00 31 32.13 Subsurface Drilling and Sampling Information]. The subsurface investigation report and samples of materials, as taken from subsurface investigations, are available for examination at [_____].

1.6.2 Caisson Drilling Equipment

****
NOTE: Caisson drilling equipment criteria should be evaluated and specified for contract site conditions. Reference: Drilled Pier Foundations - Woodward, Gardner, Greer - McGraw-Hill Book Co. Requirements should be included for determination of minimum equipment standards.
****

Provide caisson drilling equipment having a minimum torque capacity and downward force capacity for the contract site conditions.

1.7 SEQUENCING

****
NOTE: Sequence of work criteria should be modified for agency requirements.
****

1.7.1 Caisson Excavation

Perform excavation of caissons or groups of caissons so that reinforcing steel and concrete placement is a continuous operation performed the same day that the excavation is completed. Do not leave excavations open overnight.

1.7.2 Acceptance

Place concrete within 3 hours after approval of the completed excavation.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Concrete Work

****
NOTE: Insert the correlated section number and title or include concrete specification in this section, in the blank below using the proper format per UFC 1-300-02.
****

****
NOTE: Include information for concrete work. Correlate with Section 03 30 00 CAST-IN-PLACE CONCRETE for pertinent information or include concrete specifications in this section.
****

Perform all concrete work in accordance with requirements of Section [_____] 03 30 00 CAST-IN-PLACE CONCRETE, as modified herein:

2.1.1.1 Strength

****
NOTE: Compressive strength (28 day strength or f'c) of concrete should be 25 MPa 3000 psi or higher. When loads are high and drilling conditions difficult, it may be more economical to use 30 MPa 4000 psi or 35 MPa 5000 psi concrete and larger shafts rather than a smaller shaft with reinforcing or permanent casing. If there is a reinforcing cage, or if there is a large bell, the ability of the concrete to flow between reinforcing bars, or to completely fill the bell, is a matter of prime importance. For these piers, the concrete should have a slump of about 150 mm 6 inches. Slump may vary, depending on the mix, between 100 mm 4 inches and 150 mm 6 inches. A maximum size of 19 mm 3/4 inches appropriate under these circumstances.
****

Provide [_____] MPa [_____] psi strength concrete at 28 days, with slump from [_____] to [_____] mm [_____] to [_____] inches.

2.1.1.2 Coarse Aggregate

****
NOTE: Select 25 mm 1 inch maximum size coarse aggregate. Coarse aggregate may be smaller where reinforcement spacing is close or where dimension of caisson elements is dimensionally thin.
****

Provide [_____] mm [_____] inch maximum size coarse aggregate.

2.1.1.3 Reinforcing Steel

****
NOTE: Reinforcing steel grades should conform to one of the following:

ASTM A615/A615M for deformed billet - steel bars must be 400 or 500 MPa Grades 60 or 75

ASTM A966/A966M for rail-steel deformed bars must be 400 MPa Grade 60

ASTM A966/A966M for axle-steel deformed bars must be 400 MPa Grade 60
****

Provide reinforcing steel conforming to [ASTM A615/A615M] [ASTM A996/A996M] Grade [_____], welded into cages in accordance with AWS D1.4/D1.4M and inserted securely in the caissons, in position and alignment, as shown, prior to [concrete placement] [the concrete reaching an elevation of [_____] meters feet below the bottom elevation of the reinforcement].

2.1.2 Welding

Perform shop and field welding in accordance with AWS D1.1/D1.1M. Provide certification of qualification of welding procedures, welders, and welding operators in accordance with AWS D1.1/D1.1M. Keep records of test results of welding procedures not prequalified and copies of records for each qualified welding operator, containing records on positions of welding and types of electrode qualifications, and make available for examination by the Contracting Officer.

2.1.3 Casing Steel

****
NOTE: Determine minimum wall thickness based on the structural loading conditions.
****

ASTM A36/A36M. Provide zinc coating of casing steel conforming to ASTM A123/A123M. Provide casings with an outside diameters not less than indicated shaft sizes and a minimum of [6 mm] [1/4 inch] [_____] thick.

2.2 CAISSON DRILLING EQUIPMENT

****
NOTE: Caisson drilling equipment criteria should be evaluated and specified for contract site conditions. Reference: Drilled Pier Foundations - Woodward, Gardener, Greer - McGraw-Hill Book Co. Requirements should be included for determination of minimum equipment standards.
****

Provide caisson drilling equipment with minimum torque capacity and downward force capacity suitable for the site conditions.

PART 3 EXECUTION

3.1 PREPARATION

****

NOTE: Base selection of caissons for contract on analysis of subsurface investigation and design requirements. Provide complete installation information to the Contracting Officer.

Specify load tests when needed to confirm design capacities. At least one caisson location should be load tested in each area of substantially different subsoil conditions. Indicate number, size, and location of test caisson and sequence.

****

Excavate caissons to established depths and dimensions shown; clean bottoms of caissons free of loose or soft material; level caissons; and dispose of excavated material in accordance with Section 31 00 00 EARTHWORK. Submit a certified copy of the survey. Establish lines, levels, and caisson centerline locations, staked and maintained by a registered surveyor or engineer.

a. When drilling caissons, protect the surrounding soil and the earth walls against cave-ins, displacement of the surrounding earth, and retention of ground water, by means of temporary steel casings. Provide casings with outside diameters not less than indicated shaft sizes, and a minimum of 6.4 mm 1/4 inch thick. Do not remove if the structural integrity of the caisson will be impaired, as determined by the Contracting Officer. Withdraw temporary steel casings as the concrete is being placed, maintaining sufficient head of concrete within the casing to prevent extraneous material from falling in from the sides and mixing with the concrete. Casings may be jerked upward a maximum of 100 mm 4 inches to break the bottom seal, but remove thereafter with a smooth, continuous motion.

b. Thoroughly clean and oil the inside of steel casings before reuse.

c. Leave the temporary casing in place from the caisson top to the ground surface until the concrete has set if the elevation of the top of the caisson is below the adjacent ground surface.

d. Provide permanent casing with outside diameter the same as the nominal shaft diameter. Provide a minimum wall thickness of permanent casings of [_____] mm inches.

e. Continuously remove all water that flows into the excavations and from the excavation bottom, to the extent possible, prior to concrete placement. The maximum permissible depth of water is 50 mm 2 inches. In the event of a severe water condition that makes it impossible or impractical to dewater the excavation, place concrete using an underwater tremie after water movement has stabilized.

f. Enlarge the bottoms of excavations indicated to be "belled" to diameters and shapes shown. Excavate or drill bells in a similar manner to that used for shafts.

g. Prepare the excavations for caissons indicated to be ["ribbed"]

[_____] with the dimensions and shapes indicated.

h. Each caisson excavation will be inspected and approved by the Contracting Officer prior to placing concrete. Keep a record of all inspections, with related construction changes. Provide support personnel for inspection and testing procedures.

3.2 INSTALLATION

a. Continuously place concrete by methods that ensure against segregation and dislodging of excavation sidewalls, and completely fill the shaft. Place concrete by pumping or drop chutes in dry holes and by tremie or pumping in wet holes. Keep the discharge a minimum of 1 m 3 feet below the fresh concrete surface during placement. Drilling of caissons or driving of casings must not be within 6 m 20 feet of concrete placed within the last 3 days.

b. Bring concrete to a true level surface inside the shaft and a full width cross key formed, or dowels installed, if it becomes necessary to interrupt placing concrete in any caisson. Prior to placing additional concrete, clean surfaces of laitance and slush with one-to-one portland cement grout, having a water-cement ratio not exceeding that of the concrete.

c. Place concrete in dry batter caissons with a drop chute extending within 1 m 3 feet of the concrete surface in the excavation.

d. Vibrate concrete for [full height of caisson] [upper [_____] meters feet of caisson]. Vibrate belled caissons full height.

3.3 TOLERANCES

****
NOTE: Correlate tolerances with design criteria and types of caisson.
****

a. Correct any caisson out of center or plumb beyond the tolerance specified as necessary to comply with the tolerances. Any corrective cost is the responsibility of the Contractor.

b. Make cross sections of shafts and bells not less than design dimensions.

c. Install caissons with top location deviating a maximum of [75] [_____] mm [3] [_____] inches from centerline locations.

d. Install vertical caissons plumb within a maximum of 38 mm 1-1/2 inches for the first 3 m 10 feet and within 13 mm 1/2 inch for each 3 m 10 feet of additional depth.

e. Install batter caissons a maximum of [2] [_____] percent of length from specified inclination.

3.4 PENETRATION TESTS

****
NOTE: Include penetration tests when bearing investigations are determined to be a contract

requirement.
****

Perform Penetration Tests conforming to the following:

a. After excavation, make penetration tests in the bottoms of the caissons, in [locations indicated] [[_____] caissons], to determine bearing conditions, in accordance with ASTM D1586/D1586M.

b. Make the tests after caisson bottoms have been cleaned out. Minimum blow count is [_____] per meter foot. [Take penetration tests to a depth of [_____] meters feet below the bearing elevation. Obtain and retain jar samples, as directed by the Contracting Officer.]

c. If the minimum blow count is not obtained, drill the shaft an additional [_____] meters feet and rerun the penetration test.

d. Submit reports to the Contracting Officer in accordance with ASTM D1586/D1586M.

The Contracting Officer will approve tests and authorize subsequent concrete placement or initiate redesign procedures.

3.5 PROOF TEST HOLE REQUIREMENTS

****
NOTE: Omit proof test holes if rock bearing is not anticipated or nature of rock and extent of principal testing makes further testing unnecessary.
****

Perform Rock Soundness test conforming to the following:

a. After excavation, proof test the rock below each caisson bearing level for soundness by percussion or rotary core drilling one hole in each caisson in locations indicated.

b. Make holes 50 mm 2 inch diameter and drilled with a uniform downward pressure to a depth below the bearing level equal to the design caisson shaft diameter but to a minimum of 1.2 m 4 feet.

c. Record penetration time for successive 150 mm 6 inch increments , noting conditions encountered.

Submit Proof Test Holes Report to the Contracting Officer. The Contracting Officer will approve test holes and authorize subsequent concrete placement or initiate redesign procedures.

3.6 LOAD TESTS

****
NOTE: Specify load tests to confirm caisson design. Indicate number, size, and location of test caissons and sequence.
****

3.6.1 General Requirements

a. Perform caisson load tests in locations indicated.

b. Perform tests under supervision of a registered engineer provided by the Contractor and in the presence of the Contracting Officer. Secure Contracting Officer approval of the test prior to commencement of work.

c. Apply load in concentric manner with magnitude of load accurately determined and controlled.

d. Laterally support the top of caisson during entire load test.

e. [Load caisson to [150] [200] percent of design load, but do not exceed ultimate concrete strength at time of loading. Apply the load in increments of [_____]. Maintain full test load for a period of [24] [_____] hours and take settlement readings at not less than [1/2] [_____] -hour intervals.] [Perform load test in accordance with ASTM D1143/D1143M, except the maximum load must not exceed [_____] [200] percent of the design load.]

f. Submit [_____] copies of the test report directly to the Contracting Officer.

****

NOTE: Residual settlement is not to exceed 12 mm 1/2 inch for medium sized piers. Equally, the settlement caused by twice the design load is not to exceed 12 mm 1/2 inch.

****

g. Tested installations will be considered of adequate design and construction if:

(1) No apparent distress occurs in caisson construction.

(2) Residual settlement, after test load is removed, does not exceed [_____] mm inches.

(3) Twice the design load does not cause a gross settlement of more than [_____] mm inches.

3.6.2 Replacements

Replace and retest test caissons found inadequate because of improper instrumentation, testing, or construction procedures , at no additional cost to the Government.

3.7 PROTECTION

Provide protection around top of the excavation to prevent debris from being dislodged into the excavation and concrete.

3.8 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

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NOTE: Include this paragraph only when special inspection and testing for seismic-resisting systems is required by Appendix 11A of ASCE 7-16.

This paragraph is applicable to both new buildings designed according to UFC 3-301-01 SEISMIC DESIGN

FOR BUILDINGS, and to existing building seismic rehabilitation designs.

The designer must indicate on the drawings all locations and all features for which special inspection and testing is required in accordance with UFC 3-301-01 and Appendix 11A of ASCE 7-16. This includes indicating the locations of all structural components and connections requiring inspection.

Add any additional requirements as necessary.
****

Perform special inspections and testing for seismic-resisting systems and components in accordance with UFC 3-301-01 and Section 01 45 35 SPECIAL INSPECTIONS.

3.9 RECORDS

Keep and submit complete, detailed and accurate records for each caisson installation. Include locations, shaft diameters, [bell dimensions,] top and bottom elevations, depths of test holes, casing dimensions, concrete strength, concrete volume, quantity of rock excavation, excavation condition, dates of excavation and concrete placement, bearing strata description, and subsurface water conditions. Base location on the survey of the registered surveys or engineer provided by the Contractor. Tabulate all records, including corrective measures. Upon completion of caisson work, provide a record of centerline locations based on the survey of the registered surveyor or engineer provided by the Contractor. In addition, also record corrective measures. Deliver a complete tabulation of all records pertaining to approved caissons to the Contracting Officer.

-- End of Section --