DIVISION 1. GENERAL REQUIREMENTS

SECTION 1A. General Paragraphs
1B. Additional General Paragraphs
1C. Bids

SECTION 1A. GENERAL PARAGRAPHS

1A.1 General intention. It is the declared and acknowledged intention and meaning to provide and secure Water Treatment Plant, Courthouse Bay, complete and ready for use.

1A.2 General description. The work includes the provision of a water treatment plant building with concrete footing, concrete slab, concrete block and brick veneer walls, structural steel roof framing, concrete plank and built-up roofing, equipped to provide iron and hydrogen sulphide removal, water softening, water filtration, controls and pumping facilities, complete with salt storage tanks, detention basin, water storage facilities, water distribution mains, well pumping equipment, site improvements and other supporting utilities.

1A.3 Location. The work shall be located at the Marine Corps Base, Camp Lejeune, North Carolina, approximately as shown. The exact location will be indicated by the Officer in Charge.

1A.4 Commencement, prosecution, and completion of work. The Contractor will be required to commence work under this contract within 10 calendar days after the date of receipt by him of notice to proceed, to prosecute said work diligently, and to complete the entire work ready for use within 270 calendar days after date of receipt of a notice of award or any other communication authorizing the Contractor to proceed. The time stated for completion shall include final clean-up of the premises.

1A.5 Liquidated damages. In case of failure on the part of the Contractor to complete the work within the time fixed in the contract or any extensions thereof, the Contractor shall pay to the Government as liquidated damages pursuant to Clause 5 of Standard Form 23-A the sum of $125 for each day of delay. (See also section entitled "Additional General Paragraphs".)

1A.6 Drawings accompanying specification. The following drawings accompany this specification and are a part thereof. Drawings are the property of the Government and shall not be used for any purpose other than that contemplated by the specification. The drawings included with this specification are half-size. Full-size drawings are available at the bidder's or Contractor's expense. Information on procuring these full-size drawings may be obtained from the Officer in Charge of Construction. Full-size drawings may be inspected during regular working hours, at the office of the Officer in Charge of Construction.

NAVFAC DRAWING NO.	TITLE
1108371	Index and Location Plans
1108372	Site Plan
1108373	Treatment Plant, Foundation Plan and Details, Structural
1108374	Treatment Plant, Sections and Details, Structural
1108375	Treatment Plant, Detention Tank, Structural
1108376	Treatment Plant, Plan, Elevations and Details, Architectural
1108377	Treatment Plant, Elevations, Sections and Details, Architectural
1108378	Treatment Plant, Piping and Equipment, Mechanical
1108379	Treatment Plant, Piping and Equipment Details, Mechanical
1108380	Treatment Plant, Plumbing, Heating and Ventilation, Mechanical
1108381	Reservoir, Plan, Sections and Details, Structural
1108382	Reservoir, Sections and Details, Structural
1108383	Reservoir, Piping and Details, Mechanical
1108384	Treatment Plant, Interior Electrical, Plans and Details
1108385	Electrical Power and Control Distribution
1108386	Electrical Details
1108387	Wells and Miscellaneous Details - Electrical
1108388	Yard Piping
1108389	Water Distribution, Plans and Details
1108390	Wells and Transmitter Shelter - Mechanical

NAVFAC DRAWING NO.	TITLE
1108391	Instrumentation and Controls

1A.7 Factory inspection. (See Clause 10 of Standard Form 23-A and Clause 40 of form NAVDOCKS 113). Factory inspection of material and equipment for which tests at the place of manufacture are required may be waived at the option of the Government, if notarized copies of factory reports are furnished that show compliance with the specification requirements. Factory inspection will not be required for lumber if it is grade-marked and trademarked by the association under whose rules it is graded, or if it is accompanied by certificates of inspection issued by the association under whose rules it is graded or by another inspection agency that is satisfactory to the Officer in Charge of Construction. The Government reserves the right to charge to the Contractor any additional cost of Government inspection and tests when materials and equipment are not ready at the time inspection and tests are requested by the Contractor.

1A.8 Samples. As soon as practicable, and before installation, the Contractor shall submit for approval samples of the following materials and equipment: brick and concrete masonry unit.

1A.9 Information required of the Contractor. The Contractor shall submit for approval, and in accordance with Clause 37 of NAVDOCKS 113, such drawings, catalogue cuts, and/or descriptive data as may be required. Shop drawings shall be submitted and approval obtained before commencing the fabrication of the work. Other data requested shall be submitted and approval obtained prior to installation of the item or associated item. Information shall include but not be limited to the following:

1. Reinforcing steel - shop drawings

2. Structural steel - shop drawings

3. Transformers, fused cutouts, lightning arresters, insulators - manufacturer's data and electrical characteristics

4. Panelboards, lighting panel, disconnect switches, motor starters, current transformers, KWH demand meter and meter socket - manufacturer's data and electrical characteristics

5. Lighting fixtures - manufacturer's data

6. Metal doors and metal windows - manufacturer's data

7. Hardware schedule

8. Ventilating fans - manufacturer's data including fan characteristics

9. Oil heater - manufacturer's data and descriptive literature

10. Gasoline and oil storage tank - shop drawings

11. Plumbing fixtures including water cooler, water heater and frost-proof hydrant - manufacturer's data and roughing-in dimensions

12. Interior plant water piping - shop drawings

13. Pumps - shop drawings, characteristic curves and manufacturer's data

14. Aerator - shop drawings, operational data and manufacturer's data

15. Filters - shop drawings, operational data and manufacturer's data

16. Softeners - shop drawings, operational data and manufacturer's data

17. Lime-feeding equipment - shop drawings, operational data and manufacturer's data

18. Chlorinators - shop drawings, operational data and manufacturer's data

19. Auxiliary gasoline engines - shop drawings, characteristic curves and manufacturer's literature

20. Right angle gear drives - shop drawings and manufacturer's literature

21. Instrumentation and controls:

(a) Transmitters - shop drawings, manufacturer's data and operating data

(b) Receivers - shop drawings, manufacturer's data and operating data

(c) Pump programming controls - shop drawings, manufacturer's data and operating data

(d) Water meters - shop drawings and characteristic curves depicting loss of head and efficiencies

(e) Wiring diagram - depicting operation of functional components for each separate telemetering facility.

1A.10 Minimum wage rates and other labor standards. The Contractor shall pay mechanics and laborers employed or working directly upon the site of the work wage rates not less than those contained in the attached wage determination decision of the Secretary of Labor No. AH-1,237. Other requirements and information are contained in the section entitled "Additional General Paragraphs).

1A.11 Schedule of prices. Within 12 days of receipt of a notice of award, the Contractor shall prepare and submit to the Officer in Charge, in octuplicate, a schedule of prices on form NAVDOCKS 83, revised August 1963, Schedule of Prices. The schedule shall consist of a detailed breakdown of the contract price, giving the quantities for each of the various kinds of work, the unit prices, and the total prices therefor. The detailed breakdown shall be segregated under each of the construction categories given hereinafter. The required schedule must be based on the actual breakdown of the bid price. Accordingly, subcontractors who may be involved in work under more than one of these categories should be advised of this requirement in order to assure their being in a position to furnish these data without delay. The format and content required shall be as further prescribed by the Officer in Charge and shall be subject to his approval. The submission of the required data shall not otherwise affect the contract terms. Form NAVDOCKS 83 will be furnished by the Officer in Charge of Construction.

1A.12 Contractor's Invoice and Contract Performance Statement. Requests for payment in accordance with the terms of the contract shall consist of:

(a) Contractor's Invoice on form NAVDOCKS 2311, revised July 1963, which shall show, in summary form, the basis for arriving at the amount of the invoice, and

(b) Contract Performance Statement on form NAVDOCKS 2312, April 1956, which shall show, in detail, the estimated cost percentage of completion, and value of completed performance, for each of the construction categories given hereinafter.

The format, content, and number of copies required shall be as further prescribed by the Officer in Charge and shall be subject to his approval. The submission of the required data shall not otherwise affect the contract terms. Forms NAVDOCKS 2311 and 2312 will be furnished by the Officer in Charge of Construction.

1A.13 Construction categories. The construction categories given below may be amended by the Officer in Charge, as necessary, during the course of the work. The following construction categories shall apply to all work covered by this specification:

PROGRAM	CATEGORY Prim.	Secondary	DESCRIPTION

1A.14 Government work and materials. Clause 42 of NAVDOCKS 113 including connection charges does not apply. The Government will furnish at no cost to the Contractor water, steam and electricity, at the nearest existing standard outlet at the job site for construction purposes and for use in performance test.

1A.15 Anti-Brokerage Provision.

1A.15.1 Performance of work by Contractor. The Contractor shall perform on the site, and with his own organization, work equivalent to at least 35 per cent of the total amount of the work to be performed under this contract. If during the progress of the work hereunder the Contractor requests a reduction in such a percentage, and the Contracting Officer determines that it would be to the Government's advantage, the percentage of the work required to be performed by the Contractor may be reduced; provided written approval of such reduction is obtained by the Contractor from the Contracting Officer.

1A.15.2 Statement of work to be performed by the Contractor. The successful bidder shall submit with his payment and performance bonds a description of the work which he will perform with his own organization (e.g.: earthwork, paving, brickwork, roofing), the percentage of the total work this represents, and the estimated cost thereof.

1A.16 Special conditions. The Water Treatment Plant shall be completed, tested and ready to place in service prior to renewal of existing well pumps. During construction, connections to the existing systems shall be accomplished in such manner as to minimize water and electrical outages. Temporary connections shall be provided when necessary to prevent outages in excess of eight hours. The Contractor shall submit for approval his proposed plan for accomplishing the changeover and the plan shall be approved prior to starting the work. When outages are required, the Contractor shall notify the Officer in Charge 72 hours in advance of the outage.

1A.17 Certificate of current cost or pricing data is required. (See also section entitled "Additional General Paragraphs".)

1A.18 Project identification signboard. A project identification signboard shall be provided. (See also section entitled "Additional General Paragraphs".)

1A.19 Identification. All catalog cuts, shop drawings, samples and other data submitted for approval by the Contractor shall specifically identify the specification paragraph or contract drawing by number where each item submitted is required to be provided. All submittals shall be clearly marked in ink to indicate the specific item(s) submitted for approval.

1A.20 The performance bond shall specifically provide coverage for taxes imposed by the United States which are collected, deducted, or withheld from wages paid by the Contractor in carrying out the contract with respect to which such bond is furnished.

1A.21 Disposal of materials and debris. Salvageable material removed from existing work shall remain the property of the Government and shall be delivered as directed. Distance of haul shall not exceed twelve miles. Upon completion of the work, the Contractor shall remove all debris from the site. All debris shall be hauled to a Government dump, a distance not exceeding one mile from the site of the work, and placed where directed and the premises shall be left free from all litter and refuse; exterior grounds shall be left in a raked, clean condition.

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SECTION 1B. ADDITIONAL GENERAL PARAGRAPHS

1B.1 Form of contract. The contract will be executed on Standard Form 23, January 1961 edition, Construction Contract, and will include Standard Form 19-A, April 1965 edition, Labor Standards Provisions, and Standard Form 23-A, June 1964 edition, General Provisions, and form NAVDOCKS 113, revised May 1965, Additional General Provisions. In Standard Form 23-A, first sentence of subparagraph (a) of Clause 19 is amended to delete the words "and Executive Order 10582, December 17, 1954 (3 CFR Supp.)". Clause 68 of form NAVDOCKS 113 is amended by adding the following to paragraph (a) just before the last sentence: "Should the Contractor fail to take appropriate action within a reasonable time, the Government may correct such defects and hold the Contractor responsible for the expenses incurred."

Clause 21 of Standard Form 23-A

(a) Clause 21 of Standard Form 23-A is amended by deleting references to the President's Committee on Equal Employment Opportunity, Executive Order 10925 of March 6, 1961, as amended, and Section 303 of Executive Order 10925 of March 6, 1961, as amended, and substituting therefor the Secretary of Labor, Executive Order No. 11246 of September 24, 1965, and Section 204 of Executive Order 11246 of September 24, 1965, respectively.

(b) Clause 21 of Standard Form 23-A is amended to insert after the reference to "Executive Order 10925" the following: "or the clause contained in Section 201 of Executive Order No. 11114."

(c) In accordance with regulations of the Secretary of Labor, the rules, regulations, orders, instructions, designations, and other directives issued by the President's Committee on Equal Employment Opportunity and those issued by the heads of various departments or agencies under or pursuant to any of the Executive Orders superseded by Executive Order 11246, shall, to the extent that they are not inconsistent with Executive Order 11246, remain in full force and effect unless and until revoked or superseded by appropriate authority. References in such directives to provisions of the superseded orders shall be deemed to be references to the comparable provisions of Executive Order 11246.

At the end of form NAVDOCKS 113, add the following new clause:

"70. MANDATORY INSURANCE COVERAGE

"(a) Within 15 days after the award of this contract, the successful bidder shall furnish to the OICC a certificate of insurance as evidence of the existence of the following insurance coverage in amounts not less than the amounts specified below:

Type of Insurance	Coverage		
	Per Person	Per Accident	Property
1. Comprehensive General Liability	$100,000	$300,000	$10,000
2. Automobile Liability	$100,000	$300,000	$10,000
3. Workmen's Compensation	As Required by State Law		
4. (Other as Required by State Law)			

The Comprehensive General and Automobile Liability policies shall contain a provision worded as follows:

> 'The insurance company waives any right of subrogation against the United States of America which may arise by reason of any payment under the policy.'

The certificate of all policies shall provide for notice of cancellation to the OICC and the certificates shall indicate that the above provision has been included.

"(b) The Prime Contractor shall also furnish such a similar certificate of insurance as evidence of the existence of such coverage for all subcontractors who will work on the job. This certificate shall be furnished not less than five days before such subcontractor forces enter the Government premises."

1B.2 Performance and payment bonds, executed on Standard Form 25, June 1964 edition, Performance Bond, and Standard Form 25-A, June 1964 edition, Payment Bond, will be required as stipulated on the reverse side of Standard Form 20, January 1961 edition, Invitation for Bids.

1B.3 Damages for delay. The Government will take no action pursuant to Clause 5 of Standard Form 23-A, Liquidated Damages, to terminate the right of the Contractor to proceed or to assess liquidated or actual damages where the failure of the Contractor to complete the work within the time specified is due solely to the operation of the priorities and allocations system and is not otherwise caused by fault or negligence of the Contractor. Such delays will be excusable within the meaning of Clause 5, and the Contractor will be entitled to a time extension by reason thereof.

1B.4 Specifications and standards. The specifications and standards referenced in this specification (including addenda, amendments, and errata listed) shall govern in all cases where references thereto are made. In case of difference between the referenced specifications and standards and this specification or its accompanying drawings, this specification and its accompanying drawings shall govern to the extent of such difference; otherwise, the referenced specifications and standards shall apply. The requirements for packaging, marking, and preparation for shipment or delivery included in the referenced specifications shall apply only to materials

and equipment that are furnished directly to the Government and not to materials and equipment that are to be furnished and installed by the Contractor. Unless specified otherwise in this specification, the requirements included in referenced specifications are modified as follows:

Radio-interference suppression: Not required.
Fungus control: Not required.
Identification or name plate: Manufacturer's standard acceptable.
Technical publications: Manufacturer's standard acceptable.
Production test model: In lieu of tests performed on a production test model, such tests, if required at the manufacturer's plant, shall be performed on the equipment being furnished under this specification.

When a number in parentheses is suffixed to a referenced Yards and Docks, Federal or Military specification or standard symbol, it denotes the effective amendment or change to the document.

Referenced specifications or standards, other than Yards and Docks, Federal, and Military, are not available for distribution by the Department of the Navy. Requests therefor should be made to the issuing organization. They may be examined at the office where the bids are being received.

1B.5 Work outside regular hours. If the Contractor desires to carry on work outside the regular hours or on Saturdays, Sundays, or holidays, he shall submit application to the Officer in Charge, but shall allow ample time to enable satisfactory arrangements to be made by the Government for inspecting the work in progress. At night, he shall light the different parts of the work in an approved manner.

1B.6 Optional requirements. Where a choice of materials and/or methods is permitted herein, the Contractor will be given the right to exercise the option unless stated specifically otherwise.

1B.7 Definitions. Where "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that reference is made to the drawings accompanying this specification unless stated otherwise. Where "as directed", "as required", "as permitted", "approved", "acceptance", or words of similar import are used, it shall be understood that the direction, requirements, permission, approval, or acceptance of the Officer in Charge of Construction is intended unless stated otherwise. As used in this specification, "provide" shall be understood to mean "provide complete in place", that is, "furnish and install".

1B.8 Security requirements. No employee or representative of the Contractor will be admitted to the site of the work unless he furnishes satisfactory proof that he is a citizen of the United States, or, if an alien, his residence within the United States is legal.

1B.9 Methods and schedules of procedures. The work shall be exe-

cuted in a manner and at such times that will cause the least practicable disturbance to the occupants of the buildings and the normal activities of the station. Before starting any work, the sequence of operations and the methods of conducting the work shall have been approved.

1B.10 Approval of samples, cuts, and drawings. Matter submitted for approval shall be accompanied by complete information concerning the material, articles, and/or design proposed for use in sufficient detail to show compliance with the specification, and shall be approved before incorporation into the work. Approval thereof will not be construed as relieving the Contractor of compliance with the specification, even if such approval is made in writing, unless the attention of the Officer in Charge is called to the noncomplying features by letter accompanying the submitted matter. Partial submittals or submittals of less than the whole of any system made up of interdependent components, will not be considered. Approval of drawings, cuts, and samples by the Officer in Charge shall not be construed as a complete check or approval of the detailed dimensions, weights, gauges and similar details of the proposed articles. The conformance of such details with the contract requirements, together with the necessary coordination of dimensions and details between the various elements of the work and between the various subcontractors and suppliers, shall be solely the responsibility of the Contractor, approval of submitted matter notwithstanding.

1B.11 Operation of station utilities. The Contractor shall not operate nor disturb the setting of any control devices in the station utilities system, including water, sewer, electrical and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor shall notify the Officer in Charge, giving reasonable advance notice when such operation is required.

1B.12 Examination of premises. Before submitting proposals, bidders are expected to visit and inspect the site of the work and satisfy themselves as to the physical conditions at the site; the general and local conditions, including availability of labor; the nature and extent of the work; the character and effect of existing adjoining and/or adjacent work; and other factors that can affect the cost of the performance of the contract to the extent that such information is reasonably obtainable.

1B.13 Changed conditions. Wherever changed conditions as defined in Clause 4 of Standard Form 23-A are encountered, and wherever conditions exposed during the course of the work necessitate a change from quantities indicated or specified as either estimated quantities or as a basis for bids, whether or not provision for a change in price for such variation is specified, the Officer in Charge must be notified in writing and written directions to do so must be obtained before quantities stated in the contract documents are exceeded.

1B.14 Protection and repairs. The Contractor shall comply with the fire prevention requirements, security rules, and regulations of the activity; and shall provide approved means necessary for the protection of

all Government and private property, including contents of buildings affected directly or indirectly by his operations. All damage to Government or private property, resulting directly or indirectly from the Contractor's actions, shall be made good by him without expense to the Government.

1B.15 Existing work damaged or otherwise affected by the Contractor's operations shall be restored to a condition as good as existed before the work was commenced, except where indicated or specified otherwise. Where new construction adjoins, connects to, or abuts the existing work, the junction shall be made in a substantial workmanlike and weathertight manner as the case requires. All new work shall match, as nearly as practicable, the existing adjoining and/or adjacent similar work unless indicated or specified otherwise. Except where specifically designated as being retained by the Government or to be reinstalled in the new construction, all materials, fixed equipment, and debris resulting from demolition and removal operations, shall be removed by the Contractor from the limits of the Government reservation at such times during the progress of the work as directed.

1B.16 Lines and grades required for execution of the work shall be established by the Contractor starting from a bench mark established by the Government.

1B.17 Payrolls and affidavits. The Prime Contractor, subcontractor, and sub-subcontractors will be required to submit a copy of each weekly payroll together with a Contractor's Weekly Statement of Compliance covering the payroll to the Officer in Charge of Construction within seven days after the regular payment date of the payroll period. The receipt of these payrolls and statements is made a condition precedent to payment for any amounts due under the contract.

1B.17.1 Payroll. The payroll shall be identified by the name of the Contractor, contract number, and the location of the site of the work. Payrolls shall state accurately and completely for each employee, his name, classification, social security number, rate of pay, daily and weekly hours worked, wages earned, all deductions from such wages and the actual weekly wages paid. Contractors are required to submit employee's address with the payroll on which the employee's name first appears.

1B.17.2 Contractor's Weekly Statement of Compliance shall be executed on the form furnished for the purpose by the Officer in Charge. Contractors shall list by title or name, all deductions made, omitting from the listing the dollar amount of the deductions.

1B.17.3 A sworn affidavit accomplished by the Contractor, stating that he and his subcontractors have complied with the labor standards provisions of the contract, must accompany each request for reimbursement. Affidavit form will be furnished by the Officer in Charge of Construction.

1B.18 Subcontractors and personnel. Promptly after the award of the contract, the Contractor shall submit to the Officer in Charge of Construc-

tion, in triplicate, a list of his subcontractors and the work each is to perform. On this form shall appear the names of the key personnel of the Contractor and subcontractors, together with their home addresses and telephone numbers, for use in event of any emergency. From time to time as changes occur and additional information becomes available, the Contractor shall amplify, correct, and change the information contained in previous lists.

1B.19 Storm protection. Should warnings of winds of gale force or stronger be issued, the Contractor shall take every practicable precaution to minimize danger to persons, to the work, and to adjacent property. The precautions shall include closing all openings, removing all loose materials, tools and/or equipment from exposed locations; and removing or securing scaffolding and other temporary work.

1B.20 Safety requirements. A copy of the Department of the Army, Corps of Engineers, "General Safety Requirements", referenced in Clause 28 of form NAVDOCKS 113, may be examined or obtained on application to the office where the bids are being received. Prior to starting the work, the Contractor shall meet in conference with representatives of the Officer in Charge to discuss and develop mutual understandings relative to administration of the safety program.

1B.21 As-built drawings. On completion of the work, one print of each of the drawings accompanying this specification shall be neatly and clearly marked in red to show all variations between the construction actually provided and that indicated or specified in the contract documents, and delivered to the Officer in Charge. Where a choice of materials and/or methods is permitted herein, and where variations in the scope or character of the work from the entire work indicated or specified are permitted either by award on bidding items specified for that purpose or by subsequent change to the contract, the as-built drawings shall define the construction actually provided. The representation of such variations shall conform to standard drafting practice and shall include such supplementary notes, legends, and details as may be necessary for legibility and clear portrayal of the as-built construction; the marked prints shall be subject to approval before acceptance.

1B.22 Responsibility for testing. Where tests are specified to be made by the Government, the Government will make the initial tests at its expense. Should the initial samples fail to meet the requirements of the specifications, all succeeding tests of additional samples shall be made by an approved testing laboratory or agency at the expense of the Contractor.

1B.23 Schedule of prices. Unless otherwise specified in the section entitled "General Paragraphs", upon receipt of a notice of award, the Contractor shall prepare a detailed breakdown of the contract price, giving the quantities of the various kinds of work and the unit and total prices therefor. This breakdown shall be submitted promptly to the Officer in Charge on form NAVDOCKS 83, revised August 1963, Schedule of Prices, in

octuplicate. The forms will be furnished by, and shall be executed in a manner satisfactory to, the Officer in Charge of Construction. The submission of this breakdown will not affect the contract terms.

1B.24 Prints furnished to Contractor. Five one-half size prints and one set of full-size reproducibles of each drawing accompanying this specification will be furnished the Contractor without charge. Additional prints and full-size prints required by the Contractor shall be reproduced by him at his own expense.

1B.25 Priorities, allocations, and allotments. The Contractor agrees, in the procurement and use of materials required for the performance of this contract, to comply with the provisions of all applicable rules and regulations of the Business and Defense Services Administration, including Defense Materials System regulations. If the initial contract price hereunder does not exceed $100,000, this project is made a rated order pursuant to DMS Regulation 1 and is assigned DO rating C-2 unless a higher rating is specified in the section entitled "General Paragraphs". The Contractor is hereby made a self-authorizing Contractor as defined in Section 3(g) of that regulation and is required to use the self-authorization provision of Section 9 in obtaining controlled materials, as well as products and materials other than controlled materials needed to fill this rated order.

1B.26 Location of underground utilities. Where existing piping, utilities, and underground obstructions of any type are indicated in locations to be traversed by new piping, ducts, and other work provided hereunder, and are not indicated or specified to be removed, the elevations of the existing utilities and obstructions shall be determined before the new work is laid closer than the nearest manhole or other structure at which an adjustment in grade could be made. For any additional work required by reason of conflict between the new and existing work, an adjustment in contract price will be made in accordance with Clause 4 of Standard Form 23-A.

1B.27 Notice regarding Buy American Act (September 1962).

(a) The Department of Defense has changed its Buy American Act rules. Generally speaking, exception from the Buy American Act will be permitted only in the case of nonavailability of domestic construction materials. A bid or proposal offering nondomestic construction material will not be accepted unless specifically approved by the Office of the Secretary of Defense.

(b) Where it is proposed to furnish nondomestic construction material, bids or proposals shall set forth an itemization of the quantity, unit price, and intended use of each item of such nondomestic construction material. When offering nondomestic construction material pursuant to this paragraph, bids or proposals may also offer, at stated prices, any available comparable domestic construction materials, so as to avoid the possibility that failure of a nondomestic construction material to be acceptable

under this paragraph will cause rejection of the entire bid.

1B.28 Availability of utility services. In accordance with Clause 42 of form NAVDOCKS 113, as modified herein, electric and water service will be made available to the Contractor at the nearest available existing outlets at prevailing Government rates which may be obtained upon application to the Commanding Officer. The Contractor will be required to furnish all labor, equipment and materials to make utilities connections and to furnish and install valves, transformers, and meters for each service. The Contractor shall determine that each source is adequate and suitable for requirements of his equipment before making connection and on completion, shall reinstate all utility sources used to their original condition or a condition satisfactory to the Officer in Charge. No guaranty of any kind is made as to the continuity and level of the supply of such utility services. They will be reduced or suspended as the needs of the Government require and the Government shall not be liable for any damages sustained as a result of such reduction or suspension, nor for any failure of the supply lines to the Contractor's connections. Unless specified otherwise in section entitled "General Paragraphs", final connections to existing utilities shall be made by the Contractor under the direct supervision of Government personnel.

1B.29 Minimum wage rates and other labor standards. Any class of laborers and mechanics not listed in the Secretary's decision, which will be employed on the contract, shall be classified or reclassified by the Contractor or subcontractor conformably to the Secretary's decision, subject to the approval of the Contracting Officer. Mechanics and laborers shall be classified in conformance with prevailing practice. In the event of any difference between the Contractor and the Government concerning the proper wage rates to be paid, the classification of employees to conform to prevailing practice, the amount of wages due employees, or any other application or interpretation of the labor standards provisions of this contract, the difference shall be referred to the Contracting Officer (the Commander of the Naval Facilities Engineering Command or his specially authorized representative), and the Contracting Officer shall determine the matter with advice from and reports to the Secretary of Labor as required by Department of Labor regulations. This determination shall not be appealable under the Disputes clause, and the Contractor shall comply promptly with the determination of the Contracting Officer. If the Contracting Officer determines that the Contractor has not satisfied his obligations under the labor standards provisions of the contract, the Contracting Officer will forward a report on the violations to the Department of Labor and the Comptroller General for appropriate action.

1B.29.1 Investigation of labor conditions. The wage determination decision of the Secretary of Labor attached hereto, or included by addendum, is made a part of this contract solely for the purpose of setting forth the minimum hourly wage rates required to be paid by the Davis-Bacon Act and is not to be considered as a guaranty, warranty, or representation as to the wage determination decision, the wage rates therein, the prevail-

ing wages, or the availability of labor at the wage rates indicated. Bidders are advised to make their own investigations and to rely solely upon their own information as to local labor conditions, such as wage rates necessary to attract labor, the length of the workday and workweek, overtime compensation, health and welfare contributions and available labor supply, and as to prospective changes or adjustments of wage rates or employment conditions in the area concerned that might affect the operations under the contract. Neither a mistake in attaching the wage determination decision of the Secretary of Labor or in the determination or statement of the wage rates set forth therein shall entitle the bidder to the cancellation of his bid or contract, to an increase in the contract price, or to other additional payment or recovery, except when the Contracting Officer modifies the specified wage rates and when the requirements of subparagraph 1B.29.2 below are satisfied.

1B.29.2 Modification of minimum wage rates. The Contracting Officer reserves the right to require the Contractor to pay the minimum wages set forth in the wage determination that is applicable to this contract and in effect at the time of award (irrespective of the wage rates set forth in the specification) and, if necessary, to modify the contract accordingly. The Government shall not be liable to the Contractor to increase the contract price or to make any other additional payment as a result of any such modification made by the Contracting Officer in the specified wage rates, except that an equitable contract price adjustment shall be made (1) when the Contractor clearly demonstrates that his investigation of the wage rates at the site did not, and that a reasonable investigation could not, disclose that wage rates higher than those previously specified would have to be paid, and (2) when the Contractor clearly demonstrates that he actually and reasonably based his bid or proposal upon wage rates lower than those required to be paid by such modification.

1B.29.3 Apprentices employed pursuant to the wage determination decision contained in this contract must be registered in a bona fide apprenticeship program registered with a state apprenticeship council recognized by the Federal Committee on Apprenticeship, U. S. Department of Labor, or if no such recognized council exists in a state, a program registered with the Bureau of Apprenticeship, U. S. Department of Labor. The ratio of apprentices to journeyman mechanics shall not exceed that recognized by the agency of registry as prevailing.

1B.29.4 Posting of wage rates. Where compliance with Clause 1 of Standard Form 19-A requires posting the wage determination decision in an exterior location, it shall, along with other documents required to be similarly posted, be displayed in a weatherproof display case.

1B.30 North Carolina Sales and Use Tax

(a) As used throughout this clause, the term "materials" means building materials, supplies, fixtures and equipment which become a part of or are annexed to any building or structure erected, altered, or re-

paired under this contract.

(b) If this is a fixed-price type contract as defined in the Armed Services Procurement Regulation, the contract price includes North Carolina sales and use taxes to be paid with respect to materials, notwithstanding any other provision of this contract. If this is a cost-reimbursement type contract as defined in such regulation, any North Carolina sales and use taxes paid by the Contractor with respect to materials shall constitute an allowable cost under this contract.

(c) At the time specified in paragraph (d) below:

(i) The Contractor shall furnish the Contracting Officer certified statements setting forth the cost of the materials purchased from each vendor and the amount of North Carolina sales and use taxes paid thereon. In the event the Contractor makes several purchases from the same vendor, such certified statement shall indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices and the North Carolina sales and use taxes paid thereon. Such statement shall also include the cost of any tangible personal property withdrawn from the Contractor's warehouse stock and the amount of North Carolina sales or use tax paid thereon by the Contractor. The Contractor shall furnish such additional information as the Commissioner of Revenue of the State of North Carolina may require to substantiate a refund claim for sales or use taxes.

(ii) The Contractor shall obtain and furnish to the Contracting Officer similar certified statements by its subcontractors.

(d) If this contract is completed before the next July 1, the certified statements to be furnished pursuant to paragraph (c) above shall be submitted within 60 days after completion. If this contract is not completed before the next July 1, such certified statements shall be submitted on or before the 31st day of August of each year and shall cover taxes paid during the twelve month period which ended the preceding June 30.

(e) The certified statements to be furnished pursuant to paragraph (c) above shall be in the following form:

I hereby certify that during the period _____ to _____, (name of contractor or subcontractor) paid North Carolina sales and use taxes aggregating $_____ with respect to building materials, supplies, fixtures and equipment which have become a part of or annexed to a building or structure erected, altered or repaired by (name of contractor) for the United States of America, and that the vendors from whom the property was purchased, the dates and numbers of the invoices covering the purchases, the total amount of the invoices of each vendor, the North Carolina sales and use taxes paid thereon, and the cost of property withdrawn from warehouse stock and North Carolina sales or use taxes paid thereon are as set forth in the attachments hereto.

1B.31 Quarantine for white-fringed beetles. The entire Camp Lejeune reservation (including Camp Geiger) and the Marine Corps Air Facility, New River, have been quarantined by the United States and North Carolina Departments of Agriculture for the white-fringed beetle. Compliance with the quarantine regulations established by these authorities as set forth in the U.S.D.A. Quarantine No. 72 and North Carolina State Quarantine No. 7 is required for operations hereunder. Pertinent requirements of the quarantines include the following:

(a) Certification is required for the following articles and they shall not be moved from the reservation unless accompanied by a valid inspection certificate issued by an authorized white-fringed beetle inspector.

(1) Soil, sand or gravel moved independently or attached to other articles, such as heavy equipment including draglines, road-grading machines, ditch diggers, bulldozers, and equipment with tracks or cleats.

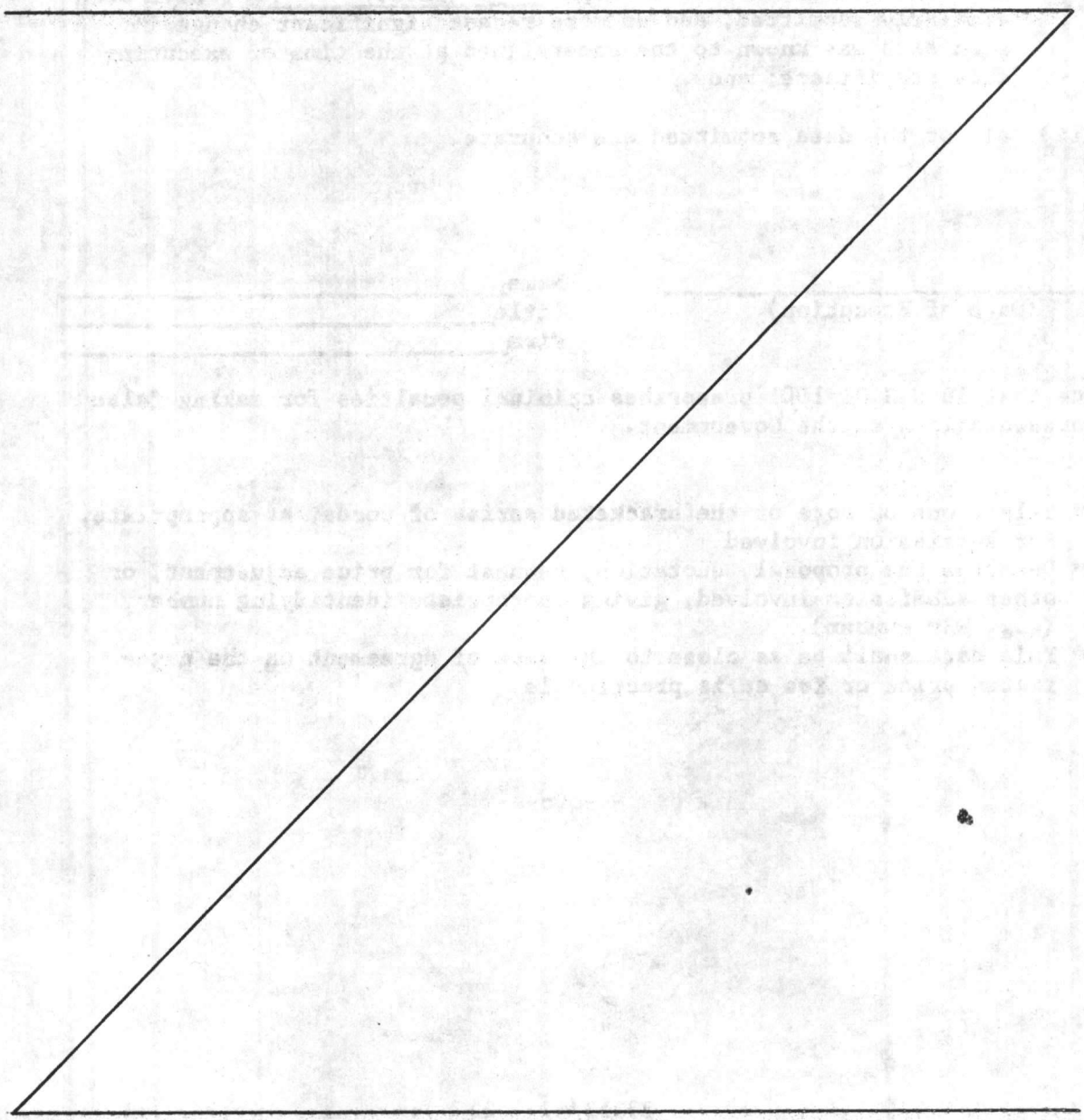
(2) Nursery stock, plants and sod.

(3) Scrap metal.

Authorization for movement of equipment shall be obtained from the Officer in Charge, and requests for inspection shall be made sufficiently in advance of the date of movement to permit arrangements for the services of authorized inspectors. The equipment shall be prepared and assembled so that it may be readily inspected. Articles and materials requiring certification for movement shall be removed from the equipment by washing with water and such other means as necessary to accomplish complete removal. Resulting spoil shall be wasted as directed.

1B.32 Project identification signboard. A project identification signboard shall be provided. The signboard shall be 4 feet high by 8 feet long constructed at a conspicuous location on the job site where directed by the Officer in Charge. The field of the sign shall consist of one 4-foot by 8-foot sheet of grade B-B, medium density overlaid exterior plywood, not less than 1/2 inch thick. The signboard shall have a 2-inch by 2-inch frame applied to the face surface of the field and nailed from the back of the field with 6 penny galvanized nails. Corners of frame shall be mitered and nailed. A 3/4-inch quarter round shall be provided next to the 2-inch by 2-inch frame on the inner side and nailed with 6 penny finish nails, set and puttied. The completed signboard shall be secured to two 4-inch by 4-inch posts with 10 penny aluminum nails, 6 inches on centers, driven slightly recessed and puttied. The signboard shall be mounted with the bottom 4 feet, 6 inches above grade. The posts shall be set 3 feet into the ground and tamped tight. Each post shall extend to the top of the signboard and shall have a 2-inch by 4-inch diagonal brace nailed to the top of the post extending down to a 3 foot, 2-inch by 4-inch stake driven 2 feet, 6 inches into the ground. A 2-inch by 4-inch strut shall be provided from brace to brace midway from top to bottom, and nailed at each brace with

three 10 penny nails. The posts shall be set 5 feet center to center. All lumber shall be B or Better Southern pine, pressure-preservative treated with pentachlorophenol. All nails shall be aluminum or galvanized steel. The entire signboard and supports shall be given one coat of exterior oil primer and two coats of exterior lead and oil paint. The lettering and sign work shall be performed by a skilled sign painter using paint known in the trade as bulletin colors. The 2-inch by 2-inch frame shall be painted black, the quarter round shall be painted gray, and the lettering shall be single stroke using bulletin blue. The lettering style shall be "Gothic", "Roman capitals", or "Thick and Thin" styles.



1B. Certificate of current cost or pricing data. Where a certificate of cost or pricing data is required, it shall be submitted in triplicate in the form set forth below:

This is to certify that, to the best of my knowledge and belief:

(i) complete /pricing data/ /and/ /cost data/* current as of _____(Date)_____ have been considered in preparing the _____** and submitted to the Contracting Officer or his representative;

(ii) all significant changes in the above data which occurred since the aforementioned date through _____(Date)_____*** have been similarly submitted; and no more recent significant change in such data was known to the undersigned at the time of executing this certificate; and

(iii) all of the data submitted are accurate.

_____
(Date of Execution)

Name_____
Title_____
Firm_____

Note that 18 U.S.C. 1001 prescribes criminal penalties for making false representations to the Government.

* Select one or more of the bracketed series of words, as appropriate, for submission involved.

** Describe the proposal, quotation, request for price adjustment, or other submission involved, giving appropriate identifying number (e.g. NBy number).

*** This date shall be as close to the date of agreement on the negotiated price or fee as is practicable.

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SECTION 1C. BIDS

1C.1 Instructions to Bidders, Standard Form 22, June 1964 edition, and Invitation for Bids, Standard Form 20, January 1961 edition, shall be observed in the preparation of bids. Bidders shall affix their names and return addresses in the upper left corner of bid envelopes. Envelopes containing bids must be sealed.

1C.2 Bid guaranty will be required as stipulated on the reverse side of Standard Form 20.

1C.3 Items of Bids. Bids shall be submitted, in duplicate, on Standard Form 21, June 1964 edition, Bid Form, and in accordance with Standard Forms 20 and 22 upon the following item(s):

Item 1. Price for the entire work, complete in accordance with the drawings and specifications.

1C.4 Telegraphic modifications of bids in accordance with Standard Form 22 may be made. Two signed copies of the telegram in a sealed envelope marked "Copies of telegraphic modification of bid for Water Treatment Plant, Courthouse Bay, Specification No. 88313/67" should be forwarded immediately to the office to which the written bids were submitted.

1C.5 Reference to addenda. Each bidder shall refer in his bid to all addenda to this specification; failure to do so may constitute an informality in the bid.

NOTICE

The Government forms, Bureau of Yards and Docks/NAVFAC standard specifications mentioned, and other information necessary may be obtained from the Commander, Atlantic Division, Naval Facilities Engineering Command, Naval Station, Norfolk, Virginia 23511. The remainder of the standard specifications and other material referred to may be examined at that office or at the Public Works Office, Marine Corps Base, Camp Lejeune, North Carolina, or the standard Government specifications may be obtained from the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120; requests for copies of specifications should indicate the contract for which required.

Atlantic Division, Naval Facilities Engineering Command
Naval Station, Norfolk, Virginia 23511
24 August 1967

H. N. WALLIN, RADM, CEC, USN
Officer in Charge of Construction

DIVISION 2. SITE WORK

SECTION 2A. Earthwork
2B. Drainage
2C. Concrete Paving
2D. Asphaltic Concrete Pavement
2E. Sanitary Sewer
2F. Fencing
2G. Establishing Vegetation

SECTION 2A. EARTHWORK

2A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

NON-GOVERNMENT

American Association of State Highway Officials (AASHO)

T180-57 Moisture-density relations of soils using a 10-pound rammer and an 18-inch drop

American Society for Testing and Materials (ASTM)

D1556-64 Density of soil in place by the sand-cone method

2A.2 Elevations and obstructions. Bids shall be based on the following:

(a) that the surface elevations are as indicated;

(b) that no pipes or other artificial obstructions, except those indicated, will be encountered; and

(c) that hard material will not be encountered.

In case the actual conditions differ substantially from those stated and/or shown, the provisions respecting an adjustment for changed conditions shall apply, subject to the requirement of notification thereunder being given. Hard material shall be defined as solid ledge rock, boulders more than one-half cubic yard in volume or any cemented material requiring blasting for removal.

2A.3 Clearing and grubbing. Trees, woods, shrubbery, and other symbols indicating vegetation are not all inclusive and are shown in approximate locations only. Pine trees over 4 inches in diameter, hardwood trees

and natural shrubbery of ornamental value which do not interfere with the new construction shall be retained. Extra care shall be taken to protect ornamental trees and shrubbery adjacent to water distribution [redacted] along Marines Road.

2A.3.1 Clearing shall be performed within the following limits:

(a) Five feet outside of chain link fence.

(b) As necessary for construction in other areas.

2A.3.2 Clearing shall include the cutting, removal and disposal of all trees, brush and undergrowth within the clearing limits specified. All trees and vegetable growth shall be cut off flush with the ground.

2A.3.3 Grubbing shall be performed within the entire area designated for clearing. All stumps shall be removed. Roots and matted roots shall be removed to a depth of 18 inches below bottom of foundations; to a depth of 12 inches below subgrade or under fill for roads or parking areas; to a depth of 6 inches below trench bottoms; and to a depth of 6 inches below subgrade or natural ground within remaining areas.

2A.3.4 Disposal of cleared and grubbed material.

(a) Trees from which saw logs, pulpwood, posts, poles or ties can be produced shall be considered merchantable timber. All merchantable timber shall be trimmed of limbs and tops, shall be sawed into merchantable lengths and stockpiled on the site where directed.

(b) All shrubs, brush, stumps, matted roots, refuse and other objectionable material will be considered debris and shall be disposed of as specified elsewhere.

2A.4 Topsoil shall be removed from the entire area of all structures having slab on fill and from all excavations having material suitable for topsoil. Topsoil shall be deposited in piles separate from other excavated material and shall be so located that the material may be used readily for finish surface grading and shall be protected and maintained until needed. Topsoil shall be spread to a uniform thickness of 4 inches over the ground within the fenced area and in the areas where natural soil condition has been disturbed by this contract.

2A.5 Shoring and pumping. Excavations shall be shored and braced by members of suitable size and arrangements where necessary to prevent danger to persons or structures, injurious caving and erosion. Shoring, bracing and sheeting shall be removed as excavations are backfilled in a manner to prevent injurious cavings. Excavations shall be kept free from water while construction therein is in progress.

2A.6 Location and protection of existing utility lines.

2A.6.1 Location of existing utility lines are shown approximately. It shall be the Contractor's responsibility to locate accurately these lines prior to the use of mechanical equipment for excavation purposes. All underground electrical and telephone cables crossing excavations shall be protected by supporting in an enclosed box.

2A.6.2 Where existing piping, utilities and underground obstructions of any type are indicated in locations to be traversed by new piping and other work provided hereunder, and are not indicated or specified to be removed, the elevation of the existing utilites and obstructions shall be determined before the new work is laid closer than the nearest manhole or other structure at which an adjustment in grade could be made. For any additional work required for reason of conflict between the new and existing work, the provisions of the contract respecting an adjustment for changed conditions shall apply, subject to the requirement of notification thereunder being given.

2A.7 Excavation general. Excavations shall be made to the lines and grades indicated and shall extend a sufficient distance from walls and footings of structures to allow for placing and removing of forms, installation of services and for inspection.

2A.7.1 Unsuitable material. Materials encountered in excavation at the subgrade indicated, that are determined unsuitable by the Officer in Charge for support of structures, utilities or pavement, shall be excavated to satisfactory material as directed. The excavation shall be backfilled to subgrade with thoroughly compacted suitable fill, or if the Contractor is so directed, shall be backfilled with concrete at the time foundations of structures are poured. For such required additional work, the provisions of the contract respecting an adjustment for changed conditions shall apply, subject to the requirement of notification thereunder being given.

2A.7.2 Overexcavation. Should excavation be carried below the lines and grades indicated, due to error on the part of the Contractor, he shall at his own expense backfill to subgrade with thoroughly compacted suitable material or if so directed, concrete footings for buildings, structures and equipment shall be extended with concrete to the bottom of the excavation.

2A.7.3 Excavation for trenches. Trenches for pipe lines, conduits and cable shall be excavated to line and grade and, unless indicated otherwise, shall provide a minimum of 6 inches between the outside of the pipe and the sides of the trench or bracing, with a minimum width of trench of 2 feet. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of pipe or conduit and shaped to fit the lower one-fourth of the circumference of the pipe or conduit on firm soil throughout its length, except for portions of the pipe sections where it is necessary to excavate for bell holes and the proper sealing of joints. Such excavations shall be made after trench bottom has been graded. Minimum cover, unless indicated or specified otherwise, shall be 2 feet.

2A.8 Filling, backfill and grading.

2A.8.1 All backfill about the structures shall be placed, as far as practicable, as the work progresses, except that backfilling against foundation walls shall be done only when directed.

2A.8.2 Embankment fill and backfill shall be constructed of approved materials and shall be free from vegetable matter, roots, refuse or other unsuitable material and the moisture content shall be of such that proper compaction will be obtained. If the mixture is excessively moistened by rain, it shall be aerated until the moisture content of the mixture is satisfactory. Fill shall be placed in layers of not more than 6-inch thickness and thoroughly compacted to a minimum density of 95 per cent at optimum moisture content as specified hereinafter. In all areas not accessible to rollers or compactors, the mixture shall be compacted with pneumatic hand tampers. The surface of the layer shall be finished by blading and rolling or a combination thereof, and shall be smooth and free from waves and inequalities.

2A.8.3 Trench backfill. As soon as practicable after the pipe has been installed and joints have acquired a suitable degree of hardness, backfilling of the space between pipe and sides of the trench shall be packed by hand shovel with selected sand and thoroughly compacted with hand tamper as fast as placed up to a level one foot above top of pipe. The fill shall be placed uniformly on both sides of the pipe and neither horizontal nor vertical alignment of the pipe shall be disturbed. The remainder of the trench shall be filled with clean earth free from vegetable or other objectionable material and thoroughly compacted in layers not exceeding 12 inches in depth by rolling or mechanical tamping; except that under all roadways, service drives, sidewalks, and other traveled areas, backfill shall be compacted by mechanical tamping in 6-inch layers for the entire depth of the trench. Excavations under concrete sidewalks shall be thoroughly compacted by mechanical tamping. If required, the backfill material shall be wet by sprinkling before rolling or tamping. Care shall be taken that lumps shall not become nested and that all voids between lumps shall be completely filled with fine material. No large masses of backfilling material shall be dropped into the excavation, as from a grab bucket, in such manner as to disturb pipe or structure.

2A.8.4 Grading. The Contractor shall perform all grading in the areas so indicated. Fill shall be brought to finished grades indicated and shall be graded to drain water away from structures. Existing grades which are to remain and which are disturbed by the Contractor's operations shall be graded to provide surfaces suitable for the proper use of mowing machines.

2A.9 Borrow required shall be taken only from approved locations. Borrow pits shall be so excavated that drainage is provided and shall not be left in an unsightly or unsanitary condition. Maximum haul for borrow shall not exceed one mile.

2A.10 Disposal of surplus material. Surplus material not required or unsuitable for fill, backfill, or grading shall be wasted as directed; waste haul shall not exceed one mile.

2A.11 Compaction tests. Wherever in the specifications percentages of density are called for, the maximum density at optimum moisture content shall be determined in accordance with AASHO Standard Method T180. Determination of density of soil in place shall be made in accordance with ASTM Designation D1556. Compaction tests will be performed by the Government at no expense to the Contractor.

2A.12 Pavement cuts. Where necessary to cut pavement for the installation of any type utility, the pavement shall be cut on straight lines. After the utility has been installed, trenches shall be backfilled with clean, refuse-free material placed in 6-inch layers with each layer thoroughly tamped with a mechanical tamper. All backfill shall be compacted to a density of 95 per cent at optimum moisture content as specified. Repairs shall be made as follows:

2A.12.1 Asphaltic concrete pavement. The top 12 inches from finished grade shall be crushed stone, crowned over one inch above the existing pavement and left open to traffic for a minimum period of 14 days. Any subsidence shall be promptly repaired. No paving material from the cut shall be used in the trench repair. At the end of the 14-day period, excess stone shall be removed and 1-1/2 inches of asphaltic concrete pavement shall be placed in the cut to 1/4 inch above the existing pavement and featheredged on each side and compacted. Materials and workmanship shall be as specified in Section 2D, Asphaltic Concrete Pavement.

2A.12.2 Concrete sidewalks. Existing walks, when cut, shall be removed back to the nearest construction or dummy joint and renewed. Sidewalks shall be renewed to the same thickness as existing sidewalks, but in no case shall be less than 4 inches thick. Materials and workmanship shall be as specified in Section 3A, Concrete Construction.

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SECTION 2B. DRAINAGE

2B.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

13Yh Concrete construction; including addendum no. 1
42Yc Drainage, sanitary, electrical, and water service appurtenances

NON-GOVERNMENT

American Society for Testing and Materials (ASTM)

C76-65T Reinforced concrete culvert, storm drain and sewer pipe

2B.2 General requirements. Storm drainage pipe shall be concrete or cast iron pipe, as indicated. Drainage structures shall be in accordance with specification 42Y, except as indicated otherwise. Excavation and backfilling for piping and structures are specified in the section entitled "Earthwork".

2B.3 Reinforced concrete pipe shall conform to ASTM specification C76, table III. Flared end section shall be the standard product of the pipe manufacturer and shall be manufactured of the same material as specified for the pipe.

2B.4 Cast-iron drainage pipe shall be extra heavy cast-iron soil pipe. Materials and installation shall be as specified in the section entitled "Plumbing".

2B.5 Laying pipe. Pipe shall be graded carefully and shall be supported firmly and uniformly at its proper elevation. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and prevent sudden offsets of the flow line. As the work progresses, the interior of the pipe shall be cleaned of dirt and superfluous materials of every description. Trenches for mortar-jointed pipe shall be kept free from water until the mortar has set, and no pipe shall be laid when the condition of the trench or the weather is unsuitable for such work. Open ends of the pipe shall be kept securely closed when work thereon is not in progress.

2B.6 Joints for concrete piping.

2B.6.1 Mortar shall be a mixture of portland cement, sand, and water mixed in the proportion by volume of one part portland cement to two parts of clean sand. Water in the mix shall not exceed six gallons per sack of

cement. Water shall be clean and free of injurious acids, alkalies, and organic impurities. Mortar shall be used within thirty minutes from the time the ingredients are mixed with water.

2B.6.2 Gasket-type joints for bell-and-spigot concrete pipe shall be made with mortar and picked oakum or hemp gaskets dipped in neat portland cement grout. The bell and the spigot of abutting pipes at the joint shall be cleaned with a wet brush before installing gasket and mortar. The gaskets shall be rammed compactly in place with a wood yarning tool. After the gasket is in place, mortar shall be pressed firmly into the joint and finished to a neat 45-degree bevel from the top of the bell to the spigot barrel. The interior of all joints shall be cleaned of surplus mortar. After finishing, the outside of each joint shall be covered carefully and shall be kept damp until just prior to backfilling.

2B.6.3 Joints in tongue-and groove pipe. Tongue-and-grooved ends of abutting pipe shall be cleaned with a wet brush before placing mortar. Mortar shall be placed in sufficient quantities so that when the pipe is inserted into the line the joint space will be completely filled and a bead of mortar will be formed on the outside. The interior of each joint shall be cleaned of surplus mortar and finished flush with the interior surfaces of the pipe. The outside of each joint shall be kept damp until just prior to backfilling.

2B.7 Drainage appurtenances including manholes and catch basins shall conform to the applicable requirements of specification 42Y. Concrete shall be class D-1 in accordance with specification 13Y. Walls shall be common brick as specified in BRICK AND CONCRETE MASONRY section.

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SECTION 2C. CONCRETE PAVING

2C.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

4Yg Portland cement concrete pavement (except for airplane traffic)

NON-GOVERNMENT

American Society for Testing and Materials (ASTM)

D1751-65 Preformed expansion joint filler for concrete paving and structural construction (nonextruding and resilient bituminous types)

2C.2 General requirements. The work includes the provision of a reinforced concrete pavement for ramp to salt storage tanks.

2C.3 Materials, proportioning, mixing, conveying, placing and curing shall conform to the applicable requirements of specification 4Y, except as indicated or specified otherwise.

2C.3.1 Concrete shall be class E-1.5.

2C.3.2 Reinforcement shall be standard wire mesh reinforcement of size indicated.

2C.3.3 Expansion joint material shall be preformed filler conforming to ASTM D1751.

2C.4 Finishing shall be by the mechanical or hand finishing method. Final surface finish shall be by brooming or burlap-drag.

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SECTION 2D. ASPHALTIC CONCRETE PAVEMENT

2D.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

SS-A-706b (1)	Asphalt; (for use in) road and pavement construction
SS-C-731a (2)	Crushed-stone, crushed-gravel, and crushed-slag; (for) bituminous-concrete-base or surface-course
SS-S-71a	Sand; (for use in) sheet-asphalt or bituminous-concrete pavements

NON-GOVERNMENT

American Association of State Highway Officials (AASHO)

M17-42	Mineral filler for sheet asphalt and bituminous concrete pavements
M156-57	Bituminous mixing plant requirements
T11-49	Amount of material finer than No. 200 sieves in aggregate
T96-56	Abrasion of coarse aggregate by use of the Los Angeles machine

2D.2 General requirements. The work includes the provision of compacted crushed-stone base course and asphaltic concrete surface course.

2D.3 Compacted crushed-stone base course.

2D.3.1 After the subgrade has been prepared and brought to true line, grade, and cross-section, the base course shall be placed, consisting of crushed stone to the thickness indicated. The base materials shall be combined in such proportions as to produce a mixture conforming to the following composition limits by weight:

STANDARD SQUARE MESH LABORATORY SIEVES

SIEVE DESIGNATION	PERCENTAGE BY WEIGHT PASSING
1-1/2 inch	100
1 inch	80 - 95
1/2 inch	60 - 75
No. 4	40 - 55
No. 10	28 - 43
No. 40	15 - 27
No. 200	5 - 12

When tested in accordance with AASHO Method T96, Test Grading A, it shall show a loss of not greater than 55 per cent.

2D.3.2 Spreading of the base material shall begin at the point nearest the source of supply. Hauling shall be done and traffic permitted over the base to assist in compaction. Any ruts formed by the traffic shall be carefully filled and re-rolled. After the base course is in place, machining and rolling shall continue until the surface is smooth, hard, well bonded, and true to the designed cross-section. Compaction of 100 per cent as defined in the EARTHWORK section shall be obtained in the base course.

2D.3.3 The base shall be machined as often as necessary to maintain it smooth and true to grade and cross-section until the surface course is applied.

2D.4 Asphaltic concrete surface course.

2D.4.1 Materials. The fine aggregate shall conform to the requirements of specification SS-S-71, except that per cent wear as determined by the Los Angeles Test, AASHO T96, shall not exceed 55, and shall be of the gradation set forth in paragraph E-1a of that specification. The coarse aggregate shall be crushed stone, size 3/8 inch to No. 8, conforming to specification SS-C-731, except that per cent wear as determined by the Los Angeles Test, AASHO T96, shall not exceed 55. The asphaltic cement shall be type AP-3, specification SS-A-706. Mineral filler shall conform to AASHO Designation M17.

2D.4.2 Composition of mixture. The aggregate and bituminous material shall be combined in such proportions as to produce a mixture conforming to the following composition limits by weight:

SIEVE DESIGNATION	TOTAL PER CENT PASSING
1/2 inch	100
No. 4	55 - 75
No. 10	40 - 60
No. 40	15 - 35
No. 80	8 - 20
No. 200	4 - 8
Bitumen	4.5 - 7.5

The amount of material finer than No. 200 sieve in the blended aggregate (exclusive of added mineral filler) before drying shall not exceed 8.0 per cent, and shall be determined by AASHO Method T11, using a detergent (sodium hexametaphosphate buffered with sodium carbonate).

2D.4.3 Formula for job mix. Before starting any work, the formula, including mixing temperature, shall be submitted and approved by the

Officer in Charge. The submission shall include a certified laboratory analysis of mix composition and the Marshall test value obtained therefrom for stability, void content, and flow. After the job mix formula is established and approved, all mixtures furnished shall conform thereto within the following ranges of tolerances:

Passing No. 4 and larger sieves	+ - 5 per cent
Passing No. 10	+ - 4 per cent
Passing No. 40 and No. 80	+ - 3 per cent
Passing No. 200	+ - 1 per cent
Asphalt cement	+ - 0.3 per cent
Temperature of mixture at time of discharge into truck	Control temperature plus 15 degrees F. to control temperature less 15 degrees F.
Temperature of mixture at time of laying	Control temperature plus 15 degrees F. to control temperature less 25 degrees F.

The mix shall produce the following values as established by Marshall Method of Test Criteria:

Stability	1200 pound (minimum)
Void content - per cent of total mix	3 - 8
Flow - hundredth of an inch	9 - 16

2D.4.4 Mixing plant shall conform to the requirements of AASHO Designation M156.

2D.4.5 Joints. Where new pavement abuts existing pavement, the existing surfacing course shall be cut back along uniform lines approximately 6 inches from the edge. The cut shall be made vertically and extend the full depth of the surfacing course. Prior to placing the surfacing course, the exposed edge of all cold joints shall be painted with a thin layer of asphalt cement.

2D.4.6 The spreading and finishing equipment shall be capable of spreading the bituminous mixture to a uniform density and striking a smooth finish, true to cross-section and free from inequalities. The screed shall be adjustable to shape the surface to true cross-section.

2D.4.7 Compaction. Rollers used to compact the bituminous surface shall be 8- or 10-ton tandem type and shall weigh not less than 250 pounds per inch of roller tread.

2D.4.8 Placing of the surface course shall be as nearly continuous

as possible. The roller shall pass over the unprotected end of the mixture only when laying is discontinued for sufficient time to permit the mixture to cool, in which case a joint shall be made by cutting back the surface course to expose a granular surface for its full depth to bond with the fresh mixture. When laying is resumed, the exposed edge shall be coated with hot asphalt cement and the fresh mixture raked against the joint, thoroughly tamped with hot tamps and rolled. The surface course shall be compacted to a density of at least 96 per cent of that obtained in the laboratory specimen.

2D.4.9 Bituminous materials and/or mixtures shall not be produced or placed when weather is rainy or foggy, when the base course is frozen or shows any evidence of excess moisture, or when the air temperature is less than 40 degrees F. in the shade away from artificial heat.

2D.4.10 Finished surfaces shall be uniform in texture and appearance and free of cracks and creases.

2D.4.11 Protection of pavement. After final rolling, no vehicular traffic of any kind shall be permitted on the pavement until it has cooled and hardened and in no case in less than six hours.

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SECTION 2E. SANITARY SEWER

2E.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

SS-S-169 Sealer; joint, sewer, mineral-filled, hot-pour

NON-GOVERNMENT

American Society for Testing and Materials (ASTM)

C425-64 Vitrified clay pipe joints using material having resilient properties

2E.2 General requirements. The work includes the provision of a sewer lateral from an existing sanitary sewer main to the building.

2E.3 Material.

2E.3.1 Sewer piping shall be vitrified, standard strength clay sewer pipe.

2E.3.2 Jointing material shall be hot-pour joint sealer conforming to type I, class 1 of specification SS-S-169 or materials having resilient properties conforming to ASTM specification C425.

2E.4 Placing and laying. All pipe shall be placed to the line and grade shown with the full length of each section resting solidly on the pipe bed. The interior of the pipe shall be cleaned of all foreign matter before being laid in the trench and shall be kept clean during the installation operation.

2E.5 Jointing.

2E.5.1 Hot-poured joints. Before jointing, the outside of the spigot and the inside of the bell shall be wiped clean and dry. Spigots shall be adjusted in the bells so as to give uniform space all around the spigot and blocking or wedging between the bell and spigot will not be permitted. Adjacent lengths of pipe shall be adjusted so that the spigot end shall uniformly butt against the head of the bell. The annular space shall then be caulked with tight twisted tarred oakum or jute in such a manner that the joint will be completely sealed with no gasket material on the inside of the pipe and minimum depth of 1-3/4 inches shall remain between the gasketing material and the mouth of the bell. The remaining space shall then be filled with one pouring of joint sealer. The joint

sealer shall adhere completely to both the bell and spigot.

2E.5.2 Compression joints shall be a factory applied joint material. Installation of joints shall be in accordance with the manufacturer's recommendations.

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SECTION 2F. FENCING

2F.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

13Yh	Concrete construction; including addendum no. 1

FEDERAL

RR-F-183 (1)	Fence posts, gates, and accessories
RR-F-191d	Fencing wire, (chain link fabric)
RR-F-00221c	Fencing wire (barbed wire, woven wire, and wire netting)

2F.2 General requirements. The work includes the provision of fencing, posts, gate and accessories as indicated or specified.

2F.3 Materials. Fence posts, gates and accessories shall conform to specification RR-F-183. The fabric conforming to specification RR-F-191. The barbed wire conforming to specification RR-F-00221.

2F.4 Fence posts, gates and accessories. Line posts, corner and gate posts shall be set in concrete footings. Footings for line post shall be 36 inches deep by 11 inches diameter and post set to bottom of concrete. Corner and gate post footing shall be 48 inches deep and 16 inches diameter and post set 42 inches in the concrete. Concrete footings shall be class D-1 in accordance with specification 13Y. The footings shall extend about 2 inches above the finished grade with the tops and exposed surfaces floated to a smooth finish. Gate shall be double leaf vehicular and swing type. Top rail and bottom reinforcing wire shall be provided. An approved type of post top shall be provided for each post having one arm set at approximately 45 degrees towards the outside and carrying three barbed wires.

2F.5 Fabric shall be type A (zinc-coated), 2-inch woven wire diamond mesh No. 6 wire, 84 inches in height with the top and bottom selvage having a twisted and barbed finish.

2F.6 Barbed wire shall be type A (zinc-coated), 4-point. Strand to be 12 gauge, barb to be 14 gauge, 3 wires shall be constructed on top of fabric. The uppermost barbed wire shall be approximately 12 inches horizontally from the fabric line.

2F.7 Installation. Fencing shall be installed in a workmanlike manner with the wires stretched and fastened securely to the posts and fabric stretched so that there will be no slack edges or warped sections.

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SECTION 2G. ESTABLISHING VEGETATION

2G.1 General requirements. The work includes seedbed preparation, liming, fertilizing, seeding and mulching of all areas within the fenced area. The work also includes those areas outside the fenced area that are disturbed by the Contractor's operation.

2G.2 Materials.

2G.2.1 Lime shall be dolomitic agricultural-ground limestone containing not less than 10 per cent magnesium oxide.

2G.2.2 Fertilizer shall be the standard commercial product of 10-10-10 analysis. All fertilizer shall be delivered in bags bearing the manufacturer's name, the chemical analysis of the product, and its weight. Fertilizer shall be stored in a manner that will not allow it to harden or destroy its effectiveness.

2G.2.3 Seed shall be certified seed or equivalent based on North Carolina Seed Improvement Association requirements for certification. If the seed is not grown in the state where it is to be used, it shall meet the certification requirements of the Seed Improvement Association for the state in which it is grown. Seed which has become wet, moldy, or otherwise damaged prior to seeding, will not be acceptable.

2G.2.4 Mulch shall be any of the materials noted below:

(a) Grain straw or dry hay. Mulch material which contains an excessive quantity of matured seed of noxious weed or other species which would hinder the establishment of desirable vegetation will not be acceptable. Any mulch material which is fresh or excessively brittle or which is in an advanced stage of decomposition as to smother or retard growth of grass will not be acceptable.

(b) Asphaltic adhesive. Asphaltic material to anchor straw mulch shall be thin enough to be blown from spray equipment. It shall be SS-1 emulsion or RS liquid asphalt 1 or 2.

2G.3 Seedbed preparation.

2G.3.1 Grading. Grades on the area to be treated shall be maintained in a true and even condition. Maintenance shall include any necessary repairs to previously graded areas.

2G.3.2 Tillage. All graded areas shall be thoroughly tilled to a depth of at least 4 inches.

2G.4 Liming. Limestone shall be uniformly applied at the rate of 3,000 pounds per acre (70 pounds per 1,000 square feet) to all areas to be vegetated. Limestone may be applied to the area prior to the preparation

of the seedbed, but in all cases, it shall be applied before seeding and thoroughly incorporated into the entire depth of the prepared seedbed.

2G.5 Fertilizing. The fertilizer shall be uniformly applied at the rate of 1,000 pounds per acre (23 pounds per 1,000 square feet) to all areas to be vegetated. Fertilizer shall be applied simultaneously with seed, using the above rate of application.

2G.6 Seeding. When conditions are such, by reason of drought, high winds, excessive moisture, or other factors that satisfactory results are not likely to be obtained, the work shall be stopped by the Officer in Charge and resumed only when directed. If inspection during seeding operations, or after there is a show of green, indicates that areas have been skipped, the Officer in Charge may require the Contractor to sow additional seed on these areas. Seed shall be sown between 1 March and 15 April, or between 1 September and 15 October. Spring seeding shall be at the rate of 100 pounds per acre of the following seed mixture:

Variety	Pounds
Ky-31 Fescue	80
Common Bermuda	20

Fall seeding shall be at the rate of 100 pounds per acre of the following seed mixture:

Variety	Pounds
Ky-31 Fescue	80
Common Bermuda (unhulled)	20

Note: The variety of seeds indicated shall be sown only during the optimum periods specified. Seeding at any other time shall be done only upon permission of the Officer in Charge and using the variety of seed and rate of sowing he shall specify.

2G.6.1 Broadcast seeding. Seed shall be sown in combination with fertilizer. Rate of seeding shall be as that specified in the table. The seed shall be uniformly distributed over the designated areas. Hand-operated equipment, such as the "Cyclone" seeder, shall be employed. The seed shall be uniformly distributed over the designated areas. In confined areas, the seed shall be covered to the depths specified by means of rakes or other approved hand tools. Broadcast seeding shall not be done during windy weather. The seed shall be planted no deeper than 1/4 inch. After seeding, the seeded area shall be compacted with a land roller, such as a cultipacker.

2G.7 Mulching. The surface of all seeded areas shall be protected by the application of any of the before-mentioned mulch material unless otherwise specified.

2G.7.1 Straw or hay shall be applied evenly over the seeded area in such a manner that thickness of the mulch is approximately uniform throughout the treated area and sunlight is not completely excluded from penetration to the ground surface.

2G.8 Anchoring mulch. Straw or hay mulch shall be anchored in place as follows: By uniformly spraying the mulch with the specified asphalt material at the rate of 0.10 gallon per square yard.

2G.9 Protection. The area shall be protected against foot and vehicular traffic by erecting adequate barricades immediately after seeding is completed, and by placing warning signs of a type approved by the Officer in Charge.

2G.10 Establishment. The Contractor shall be responsible for the proper care of the seeded area during the period when the vegetation is being established. In the event of an erosive rain before an adequate stand of vegetation is established, the Officer in Charge will require that damaged areas be repaired, limed, fertilized, seeded, and mulched wholly at the Contractor's expense. This period shall extend for 30 days after the completion of the mulching.

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DIVISION 3. CONCRETE

SECTION 3A. Concrete Construction
3B. Precast Concrete Plank

SECTION 3A. CONCRETE CONSTRUCTION

3A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

13Yh Concrete construction; including addendum no. 1

3A.2 General requirements. Concrete work, including reinforcement, shall conform to the applicable requirements of specification 13Y, except as modified herein. Horizontal steel shall be returned 18 inches at corners unless otherwise indicated.

3A.3 Concrete work for reservoir, detention tank, salt storage tanks, and pump room.

3A.3.1 Concrete for reservoir shall be air-entrained, class E-1. Concrete for detention tank, salt storage tanks and pump room shall be air-entrained, class F-1. Floors and walls shall be placed in single pours respectively. Internal vibrators shall be used for compacting all of the concrete.

3A.3.2 Forms. Form ties shall be as specified for watertight work and shall be approved. Forms for exposed surfaces shall provide for a special grout finish.

3A.3.3 Placing reinforcement. All ring bars in reservoir wall shall be lap spliced a minimum of 24 inches and all splices in adjacent bars shall be staggered a minimum of 8 feet horizontally. Splices shall not occur less than every fourth bar vertically.

3A.3.4 Placing and curing. Under floor slabs and footings, the subgrade shall be brought to a smooth surface, compacted thoroughly, and the entire subgrade under the slab shall be underlain with white polyethylene sheeting having a nominal thickness of .004 inch. The material shall be placed in the greatest widths and lengths practicable so as to eliminate joints wherever possible; where joints are necessary, the material shall be lapped not less than 6 inches for the side and end laps and sealed with approved adhesvie. Torn, punctured, or damaged vapor barrier material shall be removed and replaced as directed, prior to the placing of concrete.

Concrete shall be placed in a manner to preclude damage to the material. Walls shall be placed in horizontal lifts not to exceed 2 feet. The concrete shall be deposited at frequent intervals around the periphery. No temporary joints shall be allowed to become "cold" before the adjacent concrete is placed. The time interval shall not exceed 45 minutes. All concrete shall be water or moist cured for not less than 14 days. Floors, after pouring, shall be kept saturated with water until walls have been constructed. The exterior and interior surfaces of walls shall be protected from low temperature and shall be cured in accordance with specification 13Y for watertight construction.

3A.3.5 Finishing. A float finish shall be provided for floor slabs, except pump room; the surface of slabs shall be struck off true and finished to the indicated floor levels and slopes; all surface water shall be removed and the surface floated to a smooth, hard, reasonably nonslip finish, using a wood float. Pump room floor shall be finished as hereinafter specified for interior floor surfaces.

3A.3.6 Joint between the wall and floor slab of the reservoir, detention tank, salt storage tanks and pump room shall be made by a continuous key and copper water stop. A copper strip not less than 10 inches wide and weighing not less than 20 ounces per square foot shall be placed before the floor slab is poured. Joints in copper strips shall be lapped, locked and soldered. All dirt and other foreign matter shall be removed from the key and the concrete surface scrubbed clean and flushed with a neat cement grout immediately before the wall is poured.

3A.3.7 Testing. Upon completion of the work, the reservoir and tanks shall be filled completely with fresh water, furnished by the Government, permitted to stand for not less than 24 hours, and the entire exterior surface examined for leakage. No backfill shall be placed prior to the test and if water is present in the excavation, it shall be kept pumped down below the floor level during the test. All leaks shall be located and, after emptying, the reservoir and tanks shall be repaired as directed. Immediately after testing and correction of any defects, the structures shall be cleaned thoroughly and the reservoir filled with water.

3A.4 Other concrete work for building and miscellaneous structures.

3A.4.1 Concrete shall be class D-1, except that concrete to be used in the channel or cavities of masonry lintel or bond beam units shall be class E-0.5.

3A.4.2 Forms for exposed surfaces of the building foundation shall provide for a special grout finish.

3A.4.3 Subgrades. Floor slabs and footings shall be underlain with a single thickness of white polyethylene sheeting as specified above for reservoir, detention tank, salt storage tanks, and pump room.

3A.4.4 Expansion joints between vertical concrete surfaces and floor slabs laid on the earth shall be as shown on drawings and as described in specification 13Y.

3A.4.5 Floors shall be dished 3/4 inch immediately at floor drains and the drains set to meet the dished portion. Floors shall be screeded to provide drainage to depressed slabs under filters and softeners.

3A.4.6 Surface finishes.

(a) All exposed surfaces cast against forms shall be given a special grout finish.

(b) All interior floor surfaces, except trenches, sumps, or pits shall be given a light duty nonslip finish. Prior to application of the abrasive aggregate, the concrete shall be brought to final elevation in one lift, thoroughly compacted, and struck off. The aggregate shall be forced away from the surface and the slab floated and screeded to a true, level surface at the elevations indicated. After the concrete has set sufficiently to support the weight of the equipment, excess surface water shall be removed and the surface compacted with a heavy power-driven rotary float of the metal disc type. Dry cement or cement aggregate mixtures shall not be sprinkled on the floor to absorb moisture. Following the compacting, and after wash sheen has disappeared from the surface, the floor surface shall be given a light duty nonslip finish as specified. Troweling shall be held to a minimum consistent with obtaining the desired finish. Concrete to be so finished shall not contain more than five gallons of water per sack of cement.

(c) Exterior steps, landings and walks shall receive sidewalk finish.

3A.5 Materials installed in connection with the concrete work, including anchors, bolts, and sleeves shall be placed and secured in position when the concrete is poured.

3A.6 Miscellaneous supports, including concrete piers and foundations for piping, pumps, and other equipment where not shown shall be of proper size and finished to correct elevation and shape as required by the manufacturer's equipment. Concrete supports shall be fastened to the structural floor slab with No. 6 dowels not less than 3 inches from each corner where vibrations or dynamic forces will occur during operation of the equipment. Location and size of anchor bolts and other fasteners installed in the concrete shall suit manufacturer's equipment.

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SECTION 3B. PRECAST CONCRETE PLANK

3B.1 General requirement. The work includes the provision of precast light weight concrete planks.

3B.2 Materials. Roof deck shall be nailable precast tongue-and-groove commercial quality plank of light weight aerated concrete reinforced top and bottom with galvanized welded wire mesh reinforcement accurately placed. Planks shall be tongue-and-grooved on the sides with square ends requiring 2-inch end bearing, shall be 2 inches thick and shall weigh not more than 14 pounds per square foot. The plank shall be designed to support a superimposed safe load of 75 pounds per square foot on a 6-foot span based on a safety factor of four. All planks shall be as nearly perfect as good workmanship will permit.

3B.3 Installation. Planks may span two or more spacings but must end over supports. No warped, cracked, or broken planks shall be placed in the roof. Joints of roof plank shall be fastened to supporting steel with 20 gauge galvanized steel clips and grouted with portland cement. Planks shall be cut for chimney opening, but such cutting shall be done to fit framed opening at the time plank is installed.

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DIVISION 4. MASONRY

SECTION 4A. BRICK AND CONCRETE MASONRY

4A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

FED-STD-158a Cements, hydraulic; sampling, inspection and testing

NON-GOVERNMENT

American Society for Testing and Materials (ASTM)

C5-59	Quicklime for structural purposes
C55-64T	Concrete building brick
C62-62	Building brick (solid masonry units made from clay or shale)
C90-64T	Hollow load-bearing concrete masonry units
C91-65	Masonry cement
C144-62T	Aggregate for masonry purposes
C150-65	Portland cement
C207-49	Hydrated lime for masonry purposes
C315-56	Clay flue linings

4A.2 General requirements. Masonry work of the types indicated shall be provided, and masonry work shall be properly coordinated with the work of other trades. The source of supply for materials which will affect the appearance of the finished work shall not be changed after the work has started.

4A.3 Materials. Cement, lime, and other cementitious materials shall be delivered to the site and stored in unbroken bags, barrels, or other approved containers, plainly marked and labeled with the manufacturers' names and brands. Mortar materials shall be stored in dry, weathertight sheds or enclosures, and shall be stored and handled in a manner which will prevent the inclusion of foreign materials and damage by water or dampness. Masonry units shall be handled with care to avoid chipping and breakage, and shall be stored as directed. Materials shall be stacked or stored on newly constructed floors in such manner that the uniformly distributed loading does not exceed 50 psf. Masonry materials shall be properly protected from contact with the earth and exposure to the weather and shall be kept dry until used. Materials containing frost or ice shall not be used.

4A.3.1 Common brick shall conform to ASTM C62; they shall have true faces, and straight and sharp edges and corners. Brick shall be selected grade SW. Variations from the nominal dimensions, 2-1/4 inches by 3-5/8

inches by 7-5/8 inches, shall not exceed over or under 1/16 inch in breadth or thickness nor 1/8 inch in length. Color and texture of brick shall match, as nearly as practicable, the brick on the adjacent buildings. One manufacturer's brick shall be used throughout the work.

4A.3.2 Concrete masonry units shall be of modular dimensions, and shall be either air, water, or steam cured. Type II units shall be stored at the site before use a minimum of 28 days for air cured units; 10 days for steam or water cured units; and 3 days for units cured with steam at a pressure of 120 to 150 psi and at a temperature of 350 to 365 degrees F for at least five hours. Surfaces of units which are to be plastered or stuccoed shall be sufficiently rough to provide a suitable bond; elsewhere, exposed surfaces of units shall be comparatively smooth and of uniform texture.

(a) Hollow load-bearing units shall conform to ASTM specification C90, grade P-I or P-II, and shall be provided for walls and partitions.

(b) Concrete building brick shall conform to ASTM specification C55, grade P-I or P-II. Concrete brick shall match the concrete masonry units with which they are used as closely as practicable in color and surface characteristics.

(c) Special shapes, such as closures, header units, and jamb units, shall be provided as necessary to complete the work, and shall conform to the applicable portions of the specifications for the units with which they are used.

4A.3.3 Portland cement shall be type I, conforming to ASTM specification C150.

4A.3.4 Masonry cement shall be type II, conforming to ASTM specification C91, except that it shall be bin or car tested in accordance with Federal Standard 158.

4A.3.5 Lime paste shall be made with pulverized quicklime, or with hydrated lime, which shall be allowed to soak not less than 72 hours before use; except that hydrated lime, processed by the steam method, shall be allowed to soak not less than 24 hours and shall be made by adding the lime to the water. In lieu of hydrated-lime paste for use in mortar, the hydrated lime may be added in the dry form.

(a) Hydrated lime shall be type S, conforming to ASTM specification C207.

(b) Pulverized quicklime shall conform to ASTM specification C5, shall pass a no. 20 sieve, and 90 per cent shall pass a no. 50 sieve.

4A.3.6 Sand shall conform to ASTM specification C144.

4A.3.7 Water for mixing shall be potable.

4A.3.8 Flue linings and thimbles shall conform to ASTM C315 and shall be free from fractures, large or deep cracks, blisters, and other defects. Sizes and shapes shall be provided as indicated.

4A.4 Workmanship. Masonry walls shall be carried up level and plumb all around. One section of the walls shall not be carried up in advance of the others, unless specifically approved. Unfinished work shall be stepped back for joining with new work; toothing will not be permitted, except where specified. Heights of masonry shall be checked with an instrument at each floor, and at sills and heads of openings, to maintain the level of the walls. Door and window frames, louvered openings, anchors, pipes, ducts, and conduits shall be built in carefully and neatly as the masonry work progresses. Spaces around metal door frames shall be filled solidly with mortar. Masonry units shall be handled with care to avoid chipping, cracking, and spalling of faces and edges. Drilling, cutting, fitting, and patching, to accommodate the work of others, shall be performed by masonry mechanics. Masonry shall be cut with masonry saws in exposed work, where directed. Structural steelwork, bolts, anchors, inserts, plugs, ties, lintels, and miscellaneous metal work specified elsewhere shall be placed in position as the work progresses. Chases of approved dimensions for pipes and other purposes shall be provided where indicated or necessary. Tops of exposed walls and partitions, not being worked on, shall be covered with a waterproof membrane, well secured in place. Unless indicated otherwise, partitions shall extend from the floor to the bottom of the floor or roof construction above. Walls and partitions shall be structurally bonded or anchored to each other. Non-load-bearing partitions and interior walls shall be securely anchored to the construction above in a manner that provides lateral stability while permitting unrestricted deflection of construction above. Scaffolding shall be inspected regularly, and shall be amply strong, well braced, and securely tied in position. Overloading of scaffolding will not be permitted.

4A.4.1 Mortar mixing. Mortar materials shall be measured in approved containers that will insure that the specified proportions of materials will be controlled and accurately maintained during the progress of the work. Measuring materials with shovels will not be permitted. Unless specified otherwise, mortar shall be mixed in proportions by volume. The aggregates shall be introduced and mixed in such a manner that the materials will be distributed uniformly throughout the mass. A sufficient amount of water shall be added gradually and the mass further mixed, not less than three minutes, until a mortar of the plasticity necessary for the purposes intended is obtained. The mortar shall be machine-mixed in approved mixers, of the type in which the quantity of water can be controlled accurately and uniformly. Hand mixing may be used only when specifically approved. Mortar boxes, pans, and/or mixer drums shall be kept clean and free of debris or dried mortar. The mortar shall be used before the initial setting of the cement has taken place; retempering of mortar in which cement has started to set will not be permitted. Antifreeze compounds, salts, or any other

substance used to lower the freezing point of mortar will not be permitted.

(a) Mortar for brick and concrete masonry unit work. The color of cement and sand used in mortar for exposed work shall produce, without the admixture of any coloring matter, a mortar of uniform shade that will match the mortar of the adjacent buildings.

(b) Mortar for flue linings shall be an approved commerical fire clay.

4A.4.2 Mortar joints shall be uniform in thickness, and the average thickness of any three consecutive joints shall be 3/8 to 1/2 inch, unless otherwise specified. "Story poles" or "gage rods" shall be made and approved prior to starting the work, and shall be used throughout the work. Changes in coursing or bonding after the work is started will not be permitted. Exposed joints shall be tooled slightly concave with a round or other approved jointer when the mortar is thumbprint hard. The jointer shall be slightly larger than the width of the joint, so that complete contact is made along the edges of the units, compressing and sealing the surface of the joint. Joints in masonry that will not be exposed shall be struck flush. Horizontal joints shall be tooled first. Joints shall be brushed to remove all loose and excess mortar. All horizontal joints shall be level; vertical joints shall be plumb and in alignment from top to bottom of wall within a tolerance of plus or minus 1/2 inch.

4A.4.3 Work in freezing weather. Masonry shall not be laid when the air temperature is below 40 degrees F, on a falling thermometer, or when it appears probable that temperatures below 40 degrees F will be encountered before the mortar has set, unless approved means are provided for protecting the work from freezing. Protection shall consist of heating and maintaining the temperature of the masonry materials at not less than 40 degrees F but not more than 160 degrees F and maintaining an air temperature above 40 degrees F on both sides of the masonry for not less than 72 hours. Work will not be permitted with or on frozen materials. Masonry work may be started at 34 degrees F on a rising thermometer.

4A.4.4 Brickwork. Over or underburned, warped, spalled, cracked or broken brick shall not be used where exposed, but may be used as backup and where concealed. Brick, where exposed, shall be selected when placing for the better face for stretchers, and the better end for headers. Clay or shale brick shall be tested daily on the job, prior to laying, to determine if they will require wetting. A circle the size of a silver quarter shall be drawn on five random selected bricks with a wax pencil. Twenty drops of water shall be applied with a medicine dropper to the surface within the circle on each brick. If the average time that the water is completely absorbed in the five bricks is less than 1-1/2 minutes, the bricks represented by the five bricks shall be wetted. During freezing weather, units requiring wetting shall be sprinkled with warm water. The method of wetting shall be such as to insure that each unit is nearly saturated, but surface dry when laid. Unless indicated or specified other-

wise, brickwork shall be laid in common bond. All joints between bricks shall be filled completely with mortar. Bed joints shall be formed of a thick layer of mortar, which shall be smoothed, or furrowed lightly. Head Joints shall be formed by applying to the brick to be laid, a full coat of mortar on the entire end, or on the entire side, as the case requires, and then shoving the mortar-covered end or side of the brick tightly against the brick laid previously; the practice of buttering at the corners of brick and then throwing mortar or scrapings into the empty joints will not be permitted. Closure brick shall be laid with a bed joint and with head joints, and the brick shall be placed carefully without disturbing the brick previously laid. Dry or butt joints will not be permitted. Grouting shall be done only where directed.

(a) Brick-faced walls shall consist of a brick-facing backed with concrete-masonry units. The outside face of the backing shall be parged with a uniform trowel coat of mortar not less than 3/8 inch thick before the facing is laid. When applying the parging, extreme care shall be taken not to disalign the facing and/or backing, nor to disturb or break the bond of the joint mortar.

(b) Concrete-masonry unit work. The first course of concrete-masonry units shall be laid in a full bed of mortar, for the full width of the unit; the succeeding course shall be laid with broken joints. Concrete-masonry units laid with the cells vertical shall have the bed-joints formed by applying the mortar to the entire top surfaces of the inner and outer face shells and the head joints formed by applying the mortar for a width of about one inch to the ends of the adjoining units laid previously. The mortar for joints shall be smooth (not furrowed), and of such thickness that it will be forced out of the joints as the units are being placed in position. Where anchors, bolts, and other ties occur within the cells of the units, such cells shall be filled with mortar or concrete, as the work progresses. Concrete brick of a color and texture to match the concrete-masonry units as closely as practicable shall be used for bonding walls, working out the coursing, to top out walls under sloping slabs, to distribute concentrated loads, and elsewhere as required.

4A.4.5 Lintels shall be precast of the same materials and texture as concrete-masonry units with a minimum compressive strength of 2500 psi. Reinforcement shall conform in size and placement to the detail shown on the plan.

4A.5 Cleaning. At the completion of the masonry work, holes in exposed masonry shall be pointed, and defective joints shall be cut out and tuck pointed solidly with mortar. Exposed surfaces of exterior and interior brickwork shall be thoroughly wetted with clear water and scrubbed with a solution of not more than one part of muriatic acid to nine parts of water, applied to an area not over 15 to 20 square feet at a time, with a stiff fiber brush. Immediately after cleaning, each area shall be rinsed thoroughly with clear water. Other exposed masonry surfaces shall be scrubbed with warm water and soap, and rinsed thoroughly with clear water.

Work which may be damaged, stained, or discolored, shall be protected during the cleaning process; work that is damaged, stained, or discolored shall be restored to its original condition or replaced.

4A.6 Quality assurance provisions.

Samples of brickwork. Before brickwork is started, the Contractor shall build, where directed, a sample panel of brickwork one foot thick, 6 feet long and 4 feet high. Each face shall show the workmanship, bond, thickness, and tooling of joints, range of color and texture, and the color of the mortar, all as specified for the work. The finished work shall match the approved sample.

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DIVISION 5. METALS: STRUCTURAL AND MISCELLANEOUS

SECTION 5A. Structural Steel Work
5B. Miscellaneous Metal Work

SECTION 5A. STRUCTURAL STEEL WORK

5A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

22Yg Structural steelwork

NON-GOVERNMENT

American Institute of Steel Construction - Steel Construction Manual

American Society of Testing and Materials (ASTM)

A36-63T Structural steel

5A.2 General requirements. Steel work, including shop painting, except as otherwise specified, shall be in accordance with specification 22Y. Connections for which details are not indicated shall be designed in accordance with the latest edition of the Steel Construction Manual of the American Institute of Steel Construction. Connections shall be welded, except as indicated otherwise. Holes shall be provided where necessary for erection bolts and for securing other work to steel framing. Lintels and beams shall have an 8-inch minimum bearing on solid masonry supports.

5A.3 Structural steel shall conform to ASTM specification A36.

5A.4 Fastenings. Bolts, clips, anchors, and other miscellaneous fastenings shown, specified or necessary for securing of the work in place shall be furnished and installed.

5A.5 Grouting mortar for setting bearing plates shall be a non-shrinking type. Mortar shall be a mixture of one part blended portland cement to two parts well graded fine aggregate and enough water to provide a stiff mix consistency suitable for the intended use. The blended portland cement shall be a mixture of cement with 1/4 ounce of aluminum powder to each sack of cement. An acceptable and approved type of commercial expanding aggregate may be used with sand and normal cement in lieu of the above mix when proportioned and used in accordance with the manufacturer's recommendations. Surfaces to receive the mortar shall be clean and moistened

thoroughly and immediately before placement of mortar. Exposed surfaces of mortar shall be water cured with wet burlap for seven days.

5A.6 Erection tolerances. Individual pieces shall be erected so that deviation from plumb or level shall not exceed one to 500.

5A.7 Shop painting and surface protection. All structural steel work, except steel work which will be encased in concrete or mortar, shall be shop painted. In lieu of blast cleaning, surfaces which will be enclosed from the weather and subjected to exposure no more corrosive than indoor atmosphere controlled for human comfort may be cleaned by wire brushing or other manual or mechanical means for removal of loose mill scale, rust, dirt, and other deleterious substances. Surfaces, where the shop coat of paint has been damaged, shall be retouched using the same system as the original shop painting. All welds shall be scaled, cleaned and painted promptly after acceptance of the weld and shall be as specified.

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SECTION 5B. MISCELLANEOUS METAL WORK

5B.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

22Yg Structural steelwork

5B.2 General requirements. Miscellaneous metal shall consist of standard shapes of commercial quality. Cast iron shall be soft, tough, gray iron; castings shall have sharp corners and edges, and shall be clean, smooth and true to pattern. Welding shall conform to specification 22Y; welding shall be done in a manner that will prevent permanent buckling and all welds exposed in the finished work shall be ground smooth.

5B.3 Workmanship and finish. Workmanship and finish shall be equal to the best practice of modern shops for the respective work. Exposed surfaces shall have smooth finish and sharp, well defined lines and arrises. Sections shall be well formed to shape and size with sharp lines and angles; curved work shall be sprung evenly to curves. All necessary rabbets, lugs, and brackets shall be provided so that the work can be assembled in a neat and substantial manner. Holes for bolts and screws shall be provided. Fastenings shall be concealed where practicable. Thickness of metal and detail of assembly and supports shall provide ample strength and stiffness.

5B.4 Shop painting. All surfaces of steel and iron work, except zinc-coated work, and work with bituminous or other priming, shall be shop painted in accordance with specification 22Y.

5B.5 Anchors and fastenings. Ties, anchors and other miscellaneous fastenings shown, specified or necessary for the securing of the work in place shall be furnished and installed.

5B.6 Pipe railing shall be constructed of 1-1/4-inch diameter standard weight black iron pipe. Joints and connections in the railing shall be welded; exposed welds shall be ground smooth with changes in direction rounded neatly. Post in new concrete shall be set in pipe sleeves and caulked securely with molten lead.

5B.7 Thresholds shall be extruded aluminum. All thresholds shall be set in mastic and fastened with expansion screws not more than 3 inches from ends and staggered not over 8 inches on centers between end screws.

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DIVISION 6. CARPENTRY

SECTION 6A. CARPENTRY WORK

6A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

28Ye Carpentry and woodwork

FEDERAL

TT-W-571g (1) Wood preservation, treating practices
TT-W-572 Wood-preservative, water-repellent

GOVERNMENT

U. S. Department of Commerce; Commercial Standards

CS120-58 Ponderosa pine doors

NON-GOVERNMENT

American Society for Testing and Materials (ASTM)

C220-61 Flat asbestos-cement sheets
C221-61 Corrugated asbestos-cement sheets

6A.2 Materials and methods of application shall conform to the applicable requirements of specification 28Y, except as specified or indicated otherwise. Moisture content shall not exceed 19 per cent for framing or 15 per cent for finish items.

6A.3 Lumber grades. All lumber shall be graded in accordance with the rules of the association governing the species used, and except for cypress, shall be grade-marked and trade-marked by the association under whose rules it is graded. Lumber grades shall be as follows:

6A.3.1 Framing, joist and blocking - No. 2 dimension Southern pine.

6A.3.2 Sheathing - T&G No. 2 common short leaf Southern pine.

6A.3.3 Fascia and plates under gravel stops shall be No. 2 Southern pine.

6A.3.4 Wooden covers, baffles and framing in detention tank shall

be No. 1 common grade of cypress.

6A.3.5 Plywood shall be interior Douglas fir, grade A-B.

6A.4 Wood preservative treatment. All lumber, except cypress and plywood, shall be given a preservative treatment with material conforming to specification TT-W-572, type II, composition A; application shall be in accordance with specification TT-W-571.

6A.5 Asbestos-cement sheets. Corrugated asbestos-cement sheets for constructing mixing chamber shall conform to ASTM C221, type A. Flat asbestos-cement sheets shall conform to ASTM C220, type F. Bolts, nails and other fastening devices shall be hot-dipped zinc-coated or cadmium plated.

6A.6 Cabinet shall be of the size and style indicated and shall be shop fabricated, or, at the option of the Contractor, may be a manufactured product approximately of the size and arrangement shown. Plywood shall be used for all construction where practicable; it shall be interior grade A-B, except that for tops and other backing for laminated plastic, it shall be EXT-DFPA-A-B grade plywood with face veneers of birch, maple or other wood which is not susceptible to grain raising. Plastic counter top covering shall be a thermo-setting plastic laminate sheet of at least 1/16 inch thickness, factory bonded to wood counter with waterproof cement. Inside angles and exposed edges shall be trimmed with heavy gauge stainless steel mouldings. Plywood for tops and other backing for laminated plastic, shelves, doors, and drawer fronts shall be not less than 3/4 inch thick. Hardware shall be as specified under Division 10. Cabinet shall have a shop or factory applied prime coat of enamel undercoating, inside and outside.

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DIVISION 7. MOISTURE PROTECTION

SECTION 7A. Roofing and Sheet Metal Work
7B. Thermal Insulation
7C. Caulking

SECTION 7A. ROOFING AND SHEET METAL WORK

7A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

7Yk Roofing and sheet metal work

FEDERAL

QQ-C-576a Copper plates, rolled bars, sheets and strips
QQ-S-775c Steel sheets, carbon, zinc-coated

7A.2 General requirements. The work includes the provision of built-up roofing, flashing and hatch covers. Materials and methods of installation shall be in accordance with specification 7Y, except as indicated or specified otherwise.

7A.3 Materials. Manufactured roofing materials shall be delivered to the site in the original sealed containers or packages bearing the manufacturer's name and brand designation. Where materials are covered by a referenced specification, the containers or packages shall bear the specification number, type and class as applicable.

7A.3.1 Built-up roofing for application on insulation shall be type 4TIS. Low slope asphalt and asphalt saturated felts may be used in lieu of coal-tar pitch and tar-saturated felts.

7A.3.2 Sheet metal.

(a) Gravel stops and flashing shall be copper weighing not less than 16 ounces per square foot and conforming to specification QQ-C-576. Flange of gravel stop shall extend at least 4 inches on roof, shall be bedded in hot bitumen and covered with base flashing. Lower edge shall be locked over continuous edge strip of 24-ounce copper.

(b) Hatch covers shall be zinc-coated sheet steel, flat type, conforming to specification QQ-S-775 for class d coating and shall be not lighter than indicated.

(c) All pipes passing through roof shall be flashed with 6-pound sheet lead caulked into hubs of pipe or clamped and caulked to the pipe by means of an approved collar, the lead flange extending onto the roof at least 6 inches on all sides.

7A.4 Performance of roofing and flashing. In addition to the requirements specified, roofing and flashing shall be completely weathertight. The Contractor shall furnish, in writing, warranties providing for repairs to roofing and flashing at no additional cost to the Government, as follows:

Built-up roofing. The Contractor shall repair all leaks or defects in roofing and flashing materials and workmanship, appearing within one year of date of acceptance, except those caused by acts of God and/or improper use of the roof by the Government.

7A.5 Permanent roofing data. The Contractor shall provide a typewritten data card for the new roofing on the building. Three additional copies of the data cards shall be provided for Government records. The card shall be installed in the building under glass with a weathertight frame constructed with neat, clean, straight lines and painted as directed by the Officer in Charge. The card shall be installed near the point of access to the roof with exact location as directed by the Officer in Charge and shall contain the following information:

a. contract number

b. date work completed

c. NAVFAC specifications designation

d. type of roof decking

e. manufacturer's name; type and thickness of insulation

f. manufacturer's name; type and weight of felts used

g. method of application (hand, machine, or nailing), if applicable

h. manufacturer's name; type and quantity of bitumen per square

i. manufacturer's name; type, weight or gauge of flashing

j. name, statement of compliance, and signatures of Contractor and Resident Officer in Charge of Construction.

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SECTION 7B. THERMAL INSULATION

7B.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

49Ya Thermal insulation for buildings; including addendum no. 1

FEDERAL

HH-I-526a Insulation board, thermal-acoustical, mineral wool (for roofs)

LLL-I-535 (1) Insulation board, thermal and insulation block, thermal

7B.2 General requirements. The work includes the provision of roof insulation with vapor barrier. Materials and method of installation shall be in accordance with specification 49Y, except as indicated or specified otherwise.

7B.3 Material. Roof insulation shall be 1-1/2 inches thick and shall be one of the following:

7B.3.1 Rigid fiberboard (vegetable fiber) conforming to the applicable requirements of specification LLL-I-535, class C, except that it shall be treated chemically to resist decay, insects and fungus growth. The insulation shall be either bituminous impregnated or bituminous-coated on all surfaces. Bituminous coatings may be applied either in the factory, or in the field, subject to approval. Integrally treated insulation boards may be furnished optionally, if they provide a rate of moisture absorption equal to or less than the bituminous-coated or impregnated boards.

7B.3.2 Rigid mineral wool insulation board shall conform to the requirements of specification HH-I-526, having a bituminous impregnated kraft paper covering on the upper exposed surface and on the ends and having a density of not less than eleven pounds per cubic foot.

7B.4 Application. Application shall be as specified in specification 49Y for roof insulation on nailable concrete and poured or precast gypsum decks. A vapor barrier shall be provided.

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SECTION 7C. CAULKING

7C.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

TT-S-227b (1) Sealing compound; rubber base, two component (for caulking, sealing, and glazing in building construction)

TT-S-00230 Sealing compound; synthetic-rubber base, single component, chemically curing (for caulking, sealing, and glazing in building construction)

7C.2 General requirements. Caulking shall be provided in all open joints exposed to the weather, as indicated or specified, and in all areas normally requiring sealing with caulking material to provide water and weathertight construction.

7C.3 Materials shall be delivered to the job in the manufacturer's original, unopened containers with the brand, date of manufacture, and name clearly marked thereon. All material shall be carefully handled and stored to prevent inclusion of foreign materials or subjection to sustained temperatures exceeding 90 degrees F. Caulking compound shall be compatible with the materials to and against which it is applied and shall be the non-staining type. Materials for caulking compound more than six months old shall not be used. Color of caulking compound shall be light gray.

7C.4 Caulking compound shall be either synthetic-rubber base, two component, type II conforming to specification TT-S-227 or synthetic-rubber base, one component, non-sag type, chemically curing, conforming to specification TT-S-00230. The two component compound shall be supplied in pre-measured kit form, for on-the-job mixing. The entire portion of the accelerator, or smaller unit, shall be added to the entire portion of the compound, or larger unit. The container shall have sufficient space at the top to allow for addition of the accelerator and for mixing. The one component compound shall be supplied in a ready-to-use form. Under normal application conditions, including adequate ventilation, compounds shall be non-toxic. Primer shall be as recommended by the caulking manufacturer for the specific surface material.

7C.5 Application. Surfaces against which primer and caulking are to be applied shall be clean, free from moisture, grease, oil or other foreign matter. All loose particles of mortar shall be cleaned out just prior to caulking. Primer and caulking shall be applied in accordance with the manufacturer's printed instructions. Caulking shall be applied using a gun with nozzle of proper size to fit the joint width.

7C.6 Protection and cleaning. Areas adjacent to joints to be filled shall be protected from smearing by the compound. Paper masking tape may be used for this purpose if removed five to ten minutes after the joint section is filled. Fresh compound that has accidentally been smeared on the masonry should be scraped off immediately and rubbed clean with methyl ethyl ketone, toluene, or a similar solvent. Upon completion of caulking, all remaining smears, stains, and other soiling resulting therefrom shall be removed and work left in a clean and neat condition.

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DIVISION 8. DOORS, WINDOWS AND GLASS

SECTION 8A. Doors
8B. Metal Windows
8C. Glazing

SECTION 8A. DOORS

8A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

28Ye Carpentry and woodwork
32Yd Metal doors

FEDERAL

RR-S-141a (2) Screening, wire, insect

GOVERNMENT

U. S. Department of Commerce; Commercial Standards

CS120-58 Ponderosa pine doors

8A.2 Metal doors.

8A.2.1 Metal door and frame shall conform to the applicable requirements of specification 32Y, except as indicated or specified otherwise.

8A.2.2 Hollow pressed steel frame shall be the full welded type.

8A.2.3 Hollow metal door shall be type III industrial type door and shall be a complete integral package unit with door, frame and hardware. Upper sections shall be glazed as indicated. Hardware shall be as specified in Division 10.

8A.3 Wood doors.

8A.3.1 Wood doors shall be Ponderosa pine with solid beveled raised panels conforming to Commercial Standard CS120, grade 1. Panels shall be arranged as indicated. Louver shall be provided in lower panel of door 3.

8A.3.2 Screen doors shall be Ponderosa pine, conforming to the applicable requirements of Commercial Standard CS120, grade 1, except as speci-

fied otherwise in specification 28Y. Insect screening shall be 18 x 18 mesh aluminum insect screen, conforming to specification RR-S-141. An aluminum woven guard shall be provided as specified in specification 28Y.

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SECTION 8B. METAL WINDOWS

8B.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

10Ye Metal windows (steel and aluminum)

FEDERAL

RR-S-141a (2) Screening, wire, insect

8B.2 General requirements. Metal windows shall be steel, projected type, conforming to the applicable requirements of specification 10Y, except as specified otherwise herein and shall be the types and sizes indicated or specified.

8B.2.1 Glazing provision. Window shall be designed for inside glazing with glazing clips and metal window glazing compound.

8B.2.2 Shop finish. Members shall be phosphate treated and shop primed.

8B.3 Projected windows shall conform to the requirements for commercial type steel windows.

8B.4 Insect screens and weatherstripping shall be provided for all ventilators. Screening shall be 18 x 18 mesh aluminum conforming to specification RR-S-141.

8B.5 Hardware for windows shall be malleable iron or hot-dip zinc-coated steel.

8B.6 Quality assurance provisions. The testing requirement stated herein or incorporated in referenced documents may be waived, provided certified copies of reports of test from approved laboratories performed on previously manufactured materials are submitted and approved. Test reports shall be accompanied by notarized certificates from the manufacturer certifying that the previously tested material is of the same type, quality, manufacture, and make as that proposed for this project.

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SECTION 8C. GLAZING

8C.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

DD-G-451a (1) Glass, flat and corrugated, for glazing, mirrors, and other uses

8C.2 General requirements. Glazing rabbets shall be rigid, true, plumb, square, properly primed, clean, dry, and dust free, before glazing work is started. Glazing work shall not be started until the outdoor temperature is above 40 degrees F on a rising thermometer, unless approved provisions are made to warm the glass and rabbet surfaces. Sufficient ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or rainy weather. Sash shall be glazed in a closed position, and shall not be operated until the glazing compound has set. Glazing materials shall be mixed uniformly without the addition of thinners or other materials, and shall be used while still fresh.

8C.3 Materials. Each light shall have the manufacturer's label showing the type, thickness, and quality of glass. Labels shall not be removed until the glazing work has been approved. Putty and glazing compounds shall be delivered to the site in unopened containers, labeled plainly with the manufacturers' names and brands.

8C.3.1 Glass shall conform to specification DD-G-451, and shall be provided in locations indicated or specified. Clear sheet glass, type II, B quality, double strength, shall be used for glazing windows. Clear sheet glass, type II, B quality, 7/32 inch thick shall be used for glazing doors.

8C.3.2 Glazing compound shall be a good grade of commercial compound manufactured for glazing metal doors and sash.

8C.4 Workmanship. All glass shall be accurately cut to fit the openings and shall be set with equal bearing on the entire width of the pane. Glass shall be properly bedded and backputtied and set without springing or forcing. Glass in windows shall be secured with zinc-coated or non-ferrous metal spring wire clips and puttied on a bevel. Glass in doors shall be held in place with stop beads. The corners in putty shall be carefully made and all excess putty shall be removed and surface cleaned. On completion, all dirt and stains shall be removed and the glass shall be washed. Glass broken on the job shall be replaced with new glass at no expense to the Government.

DIVISION 9. FINISHES

SECTION 9A. FIELD PAINTING

9A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

TT-E-489d	Enamel, alkyd, gloss (for exterior and interior surfaces)
TT-E-506e (2)	Enamel, tints and white, gloss interior
TT-E-00508a	Enamel; interior, semigloss, tints and white
TT-E-543a	Enamel, interior, undercoat, tints and white
TT-L-190c	Linseed oil, boiled (for use in organic coatings)
TT-P-25c	Primer coating, exterior (undercoat for wood, ready-mixed, white and tints)
TT-P-51e	Paint, oil, interior, flat, white and tints
TT-P-0086d	Paint, red-lead-base, ready-mixed
TT-P-95a (3)	Paint, rubber: for swimming pools and other concrete and masonry surfaces
TT-P-102a	Paint, oil: titanium-lead-zinc and oil, exterior, ready-mixed, white and light tints
TT-P-645	Primer, paint, zinc-chromate, alkyd type

MILITARY

MIL-S-12935B (1)	Sealer, surface, for knots
MIL-P-15328B (1)	Primer, pretreatment (formula 117 for metals)

GOVERNMENT

Government Safety Code

9A.2 General requirements. Hardware, hardware accessories, machined surfaces, plates, lighting fixtures and similar items in contact with painted surfaces and not to be painted shall be removed, masked, or otherwise protected prior to surface preparation and painting operations. Following completion of painting, removed items shall be reinstalled. Such removal and reinstalling shall be done by workmen skilled in the trades involved. Surfaces to be painted shall be thoroughly clean and shall be dry when the paint is applied. Paint shall not be applied to surfaces upon which there is frost, ice, or snow. Interior areas shall be broom clean and dust free before and during the application of any painting materials. Paint colors not specified otherwise shall be as directed. Paint finishes not specified shall be flat, semigloss, or gloss as directed. Surfaces which will be inaccessible after erection shall be treated and primed prior to erection, using two coats of the designated primer. Such

inaccessible surfaces are defined as those surfaces that are concealed after erection or installation. Surfaces of steel to be imbedded in concrete shall not be painted. Succeeding coats of the same type and/or color of paint shall vary sufficiently from the color of the preceding coat to permit ready identification. Damaged painting shall be retouched before the succeeding coat is applied. Finished surfaces shall be smooth, even, and free from defects. The number of paint coats specified shall be in addition to the shop-priming coats. Storage of paints and paint materials and the mixing of paints shall be restricted to the locations directed. Cleaning and painting shall be so programmed that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

9A.3 Preparation of surfaces. All dirt, rust, scale, splinters, loose particles, disintegrated paint, grease, oil, and other deleterious substances shall be removed from all surfaces which are to be painted or otherwise finished.

9A.3.1 Wood surfaces shall be free from dust and in an approved condition to receive the paint or other finish. The use of water on unpainted wood shall be avoided. Prior to application of paint, knots and resinous wood shall be treated with an application of knot sealer conforming to specification MIL-S-12935. Puttying of cracks and nailholes shall be done after the priming coat has been applied and has dried properly. Sandpapering, when required, shall be done after the undercoats are dry.

9A.3.2 Concrete and masonry shall be repaired before painting. Dirt, fungus, grease, and oil shall be removed prior to application of paint by washing the surfaces with a solution composed of from two to eight ounces of trisodium phosphate per gallon of hot water and then rinsing thoroughly with fresh water. Efflorescence shall be removed from concrete and masonry surfaces by scraping, wire brushing, and washing with a 5 to 10 per cent, by weight, solution of muriatic acid and then washing thoroughly with fresh water, removing all traces of the acid. The trisodium phosphate and muriatic acid solutions shall be within the ranges specified and shall be of strengths to perform their functions properly. Glaze and all loose particles and scale shall be removed by wire brushing.

9A.3.3 Metal surfaces to be painted, including zinc-coated surfaces and unprimed steel and iron surfaces, except surfaces subject to temperatures in excess of 350 degrees F, immediately after being cleaned, shall be given one coat of pretreatment coating conforming to specification MIL-P-15328 applied to a dry film thickness of 0.3 to 0.5 mil. Zinc-coated surfaces to be painted shall be cleaned with mineral spirits and wiped dry with clean, dry cloths prior to application of pretreatment coating. Primer paint shall be applied over the pretreatment coating as soon as practicable after the coating has dried.

9A.4 Workmanship shall be first class in every respect. Paint, enamel, and varnish finish shall be applied carefully with good clean brushes, or approved rollers, or approved spraying equipment, except that

the initial coat to be provided on any new or previously unpainted surface shall be applied by brush. The work shall be so conducted as to avoid damage of other surfaces and public and private property in the area; any damage thereto shall be made good by the Contractor at his expense. Sufficient time shall be allowed between coats to assure thorough drying, and each coat shall be in proper condition before the next coat is applied; sanding and dusting, as necessary to produce finishes free of visible defects when viewed from a distance of 5 feet shall be performed; varnish shall be sanded between coats. Finish coats shall be smooth and free from runs, sags, or other defects. Each coat of paint shall be of sufficient thickness to cover completely the previous coat or surface. Exterior paint shall not be applied during foggy or rainy weather; the temperature shall be above 45 degrees F and not over 95 degrees F. Interior paint may be applied at any time provided the surfaces to be painted are dry and the temperature can be kept above 45 degrees F during the application of ordinary paints, and between 65 degrees F and 95 degrees F during the application of enamels and varnishes.

9A.5 Delivery and storage. Paint proposed for use shall be stored at the project site in sealed and labeled containers, or segregated at the source of supply, and made available for sampling not less than 30 days in advance of required approval for use to allow sufficient time for testing. The Government shall be notified when the paint is available for sampling.

9A.6 Scope of work (includes new work in well houses).

9A.6.1 Wood surfaces.

(a) Exterior. All exposed wood surfaces shall be given one coat of exterior wood primer conforming to specification TT-P-25, and two finish coats of exterior titanium-lead-zinc and oil paint conforming to specification TT-P-102.

(b) Interior. All exposed wood surfaces shall be given one coat of interior enamel undercoater conforming to specification TT-E-543, and two finish coats of semigloss enamel conforming to specification TT-E-00508.

9A.6.2 Concrete plank ceiling surface and interior masonry walls shall be primed with one coat of chlorinated rubber base paint conforming to specification TT-P-95. Ceilings and walls above dado (5 feet high) shall be given one finish coat of flat oil paint conforming to specification TT-P-51. Dado shall be given two finish coats of semigloss enamel conforming to specification TT-E-00508.

9A.6.3 Metal surfaces.

(a) General. Surfaces to be in permanent contact with concrete or masonry, or embedded in masonry, shall receive a coat of asphalt primer and two coats of asphalt varnish in the field, before being made

inaccessible. Other surfaces to be inaccessible for painting in the finished work shall be painted two coats of the same material used for the priming coat before being made inaccessible and other finish painting of such surfaces will not be required. Shop priming coats and factory applied coatings, where damaged, shall be touched up with the same material used for the shop or factory coatings before additional paints are applied. Any surfaces not shop or factory primed shall be prepared, given a pretreatment coating and primed with zinc-chromate primer conforming to specification TT-P-645 to a thickness of not less than 1.5 mils prior to finish painting. Surfaces fully factory finished; that is, having finish coatings in addition to the prime coating, shall be restored to their original finished condition wherever damaged and additional painting will not be required. Bituminous-coated surfaces, except as specified otherwise, shall receive two coats of asphalt varnish.

(b) Metal surfaces, exterior, except copper, shall be given two finish coats of synthetic enamel conforming to specification TT-E-489.

(c) Copper surfaces, exterior, shall be given a coat of boiled linseed oil applied with clean cotton waste. Linseed oil shall conform to specification TT-L-190.

(d) Metal surfaces, interior, except varnished surfaces, shall be given two finish coats of semigloss enamel conforming to specification TT-E-506, except that roof beams shall be given two finish coats of flat oil paint.

(e) Varnished piping, valves and fittings shall be given one primer coat of aluminum paint and two finish coats of gloss enamel conforming to specification TT-E-506.

(f) Surface of metal work exposed in reservoir shall be given two coats of red-lead paint conforming to specification TT-P-0086, type I.

(g) Electrical switches and control panels shall be color painted to conform to Government Safety Code requirements. Electric conduit, where exposed in room spaces, shall be painted to match the space in which it occurs.

9A.7 Clean-up. Paint shall be removed immediately where spilled or spattered on surfaces adjacent to the work, including fixtures, glass and fittings. The premises shall be kept free at all times from accumulation of waste material and rubbish resulting from the work and upon completion of the work, all tools, scaffolding, surplus material and rubbish shall be removed and the premises left clean.

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DIVISION 10. SPECIALTIES

SECTION 10A. BUILDERS' HARDWARE

10A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

FF-H-106a (1)(Int. 9)	Hardware, builders'; locks and door-trim
FF-H-00111b	Hardware, builders'; shelf and miscellaneous
FF-H-116c (4)	Hinges, hardware, builders'
FF-H-121c	Hardware, builders'; door-closing devices

10A.2 General requirements. All hardware necessary for the complete finish of the building shall be furnished and installed and shall conform to the applicable requirements of specifications FF-H-106, FF-H-00111, FF-H-116 and FF-H-121. Hardware not specified otherwise shall have a US10 finish, except that finish in toilet shall be US26. Cylinder locks shall be keyed alike. One brass key tag, approximately 1-1/8 inches in diameter, with brass chain, shall be provided for each key.

10A.3 Schedule.

10A.3.1 Doors 1 and 5 shall have:

1-1/2 pair of butts, type T2127USP, 4-1/2 x 4-1/2 inches
1 lock set, type 161B-4
1 stop, type 1328E

10A.3.2 Doors 2 and 3 shall have:

1-1/2 pair of butts, type 2127USP, 4-1/2 x 4-1/2 inches
1 latch set, type 161N-4
1 stop, type 1328E

10A.3.3 Door 4 shall have:

1-1/2 pair of butts, type 2127USP, 4 x 4 inches
1 lock set, type 161L-4
1 stop, type 1328E

10A.3.4 Screen door for 1 and 5 shall have:

1-1/2 pair of butts, type 2127USP, 4 x 4 inches
1 closer, type 3010
1 pull, type 1275

Screen door for 1 and 5 (cont'd)

2 push bars, type 472A
2 kick plates, type 1226

10A.3.5 Cabinet shall be provided with the following:

Doors shall have one pair of semi-concealed hinges
1 friction catch, type 1074
1 pull, type 1306D

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DIVISION 11. EQUIPMENT

None required.

DIVISION 12. FURNISHINGS

None required.

DIVISION 13. SPECIAL CONSTRUCTION

None required.

DIVISION 14. CONVEYING SYSTEMS

None required.

DIVISION 15. MECHANICAL

SECTION 15A. Plumbing
15B. Heating and Ventilation
15C. Plant Mechanical Equipment
15D. Well Pumping Equipment
15E. Process and Service Water Piping
15F. Instrumentation and Control

SECTION 15A. PLUMBING

15A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

31Yg	Interior plumbing systems, including erratum no. 1

FEDERAL

HH-I-552	Insulation pipe covering, thermal, and insulation blanket, thermal, pipe covering
OO-C-00566d	Dispenser, drinking water, mechanically cooled
WW-P-541b (4) and (6)	Plumbing fixtures, land use
WW-T-799b	Tubing, copper, seamless (for use with solder-joint or flared-tube fittings)

MILITARY

MIL-P-21214	Pumps, centrifugal, vertical sump, electric motor driven, automatic, wet-pit type

NON-GOVERNMENT

Underwriters' Laboratories, Inc.

15A.2 General requirements. The work includes the provision of all water piping to plumbing fixtures, piping for drains to a point 5 feet outside of building, plumbing fixtures and accessories. All piping shall be inspected, tested, and approved before being buried, covered or concealed. Materials and workmanship shall be in accordance with specification 31Y, except as modified herein.

15A.3 Pipe, valves and fittings.

15A.3.1 Sanitary sewer and drain piping.

(a) Piping buried in the ground shall be extra heavy cast-iron soil pipe and fittings.

(b) Piping above the ground. Vents less than 3 inches in diameter shall be zinc-coated standard weight screw-jointed steel pipe with cast-iron recessed and banded screw jointed drainage fittings. All other piping shall be cast-iron bell-and-spigot pipe and fittings as specified for pipe under ground, except that cast-iron pipe and fittings shall be standard weight.

15A.3.2 Water piping. Water piping shall be type K copper tubing conforming to specification WW-T-799 and soldered brass or copper composition fittings, using 50-50 lead-tin solder. Bronze gate shutoff valves shall be provided at the bottom of each riser or the beginning of each lateral for all cold water lines and on the supply to each fixture not provided with compression stop or other auxiliary shutoff valve.

15A.4 Fixtures, trimmings, fittings, accessories, and miscellaneous plumbing supplies, except as specified otherwise, shall be in accordance with specification WW-P-541, and all trimmings and fittings shown and/or described therein for the fixtures specified shall be provided. The finish of trimmings, fittings and accessories shall be brass, nickel or chromium plate, unless stated otherwise.

15A.4.1 Fixtures, as follows, shall be provided where indicated:

(a) Water closet shall be Outfit VW-9, with CETW seat.

(b) Sink shall be constructed of No. 18 US gauge Type 18-8 stainless steel with satin semi-bright finish. Fabrication shall be by welding with all welds ground and polished smooth. The sink shall have single compartment, 14 inches by 16 inches by 7-1/2 inches deep. Underside of sink shall be sound-deadened.

15A.4.2 Accessories, as follows, shall be furnished and installed where directed.

(a) Combination faucet for sink, type 41.

(b) Faucets for sampling lines shall be type 10.

(c) Paper holder shall be type 434; coat hook shall be type 419.

(d) Frostproof hydrant shall be a compression type with 1-1/2 inch hose connection and 1-1/2 inch inlet as indicated. Unit shall have zinc-coated casing.

15A.5 Electric water cooler shall conform to specification 00-C-00566, type 1, having a minimum capacity of 4.75 gallons per hour. Unit shall be

floor mounted, bubbler style, suitable for operation on single phase, 120 volt, 60 cycle current.

15A.6 Sump pump, single type, shall be electric motor driven automatic, self contained type of sturdy construction conforming to the requirements of specification MIL-P-21214. Pump shall have a capacity of 20 gpm against a total head of 10 feet. Speed shall not exceed 1750 rpm. Motor shall be suitable for operation on 120 volt, single phase, 60 cycle current.

15A.7 Water heater shall be automatic electric storage-type, glass lined with built-in magnesium anode. Dip tube, if used, shall be tin lined copper or stainless steel. Heater shall have a capacity of 10 gallons. Heating elements shall not exceed 3000 watts and shall be suitable for operation on 208 volt, 60 cycle current. Unit shall have temperature and pressure relief valve, shall be listed by Underwriters' Laboratories, and shall have a 10-year factory warranty.

15A.8 Insulation. New hot and cold water piping, after being tested, shall be cleaned and insulated. Insulation shall be sectional, removable pipe covering in accordance with specification HH-I-552, type I, class A. Insulation on hot water piping shall be jacketed with cotton cloth or canvas, weighing not less than 3-1/2 ounces per linear yard, 37-1/2 inches in width. Insulation on cold water piping shall receive a vapor barrier jacket consisting of one ply of aluminum foil and one layer of creped kraft paper, bonded together with a special non-asphaltic waterproof laminant; end joints shall be sealed with end strips of the same material and not less than 4 inches wide. Vapor barrier jacket shall be sealed at valves, fittings, etc., with pressure sensitive tape or vapor barrier adhesive. All covering shall be secured with brass, lacquered steel or aluminum bands not less than 0.005 inch thick, not less than 3/4 inch wide, and spaced not more than 18 inches on centers. Fittings and valves shall be insulated with the same material and thickness as the piping. Covering shall be finished neatly at pipe hangers and shall be terminated neatly on the ends of the unions.

15A.9 Tests. All defects disclosed as a result of the following tests shall be remedied.

15A.9.1 Water piping shall be subjected to a hydrostatic pressure test at operating pressure.

15A.9.2 Sanitary piping. Before the installation of any fixtures, the ends of the system shall be capped and all lines filled with water to the roof and allowed to stand until a thorough inspection has been made. After the fixtures are set, a smoke or equivalent test shall be made, using an approved apparatus.

15A.10 Sterilization. The water system shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The sterilization solution shall be allowed to remain

in the system for a minimum period of 24 hours. During the sterilization period, all valves and outlets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than two parts per million.

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SECTION 15B. HEATING AND VENTILATING

15B.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

21Yd	Steam power plant, heating, and ventilating equipment and piping; including erratum no. 1 and addendum no. 1
34Yd	Coal tar coating systems for steel surfaces; including addendum no. 1

FEDERAL

WW-T-799b	Tubing, copper, seamless (for use with solder-joint or flared-tube fittings)

MILITARY

MIL-F-16081D	Fans, ventilating, propeller
MIL-G-17232A	Grilles, registers, diffusers and deflectors, metal

NON-GOVERNMENT

Air Moving and Conditioning Association
American Society of Heating, Refrigerating and Air-Conditioning Engineers
National Fire Protection Association (NFPA)

30	Flammable liquids code. 1963
31	Oil burning equipment; standard for and installation of. 1965
90A	Air conditioning and ventilating systems other than residence type. 1966

Underwriters' Laboratories, Inc.

15B.2 General requirements. The work includes the provision of an oil-fired warm air furnace, sheet metal work, oil tank, piping, and accessories, and an exhaust fan for the chlorinator room. The installation shall be complete as shown and ready to operate. The installation shall be in accordance with specification 21Y and NFPA pamphlets 30, 31 and 90. Items used in the installation shall have been approved by the Underwriters' Laboratories, Inc., and listed under the proper heading.

15B.3 Furnace. The furnace shall be of a vertical discharge oil-fired type, floor mounted and shall have a net output of at least 140,000 BTUs at the bonnet. The unit shall be factory assembled, complete with all safety controls, and wired. The heat exchanger shall be a standard product of the manufacturer and shall be constructed of steel, stainless steel,

cast-iron or a combination thereof. Steel sheet shall not be less than 0.0598 inch thick. A vent port shall be provided to prevent injury to the unit in the event of delayed ignition. The casing shall be constructed of steel at least 0.0299 inch thick (22 ga.). Insulation shall be provided to limit loss to two per cent of the furnace output. Filter shall be of the throwaway type. Fan shall have a capacity of approximately 1200 cfm at 0.20-inch wg and shall be V-belt driven. Motor shall be single phase, 120 volt, 60 cycle; three phase if one-half horsepower or over. Motor shall be of ample size to pull the connected load. The oil burner shall be of a gun type, complete with fan, fuel oil pump, electric ignition system, safety controls and all accessories as required by NFPA pamphlet 31. The atmospheric draft regulator shall be at least 18 inches distant from the stack switch. Fan operation shall be controlled by a switch which shall start the fan at approximately 100 degrees F and shall stop the burner when the temperature in the unit exceeds 250 degrees F. A switch shall be provided which shall prevent operation of the burner upon failure of the circulating fan. A thermostat shall be provided where shown in the office to control the temperature of the space.

15B.4 Sheet metal. A complete system of sheet metal ducts shall be provided as shown. Sheet metal shall be rectangular. Weights shall be as specified in NFPA pamphlet 90. Clearances specified therein shall be maintained.

15B.5 Grilles shall be sized as indicated and conform to the applicable requirements of specification MIL-G-17232. Grilles in heating system shall be the adjustable deflection type and provided with opposed blade dampers.

15B.6 Fuel oil tank. The oil tank shall be 42 inches in diameter by at least 92 inches long. Tank shall be complete with fill pipe and vent, as shown. The installation shall conform to the requirement of NFPA pamphlet 30; tank shall be constructed of at least 10 gauge black steel plate and given a type I coating conforming to specification 34Y.

15B.7 Oil lines for the oil burners shall be type K soft drawn copper tubing with compression fittings in accordance with specification WW-T-799.

15B.8 Exhaust fans shall be of the propeller type, type I, class 1, style A, in accordance with specification MIL-F-16081. Capacity shall not be less than 1000 cfm at 1/8-inch SP. Motor shall not be less than 1/20 horsepower, directly connected, standard for wall mounting. Fan shall have been tested and approved by the Air Moving and Conditioning Association and the American Society of Heating, Refrigerating and Air-Conditioning Engineers. Fan shall be mounted as shown. Fan shall be complete with self-closing (gravity) louvers on the outside and a proper propeller guard on the inside. Shop drawings shall be provided. An Underwriters' label of approval will be required. Radio suppression will not be required.

15B.9 Operation and maintenance instructions and spare parts list, in printed form, covering the operation and maintenance of each item of equipment, shall be posted at designated locations. Four additional copies shall be delivered to the Officer in Charge.

15B.10 Tests. After installation, the furnace unit shall be tested as in-service to determine its adequacy to heat the space, compliance with the specifications and air distribution. Equipment failing to perform as specified shall be replaced by the Contractor at no additional cost to the Government.

15B.11 Warranty. All the equipment to be furnished under this section of the specification shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or for final acceptance, whichever is earlier, against defective material, design and workmanship.

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SECTION 15C. PLANT MECHANICAL EQUIPMENT

15C.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

9Yh	Electrical apparatus, distributing systems, and wiring; including addendum no. 2
34Yd	Coal tar coating systems for steel surfaces; including addendum no. 1

FEDERAL

GG-G-76c	Gages, pressure and vacuum, dial indicating, (for air, steam, oil, water, ammonia and freon)

MILITARY

MIL-W-17121C	Water softener unit, zeolite pressure type
MIL-C-17226B	Chlorinator, water purification, gas-solution type
MIL-H-17278A (1)	Feeders, chemical solution, water purification, fully automatic, manually adjusted
MIL-P-17552C (1)	Pumps, centrifugal, water, horizontal, general service; and pumps, centrifugal, water, horizontal, boiler feed: electric motor or steam turbine driven

NON-GOVERNMENT

American Standards Association (ASA)

National Electrical Manufacturers Association (NEMA)

National Fire Protection Association (NFPA)

Pamphlet 30 Flammable liquids code. 1963

Underwriters' Laboratories, Inc. (UL)

15C.2 General requirements. The work includes the provision of all water treatment equipment, accessories and appurtenances indicated and specified to provide a complete and operating water treatment plant. The water treatment equipment shall include an aerator, lime-feeding equipment, filter pumps, pressure filters, water softeners, chlorinators, service pumps, brine pumps, and associated equipment.

15C.2.1 Service. This equipment shall perform the service of pro-

ducing an effluent as specified from raw water, having an analysis as shown, in the quantities specified.

15C.2.2 Source. The raw water supply is derived from wells located on the station as indicated on the plans.

15C.2.3 Raw water analysis is as follows:

Item	PPM
(a) Calcium (Ca) (as $CaCO_3$)	116.
(b) Magnesium (Mg) (as $CaCO_3$)	8.
(c) Sodium (Na) and Potassium (K)(as $CaCO_3$)	21.
(d) Silica (Sicl)	11.4
(e) Iron (Fe) Total	2.
(f) Bicarbonate (HCO_3)(as $CaCO_3$)	116.
(g) Carbonate (CO_3)(as $CaCO_3$)	0.0
(h) Hydroxide (OH)(as $CaCO_3$)	0.0
(i) Sulphate (SO_4)(as $CaCO_3$)	8.
(j) Chloride (Cl)(as $CaCO_3$)	21.
(k) Phosphate (PO_4)	0.0
(l) Carbon Dioxide (CO_2)	20.
(m) Total hardness (as $CaCO_3$)	124.
(n) pH	7.2
(o) Color	15.

15C.2.4 Effluent. The effluent, or service water, produced shall have a total hardness as $CaCO_3$ not to exceed 45 ppm and a total combined iron and manganese content not to exceed 0.3 ppm. The solids in solution shall not be greater than those in the raw water.

15C.2.5 Capacity. The water treatment equipment shall have the capacity to produce a service water effluent as herein specified of not less than 576,000 gallons daily.

15C.2.6 Proportioning equipment. Proportioning equipment shall be provided to direct predetermined portions of flow through the softeners in such a manner as to produce a blend in accordance with the effluent specification. This apparatus shall maintain the proper proportioning for all rates of flow between 30 per cent and 150 per cent normal. It shall be readily adjustable to changing water conditions without dismantling and shall be hydraulically operated. It shall be accurate within plus or minus 5 per cent.

15C.2.7 Controls. Individual units of the water treatment equipment shall have automatic controls, as specified herein, interlocked in such a manner as to constitute an integral part of an automatic treatment facility.

15C.2.8 Standard products. It is intended that the equipment and its component parts hereinafter specified shall be a regular commercial

product of the manufacturer or his suppliers, and shall be new and unused.

15C.2.9 Approved safety guards shall be provided on all moving parts of mechanical equipment.

15C.2.10 Operation and maintenance instructions and equipment. Five copies of manual covering each item of mechanical equipment shall be furnished the Officer in Charge. The manual shall contain but not be limited to the following: operating instructions, illustrations, drawings, detail description, installation instructions, adjustments, tests, parts list, etc.

15C.3 Aerator. The aerator shall have a capacity of approximately 400 gpm and shall consist essentially of a closed chamber for counter-current flow of the water and air, to reduce the carbon dioxide content from 20 ppm to an average of 5 ppm, and shall be used to reduce hydrogen sulfide content.

15C.3.1 The pressure chamber shall be substantially constructed of clear redwood or select cypress, or other approved material, with effective internal cross-section area to handle the required flow of 400 gpm at the proper velocity to provide for efficient CO_2 and H_2S reduction. The inlet water shall be distributed through non-metallic distributors of nonclogging design to avoid corrosion or clogging.

15C.3.2 Complete internal distributors and collectors shall be provided for the uniform distribution of the water over the horizontal cross-section of the chamber and for the uniform collection of the air. A positive air seal shall be provided at water inlet and outlet, and the water shall cascade over staggered slat trays counter-current to a rising flow of air induced by the blower. The trays shall be constructed of corrosion-resistant material. A permanent vent shall be provided on top of the unit. The side of the chamber adjacent to the blower shall have removable doors to provide easy access for cleaning trays.

15C.3.3 A motor-driven blower complete with starter shall be provided, designed to operate successfully against the head required for the design employed. The blower shall have a capacity of not less than 2000 cfm. Motor shall be totally enclosed and suitable for operation with three-phase, 208 volt, 60 cycle current. Motor shall have a magnetic full voltage across-the-line starter. Starter shall have hand-off-automatic switch which shall be connected in the control system to operate the fan when a well pump operates.

15C.4 Lime-feeding equipment. The Contractor shall provide lime-feeding equipment to include the lime slurry tank, slurry mixer, feed pump, discharge hose, related piping, accessories and equipment. The equipment shall be designed to continually mix and to feed a 10 per cent lime slurry solution.

15C.4.1 Lime slurry tank shall be a standard open tank with slotted

hinged cover, permanent mixer mounting bracket, stand, related make-up water and discharge piping and accessories. The shell shall be made of steel and shall conform to the dimensions shown except for minor variations to match a standard manufactured product.

15C.4.2 Mixer shall be a standard manufactured product satisfactory for use with a 10 per cent lime slurry solution. The unit shall be a fixed-mounted, electrically operated, gear-driven, propeller-type agitator complete with stainless steel shafting, mounting facilities and other necessary accessories. The propeller shall be stainless steel with an approximate diameter of 12 inches with three blades, and shall have a rotational speed of approximately 400 rpm. The exact size, pitch and rotation speed shall be such as to provide optimum efficiency. The unit shall be designed to operate on 208 volt, three phase, 60 cycle current, and shall have outboard facilities for lubricating shaft bearing.

15C.4.3 Lime-feed pump shall be an electric motor-driven, manually adjusted variable feed-type pump with the capacity to supply 20 gallons per hour with 150-foot TDH. The adjustment range shall be from zero to at least 20 gallons per hour and shall be manually selected. The motor shall be designed to operate on 120 volt, 60 cycle current and the starter shall have a hand-off-automatic selector switch which shall be electrically interconnected with control panel. The pump shall conform to the applicable requirements of MIL-H-17278 for type II, except that the feed rate shall be manually adjustable rather than automatic proportioning.

15C.5 Chlorination equipment. Two fully automatic manually adjustable gas-solution type chlorinators shall be provided. One chlorinator shall be installed to feed chlorine solution to the raw water at entrance to detention tank and to the treated water prior to storage. The other shall be connected to the suction side of the service pumps. The exact points of application shall be as indicated. The two chlorinators shall be interconnected for interchangeable use. The chlorinators shall be in accordance with specification MIL-C-17226, except as modified herein. One platform scale without wheels having a minimum capacity of 1000 pounds and one gas mask shall be provided for use with the two chlorinators.

15C.5.1 The equipment shall be the gas type, each designed to feed from 0 to 100 pounds of chlorine per 24 hours. A minimum water pressure of approximately 40 psi is available for the operation of the equipment. The water pressure at all points of application will not exceed 10 psi.

15C.5.2 Chlorine solution hose shall be a standard product normally used in conveying chlorine in solution under the pressure as indicated herein with suitable flexibility.

15C.5.3 Chlorine gas piping shall be black extra heavy wrought iron pipe fitted with extra heavy black malleable iron fittings. Valves shall be standard products normally used with chlorine gas and capable of resisting the corrosive action of chlorine gas.

15C.5.4 Controls. The chlorinator feeding the suction side of the service water pumps shall be actuated by the service water meter and the other chlorinator shall be actuated by the raw water meter.

15C.5.5 Five copies of complete operating instructions and five copies of spare parts catalogue shall be furnished with the equipment.

15C.5.6 Spare parts auxiliary equipment and maintenance tools shall be furnished as specified in specification MIL-C-17226.

15C.6 Filters. The filter battery shall include three vertical, pressure-type units, sized for 400 gpm with a flow rate not to exceed 3 gpm per square foot of filter bed. Filters shall be arranged for automatic group control and shall be complete with all controls, valves, fittings, piping and accessories specified or necessary for automatic operation of the units. They shall be used for filtering the detention tank effluent which is aerated, lime-treated, and settled water derived from deep wells. The filters shall be the regular commercial product of the manufacturer or his supplier.

15C.6.1 Filter tanks. The shells shall be welded steel construction. The shell shall be tested to withstand a hydrostatic pressure 50 per cent in excess of a working pressure of 45 psi. The shell shall be equipped with screw jack supports. Each shell shall have a manhole and handholes for permitting easy access to the entire interior and shall not be lined. Class 125 ASA flanged connections shall be provided for the unfiltered water inlet and filtered water outlet. A hand-operated vent shall be placed on top of the shell.

15C.6.2 Water distribution and collection system shall be the header-lateral underdrain type. The piping manifold shall be either wrought iron or brass and shall have stainless steel non-clogging nozzles. The filter service flow shall be downward and the backwash flow shall be reversed. Baffles shall be provided as necessary to prevent channeling of sand and gravel bed and to cause the water to have an even distribution across the filter media. Each filter shall have a self-propelled rotary surface washer to thoroughly agitate the media during filter backwashing. The tanks shall be designed to provide for a minimum expansion of 50 per cent of the sand bed during a backwashing operation with a water rise rate of 30 inches per minute.

15C.6.3 Filter media. Each filter shall be provided with an aggregate depth of at least 42 inches of a filtering media consisting of suitable grades of screened silica filter sand and gravel with layers apportioned approximately as follows:

22 inches of sand
4 inches of 1/8-inch to 1/4-inch gravel
4 inches of 1/4-inch to 1/2-inch gravel
8 inches of 1/2-inch to 1-inch gravel
4 inches of 1-inch to 1-1/2-inch gravel

The sand shall have an effective size of 0.45 to 0.55 millimeters with a uniformly coefficient of .70 (max) to 1.20 (min).

15C.6.4 Main operating valve for the filter battery shall have three positions; filter, wash and backwash (rinse). Valve shall have minimum pressure loss and shall open and close without hydraulic shock, and shall be designed for a working pressure of 75 psi and shall be tested at 1.5 times the working pressure. Positions shall be permanently marked on the valve.

15C.6.5 Automatic operation. Filter operation shall be automatic and all necessary additional electrical and mechanical equipment shall be provided. The main operating valve shall be positioned by an electric motor and reduction gear, totally enclosed. Operation shall be initiated by an adjustable 7-day time clock. The backwashing shall be carried out in sequence with each filter backwashing for a specified period, all three rinsing for a specified period and all three to go back on the line simultaneously. The control equipment shall be interlocked to other control equipment to cut-on and cut-off water supply to rotary surface washers at the proper time during the backwashing operations. A holding device shall be provided to prevent automatic timer from operating while softeners are regenerating.

15C.6.6 Rate of flow controllers shall be furnished for washing and rinsing. The controllers shall be the external float type or built-in type hydraulically operated. The controllers shall maintain the correct flow within $\pm$ 5 per cent, regardless of pressure fluctuations in the line. Rates of wash and rinse shall be adjustable. When the controllers are of the external-float type and require sumps, the sumps shall be constructed of reinforced concrete to dimensions as recommended by the manufacturer and as approved by the Officer in Charge.

15C.6.7 Rate of flow indicators shall be provided with each filter to indicate the rate of flow during filtration and backwashing.

15C.6.8 Pressure loss. The pressure loss through the filter battery after washing shall not exceed 10 feet of water, measured between the main operating valve inlet and outlet. Two pressure gauges shall be provided, one for mounting on the raw water inlet and one for the filtered water outlet. Gauges shall conform to specification GG-G-76, class 2, type A, 6-inch brass case.

15C.6.9 Manufacturer's identification. Components of the system shall bear the manufacturer's name or trademark on a nameplate securely affixed in a conspicuous place. In lieu of the nameplate, a cast, stamped or other permanent marking may be applied to the components.

15C.7 Water softening equipment. The equipment shall be water softeners conforming to the applicable requirements of specification MIL-W-17121, except as specified otherwise herein. Flow rate shall not exceed

8 gpm per square foot of bed area. The equipment shall consist of two softeners complete with all necessary working parts, interconnecting piping, valves, fittings, meters, gauges, and shall include a main operating valve system, brine measuring tanks, and all associated controls.

(a) Controls. The softening equipment shall be automatically controlled, and shall be designed for regeneration not oftener than once every 12 hours.

(b) Water pressure available to operate the brine injectors will be 15 psi minimum.

(c) Current. Power supply will be 120/208 volt, 60 cycle, three phase current.

(d) Electrical equipment having radio interference reduction is not required.

(e) Repair and maintenance parts and tools. A set of all special tools required for access to, repairs to, and operation of the equipment, other than ordinary mechanic's tools, shall be furnished.

(f) Production test model will not be required.

(g) Brine measuring tanks shall be made of fiber glass.

(h) Salt storage tanks will not be required.

(i) If the rinse water and backwash water flow rate controls are of the external type and require sumps, the sumps shall be constructed of reinforced concrete to dimensions as recommended by the manufacturer and as approved by the Officer in Charge.

15C.8 Water pumps. Service water pumps and filter pumps shall conform to the applicable requirements of specification MIL-P-17552, type I, style I, class I, except as modified herein. Pumps shall be electric motor driven, except that service water pump No. 3 shall be dual-driven (electric and gasoline engine).

15C.8.1 Pumping conditions. Each pump shall be designed to pump the capacity herein specified when discharging against the total dynamic head specified. The speed of the pumps shall not exceed 1800 rpm. Efficiency of the pump shall be not less than 70 per cent.

	Capacity	TDH
Service Water Pump No. 1	500 gpm	120 feet
Service Water Pump No. 2	500 gpm	120 feet
Service Water Pump No. 3	750 gpm	125 feet
Filter Pump No. 1	430 gpm	70 feet
Filter Pump No. 2	430 gpm	70 feet

15C.8.2 Stuffing boxes shall have packing rings.

15C.8.3 Pumps shall be of the split-case, double-suction type.

15C.8.4 Motors shall be designed to operate on 208 volt, three phase, 60 cycle current. Motors shall be of the squirrel-cage type and shall be drip-proof. Speed shall not exceed 1800 rpm. Motor shall have ample capacity to properly operate the pump through its entire head-capacity range without exceeding the temperature limits of NEMA and shall be rated on a basis of 55 degrees centigrade temperature rise.

15C.8.5 Motor controllers. Motor starters, except as specified otherwise, shall conform to specification 9Y for NEMA type I enclosure, and shall have three-phase thermal overload protection and undervoltage release for use with a maintained-contact pilot device. All starters shall be provided with hand-off-automatic selector switch. Motors 30 horsepower and less shall be enclosed magnetic full-voltage across-the-line type. Motors larger than 30 horsepower shall be provided with an auto-transformer type reduced voltage starter with taps for 50 per cent and 65 per cent voltage and equipped with a start-stop push button arrangement for operation on the manual position.

15C.8.6 Gasoline engine, for dual-driven service-water pump No. 3, shall be a complete self-contained, multi-cylinder, water-cooled, heavy duty gasoline power plant with maximum horsepower of at least 30 per cent in excess of the maximum brake horsepower required to operate the pump continuously at its rated speed over the entire head capacity range of the pump. The engine shall be arranged for motor cranking and shall be equipped with a high tension ignition system, battery, and required appurtenances; shall include an adjustable governor, carburetor, gasoline pump and filter, air cleaner, 18-ampere generator, oil filter, starting crank, exhaust pipe muffler and radiator.

15C.8.7 Centrifugal clutch-coupling shall be provided for connection of the auxiliary gasoline engine to the dual-driven high lift pump (Pump No. 3). The coupling shall be designed to permit the engine to idle at any predetermined speed, automatically picking up the pump load when the engine speeds up and again releasing the pump at the idling speed. The coupling shall be of sufficient capacity to transmit the torque developed by the engine.

15C.8.8 Gasoline storage tank shall be constructed in accordance with NFPA 30 and shall bear the Underwriters' Label. Tank shall have a capacity of 560 gallons and be provided with fittings and accessories, including gravity tank and hand pump for filling gravity tank. The tank shall be given a type I coating conforming to specification 34Y.

15C.8.9 Exhaust pipe from the engine shall be carried through the wall of the pump house in a sleeve and a suitable muffler shall be mounted on the end of the exhaust pipe, as indicated. The muffler shall be pro-

perly supported in an approved manner.

15C.8.10 A metal instruction plate shall be mounted on the engine unit giving the manufacturer's recommendations for lubricating oil and other pertinent information.

15C.8.11 Pump characteristic curves. The Contractor shall submit for each pump for approval prior to ordering, certified characteristic curves prepared by the pump manufacturer, showing the capacities, heads, efficiencies and brake horsepower through the entire range of the pump.

15C.8.12 Nameplates. A corrosion-resistant metal nameplate shall be attached to each pump in a conspicuous place. The following information shall be plainly marked on the nameplate:

(a) Name and address of the pump manufacturer

(b) Speed

(c) Capacity and head at maximum efficiency

(d) Required horsepower

(e) Serial number, model number and such other information as the manufacturer may consider necessary for complete identification.

15C.8.13 Battery charger, electric type, shall be mounted on wall of pump room where directed and shall be the rectifier type for operation with 120 volt, 60 cycle current. Charger shall be protected by an automatic circuit breaker and shall have capacity to charge two 6-volt batteries or one 12-volt battery at eight to five amps. One direct current ammeter shall be included and shall be flush-mounted on the front of the enclosure. All metal parts shall be corrosion-resistant or shall be suitably protected against corrosion.

15C.9 Brine pumps shall be in accordance with the applicable requirements of specification MIL-P-17552, type 1, style 2 (support head), except as modified herein. All parts exposed to the corrosive action of the brine shall be carpenter 20, stainless steel or approved equal, designed and constructed to resist the action of the brine. Pumps shall be designed to deliver 10 gallons of brine per minute against a total dynamic head of 20 feet.

15C.9.1 Float switches, adjustable to start and stop pumps at predetermined levels, shall be provided in the brine tank. Parts exposed to the corrosive action of the brine shall be constructed of materials that will resist such corrosive action.

15C.9.2 Motors shall be drip-proof, designed to operate on 120 volt,

60 cycle, single-phase current. Starters shall be magnetic full voltage across-the-line starters and be equipped with hand-off-magnetic switch.

15C.10 Operation and maintenance instructions and equipment. Five copies of manual covering each item of control equipment shall be furnished the Officer in Charge. The manual shall contain, but not be limited to, the following: operating instructions, illustrations, drawings, detail description, installation instructions, adjustments, tests, parts list, etc.

15C.11 Installation. Equipment provided shall be installed to conform with the general arrangement shown. Final adjustments on the installed filter and softening equipment shall be made under the direction of a supervisory engineer regularly employed by the manufacturer of the equipment. The Contractor shall perform operational tests with the installed equipment as required to demonstrate a satisfactory facility. Equipment failing to perform as specified shall be replaced by the Contractor at no additional cost to the Government.

15C.12 Warranty. All the equipment furnished under this section of the specification shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or for final acceptance, whichever is earlier, against defective material, design and workmanship.

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SECTION 15D. WELL PUMPING EQUIPMENT

15D.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

FEDERAL

WW-P-441c Pipe; wrought iron (welded, black or zinc-coated)

NON-GOVERNMENT

National Electrical Manufacturer's Association (NEMA)

15D.2 General requirements. The work includes the removal of deep well pumping equipment, chlorinator equipment, electrical control equipment and appurtenances in two existing pump houses and provision of new pumping equipment as indicated and specified herein. The installations shall be complete and ready to operate.

15D.3 Existing conditions.

15D.3.1 Well House No. BB-43. The well pumping equipment includes a deep well turbine pump with depth of setting of 45 feet, right angle gear drive, 10 horsepower vertical hollow shaft electric motor, motor starter and auxiliary air-cooled gasoline engine. Other installed equipment includes chlorinator, booster pump, two water pressure tanks and miscellaneous control equipment. All of this equipment shall be removed and salvaged and a new pump, motor, motor starter, right angle gear drive, auxiliary gasoline engine and all accessories and appurtenances indicated or specified provided.

15D.3.2 Well House No. BB-44. The pumping equipment includes a deep well turbine pump with a depth of setting of 35 feet, 15 horsepower vertical hollow shaft electric motor, motor starter and control equipment. Other installed equipment includes a chlorinator, booster pump and miscellaneous control equipment. All of this equipment shall be removed and salvaged and a new pump, motor, motor starter and all accessories and appurtenances indicated or specified provided.

15D.4 Pumps shall be the vertical turbine type, oil lubricated and provided with a non-reverse ratchet to prevent reverse rotation. Pumps shall have an efficiency of not less than 70 per cent.

15D.4.1 Pumping conditions. Speed of pumps shall not exceed 1800 rpm. Pumps shall be designed for the following conditions:

Well No.	Capacity	T.D.H	Depth of Setting (Top of Bowls)
43	175 gpm	63 ft	40 ft
44	190 gpm	60 ft	40 ft

15D.4.2 Pump head. Pump heads shall be constructed from close-grained cast iron and shall be heavy duty type designed for hollow shaft drive. Pump shall have flanged above ground discharge.

15D.4.3 Pump column. The column shall be genuine wrought iron conforming to specification WW-P-441, and shall be in sections not to exceed 10 feet in length and of proper diameter to eliminate undue friction when pumping at pump capacity.

15D.4.4 Line shaft. The line shafting shall be high-grade ground and polished steel and not less than 1-3/16 inches in diameter. The shaft shall be furnished in interchangeable sections not over 10 feet in length and fastened with threaded steel couplings having a strength of not less than 100 per cent of the strength of shaft after being assembled. The ends shall be machine finished and undercut for proper butting of the shaft. All threads shall be lathe cut.

15D.4.5 Bearings. The pumping unit shall have sufficient guide bearings to maintain the alignment of the pump and shafting and to prevent vibration. The inner column couplings shall be bronze and shall act as bearings for the line shaft which shall be turned and polished. Oil lubricated bearings shall be provided with oil grooves to effect passage of oil down through the entire length of oil tube and shafting. An automatic lubricator with capacity sufficient for one week of continuous operation shall be provided to feed oil to the bearings. Lubricator shall have sight glass and feed adjustment.

15D.4.6 Bowls. The pump bowls shall be made of close grained cast iron, free from blow-holes and all other defects which would impair their strength or durability for the service, and shall be lined with vitreous porcelain enamel. Bowls shall have smooth, curved vanes to efficiently direct the flow of water and to prevent air locking. The bowls shall be of suitable thickness and strength to withstand the shutoff pressure of the unit. Bowls shall be fastened together in such a manner that accurate alignment is assured and maintained. Guide passages for water shall be so designed and finished as to reduce friction to a minimum.

15D.4.7 Impellers shall be of the enclosed type, of heavy construction, and lined with vitreous porcelain enamel. Each impeller shall be accurately fitted and perfectly balanced both dynamically and hydraulically. Impeller shaft shall be of high grade stainless steel, carefully ground and polished and furnished with lathe cut threads. No keyways shall be cut into the shaft. Impellers shall have non-overloading characteristics and shall have head characteristics as steep as possible so that an increase or

decrease in the operating head above the design point will not cause an excessive decrease or increase in pump capacity. Impellers shall be attached and locked to pump shaft in such a manner that they may easily be removed, and that they will not work loose for any reason.

15D.4.8 Suction pipe and strainer. A suction pipe of suitable diameter and 10 feet long shall be provided for each pump. A galvanized strainer having a net inlet opening area of at least five times the area of the suction pipe shall be provided at the lower end of the suction pipe.

15D.5 Motors. Motor shall be a hollow shaft, vertical, fully enclosed electric motor and shall be squirrel-cage induction type for operation on 208 volt, 3 phase, 60 cycle service and shall have ample capacity to operate the pump properly through its entire head capacity range without exceeding its rated capacity, but shall be not less than 5 horsepower. The speed of the motor shall not exceed 1800 rpm. The motor shall conform to NEMA standards.

15D.6 Magnetic motor starters shall be of the full voltage across-the-line type conforming to the latest NEMA standards. Starters shall be of the quick-make and quick-break type having a low voltage and thermal overload release and hand reset device. Starters shall have hand-off-automatic switch and shall be provided with the pumping equipment, but shall be wired in accordance with the electrical section of this specification.

15D.7 Right angle drive. A combination electric motor and right angle gear drive shall be provided for dual drive arrangement. The drive shall have one to one gear ratio to transmit the power from the engine to the pump at normal operating speed and shall be of the vertical, hollow shaft, spiral bevel gear type equipped with anti-friction bearings and a base flange matching the pump head flange. It shall be conservatively rated to transmit the maximum power requirements of the pump and be equipped with a heavy duty ball thrust bearing capable of carrying the hydraulic thrust of the pump and the weight of the rotating element. An oil reservoir of ample capacity shall supply adequate lubrication to the gears and bearings. A suitable motor stand shall be furnished which provides ample room for a sliding clutch for alternating the prime mover. A sliding clutch shall be mounted on the head shaft so the gears do not operate when the pump is driven by the electric motor. A non-reverse ratchet shall be incorporated in the clutch to prevent backspin in the event of reverse rotation.

15D.8 Auxiliary gasoline engine shall be a complete self-contained, multi-cylinder, water-cooled, heavy duty gasoline power plant with maximum horsepower at least 30 per cent in excess of the maximum brake horsepower required to operate the pump continuously at its rated speed, over the entire head capacity range of the pump. The engine shall be arranged for motor cranking and shall be equipped with a high tension ignition system, battery and required appurtenances, shall include an adjustable governor,

carburetor, tachometer, oil pressure gauge, cylinder temperature gauge, gasoline pump and filter, gravity tank, air cleaner, oil filter, generator, starting crank, radiator, exhaust pipe and muffler, and clutch take-off assembly.

15D.8.1 Battery charger, electric type, shall be mounted on wall of pump house BB-43 where directed and shall be the rectifier type for operation with 120 volt, 60 cycle current. Charger shall be protected by an automatic circuit breaker and shall have capacity to charge two 6-volt batteries or one 12-volt battery at eight to five amps. One direct current ammeter shall be included and shall be flush-mounted on the front of the enclosure. All metal parts shall be corrosion-resistant or shall be suitably protected against corrosion.

15D.8.2 Exhaust pipe from the engine shall be carried through the wall of the pump room in an asbestos-cement sleeve and a suitable muffler shall be mounted on the end of the exhaust pipe. The muffler shall be properly supported in an approved manner.

15D.8.3 A metal instruction plate shall be mounted on the engine unit giving the manufacturer's recommendations for lubricating oil and other pertinent information.

15D.8.4 Safety guards. The interconnecting shafting between the gasoline engine and the combination drive and all other rotating units shall be provided with approved safety guards for protection of operating personnel.

15D.9 Existing pump and engine foundations and discharge piping shall be modified as necessary to fit the new pumping equipment and accessories.

15D.10 Performance test. Each unit shall be tested by the Contractor after being put in operation to determine conformance with this specification. Equipment failing to perform as specified shall be replaced by the Contractor at no additional cost to the Government.

15D.11 Warranty. All the equipment to be furnished under this section of the specification shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or for final acceptance, whichever is earlier, against defective material, design and workmanship.

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SECTION 15E. PROCESS AND SERVICE WATER PIPING

15E.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

42Yc Drainage, sanitary, electrical and water service appurtenances

FEDERAL

FF-B-575 Bolts, hexagon and square
GG-G-76c Gages, pressure and vacuum, dial indicating (for air, steam, oil, water, ammonia and freon)
HH-G-76b Gasket, asbestos metallic cloth
QQ-L-00156a Lead; caulking
SS-P-351a Pipe, asbestos-cement
WW-H-171c (1) Hangers and supports, pipe
WW-P-421b (1) Pipe, cast-iron, pressure, (for water and other liquids)
WW-P-441c Pipe; wrought iron (welded, black or zinc-coated)
WW-P-521e Pipe-fittings, malleable iron, wrought iron and steel, (screwed), 150-pound
WW-T-799b Tubing, copper, seamless (for use with solder-joint or flared-tube fittings)
WW-V-51a (2) Valves, bronze; angle, check and globe, 125- and 150-pound, screwed and flanged (for land use)
WW-V-54b Valves; bronze, gate; 125- and 150-pound, screwed and flanged (for land use)

MILITARY

MIL-V-18436A Valves, check
MIL-V-18634 Valves, safety relief (shore use)
MIL-C-18969B Calking compounds, metal seam and wood seam

NON-GOVERNMENT

American Standards Association (ASA)

A21.10-1964 Short body cast iron fittings

American Society for Testing and Materials (ASTM)

D1785-64T Poly (vinyl chloride) (PVC) plastic pipe (Schedules 40, 80 and 120)
D2464-65T Poly (vinyl chloride) (PVC) plastic pipe fittings, threaded, Schedule 80

American Water Works Association (AWWA)

C100-55 Cast-iron pressure fittings
C500-61 Gate valves for ordinary water works service
C504-58 Rubber seated butterfly valves
C601-54 A standard procedure for disinfecting water mains

15E.2 Services covered:

(a) Raw water
(b) Treated water
(c) Brine
(d) Sampling lines
(e) Instrumentation

15E.3 General requirements. Piping shall be any of the types and materials as specified herein and shall be of new and unused materials. All piping shall be placed to follow the general arrangement shown and shall be entirely out of the way of lighting fixtures, doors, windows and other openings. The interior of all pipe and fittings shall be thoroughly cleaned of debris and foreign matter prior to installation and shall be kept clean throughout the installation operation. When work is not in progress, open ends of pipe and fittings shall be secured with plugs, or other approved methods, in such a manner as to prevent trench water or other foreign matter from entering the pipe.

15E.4 Piping 4 inches and larger.

15E.4.1 Plant and yard raw water and treated water piping shall be cast iron pipe, class 150, outside coated, cement lined, conforming to specification WW-P-421, type I, II or III, or at the option of the Contractor, slip-on jointed pipe may be provided. Slip-on jointed pipe shall conform to specification WW-P-421 for class 150, outside coated, cement lined pipe, except for dimensional modifications to bell-and-spigot end to suit gaskets. Exposed plant piping and where indicated shall be flanged piping and shall be class 150 cast iron pipe as specified above, with ASA class 125 flanges.

15E.4.2 Treated water piping, except for yard and plant piping, shall be cast iron piping as specified above, or at the Contractor's option, shall be asbestos-cement pipe, class 150, conforming to specification SS-P-351.

15E.5 Piping 3 inches and smaller.

15E.5.1 All piping, except as specified otherwise, shall be zinc-coated wrought iron pipe conforming to specification WW-P-441. Gasoline piping shall be black.

15E.5.2 Instrumentation tubing shall be type K copper in accordance with specification WW-T-799.

15E.5.3 Brine piping shall be Schedule 80 PVC pipe conforming to ASTM specification D1785 with threaded joints.

15E.6 Fittings and specials.

15E.6.1 Fittings and specials for bell-and-spigot cast iron pipe and asbestos-cement pipe shall be class D, in accordance with AWWA specification C100 with lead joints. At the option of the Contractor, mechanical jointed fittings, as hereinafter specified, may be used with asbestos-cement pipe.

15E.6.2 Fittings for mechanical jointed pipe and flanged jointed pipe shall be short-body fittings in accordance with American Standards Association specification A21.10 and flange fittings provided with ASA class 125 flanges.

15E.6.3 Fittings for use with pipe 3 inches and smaller, except as specified otherwise, shall be zinc-coated malleable iron conforming to specification WW-P-521.

15E.6.4 Fittings for use with copper tubing shall be bronze or copper composition with soldered or compression joint.

15E.6.5 Fittings for PVC brine piping shall be threaded PVC fittings conforming to ASTM specification D2464.

15E.6.6 Standard wall castings of the type shown shall be provided where indicated and all necessary precautions shall be taken to accurately locate castings and to prevent their displacement during the pouring of concrete. Sleeves through concrete walls shall be poured with lead on each side of the wall and caulked. Sleeves through masonry walls shall be caulked with compound conforming to specification MIL-C-18969.

15E.7 Placing and laying.

15E.7.1 Cast iron pipe.

(a) Pipe laid underground shall be inspected in the sling, tapped with a light hammer to detect cracks, before lowering into the trench. Defective, damaged, or unsound pipe will be rejected. Deflections from a straight line or grade, as required by vertical or horizontal curves or offsets shall not exceed 6/D inches per lineal foot of pipe, where D is the nominal diameter of the pipe in inches, between the center lines extended, of any two connecting pipes. If the alignment requires deflection in excess of that limitation, the Contractor shall provide special bends or a sufficient number of shorter lengths of pipe to conform to the limitation specified. Except where necessary in making connections with other lines, pipe shall be laid with the bells facing in the direction of laying. Except at closures, not less than two lengths of bell-and-spigot pipe shall be in position ahead of each joint, with packing installed and earth fill

tamped alongside the pipe, before the joint is poured. Where cutting of pipe is necessary, it shall be done with approved mechanical cutters in a manner that will not damage the pipe. Where coatings are damaged, they shall be touched up with material similar to that used for the original coating.

(b) All flanged pipe shall be accurately cut and shall be worked into place without springing or forcing.

15E.7.2 Zinc-coated wrought iron piping shall be accurately cut, shall be worked into place without forcing or springing, and shall be free of burrs or fins.

15E.7.3 Brine piping (PVC) shall be installed and supported in accordance with the manufacturer's instructions.

15E.7.4 All water pipe laid underground shall be installed at an average depth of 3 feet to the top of pipe unless otherwise indicated and not less than 2 feet of cover shall be provided.

15E.8 Pipe supports. All piping shall be supported in a manner to adequately carry the weight of the lines and maintain proper alignment. Exposed piping in the Water Plant shall be adequately supported from floor, ceilings or walls as required. Hangers shall conform to specification WW-H-171. Pipe below the ceiling shall be suspended from steel roof beams, and where necessary additional steel supports shall be provided between beams for adequate support of hangers. Pipe laid underground shall have the bottom third (1/3) of the barrel supported on firm soil. All 1/16 and sharper cast iron bends, including connections to existing mains and services, shall be securely blocked in the direction of flow. Pipe laid underground shall be blocked in accordance with specification 42Y. Plugs shall be secured similarly except that concrete bracing shall be poured in a manner that affords easy removal of the concrete without disturbing the piping.

15E.9 Joints.

15E.9.1 Bell-and-spigot joints. Before jointing, all lumps, blisters and excess coating material shall be removed from the bell and spigot ends of the pipe. All oil or grease shall be removed. The outside of the spigot and inside of the bell shall be wire brushed and wiped clean and dry. Spigots shall be adjusted in the bells so as to give uniform space all around and if any pipe does not allow sufficient space for proper caulking, it shall be replaced with one of proper dimensions. Adjacent lengths of pipe shall be adjusted with reference to each; blocking or wedging between hub and spigot will not be permitted. Molded or tubular rubber, asbestos, or especially prepared paper rings treated to prevent deterioration or support of bacteria shall be used as gaskets. The gasket shall be driven or caulked tightly into the annular spaces between the pipes, and shall be of proper size to seal the joint tightly and leave sufficient space for

lead as specified. Where rubber rings are used as gaskets, a braided or twisted hemp or jute ring shall be caulked into the joint after the rubber ring is placed to prevent contact of the molten lead with the rubber. Gaskets shall not project into the bore of the finished joint. When the joints are approved for pouring, the joints shall be cleaned and the remaining space filled at one pouring with lead which shall be caulked in a manner that will assure tight joints without overstraining the bells. The depth of lead shall be not less than 2-1/4 inches measured from the face of the bell. After caulking, the lead shall be practically flush with the face of the bell. The lead shall conform to specification QQ-L-00156.

15E.9.2 Roll-on joints shall be made with the standard materials furnished with the pipe, and in accordance with the recommendations of the manufacturer, subject to approval of the Officer in Charge.

15E.9.3 Mechanical joints. The jointing shall be in accordance with the recommendations of the manufacturer of the joint. Bolts, nuts and exposed threads shall be coated with asphalt varnish after installation.

15E.9.4 Flanged joints. The joints shall be firmly bolted with machine bolts. Bolts shall be regular hexagon bolts conforming to specification FF-B-575, type II. Gaskets shall be made of asbestos metallic cloth conforming to specification HH-G-76, and shall be full-faced.

15E.9.5 Screwed joints shall have the threads cut full and not more than three threads on the pipe shall remain exposed. Pipe lubricant shall be applied to the male threads only.

15E.10 Valves.

15E.10.1 Gate valves for use with pipe 4 inches and larger shall be the double-disc type with non-rising stems unless indicated or specified otherwise, and shall conform to American Water Works Association standard AWWA C500. Stems shall have nuts similar to those on valves of the existing system except exposed flanged valves in Water Plant and Reservoir shall have standard size wheels. Gate valves shall be of one make and shall open by a counterclockwise rotation of the valve stem for non-rising stems; valves with rising stems shall open by a counterclockwise rotation of the operating wheel.

15E.10.2 Gate valves for use with pipe 3 inches and smaller shall be bronze wedge disc in accordance with specification WW-V-54, type I, class A.

15E.10.3 Check valves for use with pipe 4 inches and larger shall be cast iron body, bronze mounted, tilting disc, class 150, non-slamming type and shall conform to the applicable requirements of specification MIL-V-18436, type II, style A.

15E.10.4 Check valves for use with pipe 3 inches and smaller shall be bronze and shall conform to specification WW-V-51, class A.

15E.10.5 Rubber-seated butterfly valve shall conform to AWWA C504, class 125-8. The valve shall be equipped with electric operator designed for a 60-second cycle. Valve shall have ASA class 125 pound flanges. Motor shall be suitable for operation with 120 volt, single-phase, 60 cycle current.

15E.10.6 Back-pressure valve. The back-pressure valve shall be designed to maintain an upstream pressure from 5 to 20 psi. The valve shall be controlled by a hydraulic pilot valve. The valve shall be cast iron globe-type, bronze-mounted, with ASA class 125 pound flanges, and suitable for operating pressures up to 150 psi. The back-pressure valve shall be complete with all auxiliary valves, strainers, and appurtenances.

15E.10.7 Air release valves. Where indicated, an approved pressure air valve shall be provided to automatically permit air to escape while the pipe line is in service and under pressure. The valve shall be iron body, bronze-mounted and designed for 125 pounds working pressure. The float shall be made of hard rubber with phosphor-bronze levers. The seat shall be hard rubber and plunger of hard quality soft rubber. The construction of the valve shall be such that valve seats may easily be replaced.

15E.10.8 Sluice gate shall be constructed of high strength cast iron, bronze mounted, with solid bronze adjustable wedges and bronze stem. Gate shall be circular type with ASA class 125 pound flange for bolting directly to pipe, shall be manually operated, open counterclockwise and have non-rising stem. Steel extension stem, wall guide and operating wheel shall be provided. Operating wheel shall be cast iron of sufficient diameter to easily operate the gate. Wall guide, bracket and bearing shall be of rugged construction to hold stem in alignment for easy operation. Bearing shall be lined with non-corrodible metal.

15E.10.9 Safety valve shall be in accordance with specification MIL-V-18634, Table I, class 2, water at 125 psig. Valve shall have 3-inch threaded inlet and outlet.

15E.10.10 Pressure gauges shall conform to specification GG-G-76, class 2, type A, 6-inch, brass case.

15E.10.11 Solenoid valve. Solenoid valves shall be of the globe type constructed of bronze with non-metallic valve disc. The valve shall be designed for 125 psi water pressure. The valves shall have moisture-proof coils designed for operation on 120 volt, 60 cycle, single-phase current, and shall be normally closed.

15E.10.12 Float control switch shall be provided for each salt storage tank to operate solenoid valve on make-up water line. The switches shall be bracket-mounted on wall where indicated and shall be housed in a weatherproof cast aluminum enclosure. Float switches shall be complete with non-corrosive float, rod and all accessories. Electrical components

and installation shall comply with the electrical section of this specification.

15E.11 Rate of flow controller shall maintain the set rate within three per cent of the mean when operating in the range of 0.3 mgd to 1.0 mgd. The controller shall be of the venturi direct-acting type and shall be self-operated and require no outside power. A rate beam shall be provided with a rate-setting scale attached graduated in gallons per minute. Control valve shall be of the balanced type.

15E.11.1 Controller body shall be close grain, high tensile, cast iron, and shall be suitable for operating at 65 psi working pressure. All working parts shall be constructed of corrosion-resisting materials. The controller body and all component parts shall be hydrostatically tested at pressure at least 50 per cent in excess of the maximum working pressure.

15E.11.2 Ends shall be flanged, faced and drilled in accordance with ASA class 125 pound.

15E.11.3 All ferrous surfaces shall have a protective coating of coal-tar pitch varnish on inside and outside surfaces.

15E.12 Floor stands. Valves shall be equipped with stem extensions, floor stands and operating wheels where indicated. Stem extensions shall be solid round steel rods of required size and length. Operating wheels shall be cast iron of sufficient diameter to easily operate the respective valves. Floor stands shall be manufacturer's standard with indicator for operation with non-rising stem valves and shall be arranged to permit secure bolting to concrete slab. The stands shall be approximately 36 inches in height.

15E.13 Roadway boxes. Each valve on underground piping shall be provided with an adjustable cast iron roadway box of a size suitable for the valve on which it is used. The head shall be round and shall have the word "WATER" cast upon it. The least diameter of the shafts of the boxes shall be 5.25 inches. Boxes shall be given a heavy coat of bituminous paint.

15E.14 Hydrants shall be a standard type conforming to the latest specifications for valves and hydrants of the American Water Works Association and shall be a type approved by the National Fire Protection Association. They shall be 6 inches in diameter with 5-inch clear opening through the valve and shall be provided with a 4.5-inch pumper connection and two 2.5-inch hose connections. Hydrants shall be of the frost-proof and non-flooding type which will not flood in case the barrel or valve stem is damaged, with waste orifices for draining the hydrant when the valve is closed, and shall be of the type which opens against the water pressure. Hydrant construction shall permit 360-degree orientation without disturbing sub-surface setting. The hydrants shall be designed for 150 pounds working pressure or 300 pounds hydrostatic pressure and shall open counterclockwise.

All working parts shall be bronze. Hose and pumper connection threads and operating nut shall be National Standard.

15E.15 Setting hydrants, valves and valve boxes. Hydrants, valves and valve boxes shall be set plumb, and centered, with valve boxes placed directly over the valves. Valve boxes shall, if possible, be located outside the area of roads and streets. Earthfill shall be carefully tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Hydrants shall be set in accordance with specification 42Y. The backfill around hydrants shall be thoroughly compacted to the grade line. Hydrants and valves shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant or valve shall be inspected in opened and closed positions, to see that all parts are in working condition.

15E.16 Connections to existing mains shall be made by means of tapping sleeves and valves where indicated. The valves shall meet the requirements of AWWA standard C500, except that ends and seat rings may be oversized to permit use of full size cutter. Joints in tapping sleeves shall be poured with lead and caulked.

15E.17 Tests. Before being covered, the completed pressure piping shall be subjected to a hydrostatic pressure test of 200 pounds per square inch maintained for two hours. All pipe, joints, valves and fittings in the test section shall be examined. Defective material disclosed as a result of the test shall be replaced and the test repeated; any joint showing visible leakage shall be made watertight.

15E.18 Sterilization.

15E.18.1 Before being placed in service, the new piping shall be flushed and sterilized by chlorination in accordance with the American Water Works Association standard AWWA C601. The chlorine solution shall remain in the system at least 24 hours. After final flushing, the quality of the water shall be approved by the Officer in Charge before acceptance.

15E.18.2 Before being placed in service, the reservoir and piping shall be flushed out and scrubbed with scrub brushes and rinsed. After rinsing, the interior surface of the reservoir, outer surface of all pipes, columns, valve and appurtenances and manhole steps shall be mopped or sprayed with a strong chlorine solution and allowed to stand for 4 hours. The reservoir shall be given a final flushing prior to filling.

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SECTION 15F. INSTRUMENTATION AND CONTROLS

15F.1 General. All materials and equipment shall be new and unused, unless otherwise shown or specified. The work includes provision of the following facilities complete with piping, tubing, electrical wiring and all related accessories necessary for proper facility function.

15F.1.1 Telemetering facility for determining and recording the depth of water in the elevated tank and for automatically operating the service pumps using the depth of water as a basis of control.

15F.1.2 Telemetering facility for determining and recording the depth of water in the reservoir and for automatic operation of the filter pumps using water depth as a basis of control.

15F.1.3 Telemetering facility for determining and recording the depth of water in the detention tank and for automatically operating the well pumps, the aerator blower and the lime feed pump, using water depth as a basis of control.

15F.1.4 Metering facility for determining and recording the rate and quantity of raw water delivery and for automatically controlling chlorinator No. 2.

15F.1.5 Metering facility for determining and recording the rate and quantity of service water delivery and for controlling chlorinator No. 1.

15F.1.6 Instrument and control panel with the pertinent instrumentation components mounted thereon to facilitate observation, analyzation and control of the various plant operations.

15F.2 Elevated tank water level telemetering and service pump controller facility. The Contractor shall provide at the elevated tank telemetering transmission equipment complete with all appurtenances, electrical connections, piping connections and shelter. The transmitter shall dispatch signals on the interconnecting control wiring to the receiving and service pump controlling equipment to be provided at the Water Treatment Plant. The facility shall be designed to measure and record the water level at all times.

15F.2.1 Transmitter. The transmitter shall be housed in a suitable metal moisture-proof case and shall incorporate an adjustable pressure-measuring element which shall be subjected to a total head of 122 feet which includes a suppression head of 98 feet and an operating range of 24 feet. The transmitter shall send out mechanically-timed direct-current electrical impulses, the duration of which shall be proportional to the measured pressure. The signal dispatched by the transmitter shall reflect the level of the water in the tank within an accuracy of 12 inches.

15F.2.2 Receiver and pump controller. The receiver shall be the indicating-recording type and shall have a circular recording chart approximately 12 inches in diameter for 24-hour rotation with graduations uniformly spaced from 0 to 25 feet. The receiver shall have incorporated with it, or in an auxiliary control box, a pump-programming control equipped with mercury switches actuated at the receiver by the transmitted duration signals to provide adjustable start and separate adjustable stop contacts wired, in each case, into the operating coil circuit of the respective pump motor magnetic starters. The pump-programming control shall be designed to operate the three pumps automatically as determined by the water level in the tank, the limits of which shall be adjustable, and shall be in accordance with the sequence of operations indicated. The receiver and pump-programming control shall be housed in suitable panel-mounted metal case or cases and shall have doors providing easy access to all parts with glass in front of the recording chart and in front of the indicator. The pump-programming control shall be electrically connected to the reservoir telemetering facility in a manner that will cause the service pumps to be shut off at a predetermined low-water level in the reservoir. The equipment shall also include warning and indicating systems to indicate a telemetering reception outage and to indicate a high water level condition to be incorporated as outlined below.

(a) There shall be provided an alarm system with a horn mounted on the panel so circuited with the receiver that in the event of a signal failure between the transmitter and the receiver, the horn will blow. The horn shall be provided with a manually-operated cutoff switch which may be used to interrupt the horn signal; otherwise, the horn will blow throughout the duration of a receiver signal outage.

(b) There shall be provided on the panel a bell which shall be so circuited with the receiver that the bell will ring when all pumps are shut off as caused by the water in the elevated tank reaching its upper limit. The bell shall be provided with a manually-operated cutoff switch which may be used to interrupt the bell signal; otherwise, the bell shall ring throughout an "all pumps off" condition as caused by the water level in the tank being at its upper limit.

(c) There shall be provided on the panel a red light and an automatic disconnect switch so circuited with the reservoir water level receiver that the light will come on and all service pumps will shut off in the event a predetermined low water is reached in the reservoir. The light and the disconnect switch shall be provided with a manually-operated reset button for turning out the light and for resuming automatic service pump-programming operations; otherwise, the light shall continue to glow and the pumps remain off until manually reset.

15F.3 Reservoir water level telemetering and filter pump controller facility. The Contractor shall provide at the reservoir telemetering transmission equipment complete with float, float cage, and all appurtenances and electrical connections. The transmitter shall dispatch signals on

interconnecting control wiring to the receiving and filter-pump controlling equipment to be provided in the Water Treatment Plant. The filter-pump controlling equipment shall also be electrically interconnected to the automatic filter control valve and to the detention tank water level telemetering facility in a manner that will preclude automatic filter-pump operation during periods of filter back wash and/or periods of low water in the detention tank.

15F.3.1 Transmitter. The transmitter shall be a pedestal-mounted, float-operated, depth-differential type. The instrument shall use the time impulse transmission method with the time impulse signal being directly proportional to the depth of water. The unit shall be provided with a direct reading, uniformly graduated, concentric scale approximately 12 inches in diameter and indicating depth in feet with a range of 0 to 15 feet. The transmitter shall indicate the depth at all times. The equipment shall be housed in a dust-tight, rainproof case and all working parts shall be corrosion-resistant.

15F.3.2 Receiver. The receiver shall be an indicating and recording meter register housed in a dust-tight, moistureproof case and designed for panel mounting. All working parts shall be corrosion-resistant. The instrument shall indicate the instantaneous depth at all times on a uniformly graduated direct reading scale having a peripheral length of approximately 9 inches and depicting depth in feet with a range from 0 to 15 feet. The depth shall be recorded on a 12-inch diameter evenly spaced circular and concentrically graduated chart with a range of 0 to 15 feet and designed for daily removal. The receiver shall have incorporated with it, or in an auxiliary control box, an automatic filter pump controller with switches actuated at the receiver by transmitted signals to provide adjustable start and separate adjustable stop contacts wired, in each instance, into the operating coil circuit of the respective pump motor magnetic starter. The controller shall include an alternator to alternate the starting sequence of the two filter pumps. The receiver shall also be electrically connected with the service pump program control so as to shut off the service pumps when the scheduled low water level is reached.

15F.4 Detention tank water level telemetering and wells and lime feed pump controller facility. The Contractor shall provide at the detention tank telemetering transmission equipment complete with float, float cage, electrical connections and all appurtenances. The transmitter shall dispatch signals on interconnecting control wiring to the receiving and well pump, aerator blower, and lime feed pump-controlling equipment to be provided in the Water Treatment Plant. The facility shall also be interconnected with filter pump controller to prevent filter pump operation during periods of low water in the detention tank.

15F.4.1 Transmitter. The transmitter shall be a pedestal-mounted, float-operated, depth-differential type. The instrument shall use the time impulse transmission method with the time impulse signal being directly proportional to the depth of water. The unit shall be provided with a di-

rect reading, uniformly graduated, concentric scale approximately 12 inches in diameter and indicating depth in feet with a range of 0 to 10 feet. The transmitter shall indicate the depth at all times. The equipment shall be housed in a dust-tight, rainproof case and all working parts shall be corrosion-resistant.

15F.4.2 Receiver. The receiver shall be an indicating and recording meter housed in a dust-tight, moistureproof case and designed for panel-mounting. All working parts shall be corrosion-resistant. The instrument shall indicate the instantaneous depth at all times on a uniformly graduated direct reading scale having a peripheral length of approximately 9 inches and depicting depth in feet with a range from 0 to 10 feet. The depth shall be recorded on a 12-inch diameter evenly spaced circular and concentrically graduated chart with a range of 0 to 10 feet and designed for daily removal. The receiver shall have incorporated with it, or in auxiliary boxes, a well pump and aerator blower controller and a lime feed pump controller which shall be responsive to signals actuated in the receiver. The receiver shall cause the controllers to automatically start and stop their respective units at the scheduled predetermined water levels, the limits of which shall be adjustable. The facility shall also be electrically interconnected with the filter pump controller so as to automatically stop the filter pumps at a predetermined low water level in the detention tank and to automatically permit the filter pumps to resume normal operation when a predetermined higher water level is reached.

15F.4.3 Well pump controller. The well pump controller shall be provided to house switches for the two existing wells, a space for a future additional well and the aerator blower. The unit shall be designed to permit manual selection of any combination of the two existing and future additional well to operate automatically as a group at any instance. The switches for the group selected at any instance shall be wired into the operating coils of the respective pump motor magnetic starters to automatically start and stop the selected group as scheduled. The blower motor shall operate simultaneously with any group.

15F.4.4 Lime feed pump controller. This controller shall have switches actuated at the receiver and wired into the operating coil of the pump motor magnetic starter so as to automatically start and stop the pump as scheduled.

15F.5 Raw water metering facility and chlorinator controller. The Contractor shall provide a venturi meter complete with manhole and all appurtenances, and interconnecting piping to chlorinator No. 2 and receiver to be located in the Water Treatment Plant. The facility shall be designed to measure and record flows from a minimum rate of 100 gpm to 600 gpm. The average pressure at the venturi tube will be approximately 12 psi. The measured flow shall be accurate within three per cent and shall have a hydraulic irrecoverable head loss not to exceed 2 feet.

15F.5.1 The venturi tube shall be of the concentric type constructed

190
170
360

of good gray cast iron of class 150 thickness with flanged ends for installation in the 10-inch main. The tube shall be designed for measurement of clear water and shall have a bronze-lined throat. There shall be an annular pressure ring at the main diameter with a sufficient number of holes leading from the interior of the tube to the pressure ring. These holes shall be bronze-bushed with the ends of the bushing at right angles to and flush with the inside diameter of the tube and free of burrs. There shall also be a pressure ring at the throat section of the venturi tube, the inner wall of which shall consist of the bronze throat liner. The liner shall contain a sufficient number of holes leading from the inside diameter of the throat section to the pressure ring, these holes being at right angles to the throat and free from burrs. On each pressure ring there shall be at least two properly designed handholes and at least four suitably designed cleaning valves. Immediately downstream of the throat section, there shall be a handhole by means of which inspection can be given to the throat and upstream barrel at any time.

15F.5.2 Receiver. The receiver shall be an indicating, recording and totalizing meter register housed in a dust-tight, moistureproof case and designed for panel-mounting. All working parts shall be corrosion-resistant. The instrument shall indicate the instantaneous flow at all times on a uniformly graduated direct reading flow scale having a peripheral length of approximately 9 inches and depicting U. S. gallons per minute with a range of 0 to 600. The rate of flow shall be recorded on a 12-inch diameter evenly spaced circular and concentrically graduated chart designed for daily removal. The totalizer shall have at least six digits and shall record total amount pumped in thousands of U. S. gallons. The totalizer and chart elements shall be actuated by electric clock drives.

15F.6 Service water metering facility and chlorinator controller. The Contractor shall provide a venturi meter complete with manhole and all appurtenances, and interconnecting piping to chlorinator No. 1 and receiver to be located in the Water Treatment Plant. The facility shall be designed to measure and record flows from a minimum rate of 400 gpm to 1500 gpm. The average pressure at the venturi tube will be approximately 60 psi. The measured flow shall be accurate within three per cent and shall have a hydraulic irrecoverable head loss not to exceed 40 inches.

15F.6.1 The venturi tube shall be of the concentric type constructed of good gray cast iron of class 150 thickness with flanged ends for installation in the 12-inch main. The tube shall be designed for measurement of clear water and shall have a bronze-lined throat. There shall be an annular pressure ring at the main diameter with a sufficient number of holes leading from the interior of the tube to the pressure ring. These holes shall be bronze-bushed with the ends of the bushing at right angles to and flush with the inside diameter of the tube and free of burrs. There shall also be a pressure ring at the throat section of the venturi tube, the inner wall of which shall consist of the bronze throat liner. The liner shall contain a sufficient number of holes leading from the inside diameter of the throat section to the pressure ring, these holes being at right

angles to the throat and free from burrs. On each pressure ring there shall be at least two properly designed handholes and at least four suitably designed cleaning valves. Immediately downstream of the throat section, there shall be a handhole by means of which inspection can be given to the throat and upstream barrel at any time.

15F.6.2 Receiver. The receiver shall be an indicating, recording and totalizing meter register housed in a dust-tight, moistureproof case and designed for panel-mounting. All working parts shall be corrosion-resistant. The instrument shall indicate the instantaneous flow at all times on a uniformly graduated direct reading flow scale having a peripheral length of approximately 9 inches and depicting U. S. gallons per minute with a range of 0 to 1500. The rate of flow shall be recorded on a 12-inch diameter evenly spaced circular and concentrically graduated chart designed for daily removal. The totalizer shall have at least six digits and shall record the total amount pumped in thousands of U. S. gallons. The totalizer and chart elements shall be actuated by electric clock drives.

15F.7 Instrument and control panel. The Contractor shall provide in the office an instrument and control panel to incorporate the instruments and controls as diagrammed. The unit shall be a factory-manufactured, floor mounted insert-type panel or cabinet with turn backs to the wall. The unit shall be constructed of not thinner than 10-gauge steel, bonderized, primed, and factory-finished in accordance with the manufacturer's standard practice. Spacing and arrangement of instruments shall be dependent upon the size of instruments provided, but shall conform to the general arrangement shown. Names of instruments shall be painted with letters 3/4 inch high. Terminal strip connections and panel contact shall be installed as required for proper function. All wiring and electrical apparatus shall adhere to requirements of the National Electric Code for general purpose conditions with all contacts enclosed. Tubing runs shall be neatly formed, adequately supported and arrangement to facilitate tracing of individual lines. The composite unit shall be subject to approval.

15F.8 Operation and maintenance instructions and equipment. Five copies of manual covering each item of control equipment shall be furnished the Officer in Charge. The manual shall contain, but not be limited to the following: operating instructions, illustrations, drawings, detail description, installation instructions, adjustments, tests, parts list, etc. Contractor shall also furnish a year's supply of charts, pens, ink, tools and accessories, together with setting devices for checking the accuracy of meters at any time.

15F.9 Installation. Equipment provided shall be a standard manufactured product normally used for this purpose and shall be installed to conform with the general arrangement shown. Final adjustments on the installed equipment shall be made under the direction of a supervisory engineer regularly employed by the manufacturer of the equipment.

15F.10 Performance test. All equipment furnished under this section of the specification shall be tested by the Contractor, after being put in

operation, to determine conformance with this specification. Equipment failing to perform as specified shall be replaced by the Contractor at no additional cost to the Government.

15F.11 Warranty. All the equipment to be furnished under this section of the specification shall be guaranteed for a period of one year from the date of acceptance thereof, either for beneficial use or for final acceptance, whichever is earlier, against defective material, design and workmanship.

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DIVISION 16. ELECTRICAL

SECTION 16A. Interior Electrical
16B. Exterior Electrical

SECTION 16A. INTERIOR ELECTRICAL

16A.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

9Yh	Electrical apparatus, distributing systems, and wiring; including addendum no. 2
42Yc	Drainage, sanitary, electrical and water service appurtenances

FEDERAL

J-C-30 (Int. 1)	Cable and wire, electrical (power, fixed installations)
W-C-375a (3)	Circuit breaker, molded case; branch circuit and service
W-F-00414b (1)	Fixture, lighting (fluorescent, alternating-current, general purpose)
CC-M-636c	Motor, alternating-current, (fractional horsepower)
CC-M-641d	Motor, alternating current, (integral horsepower, 200HP and smaller)

NON-GOVERNMENT

National Electrical Manufacturers Association (NEMA)

Underwriters' Laboratories, Inc.

16A.2 General requirements.

16A.2.1 The work includes the provision of a service entrance to the Water Treatment Plant, panelboards, circuit breakers, lighting panel, disconnect switches, lighting and power circuits in conduit, wiring of motor starters, lighting fixtures complete with lamps, wall switches, receptacles and other miscellaneous items as required to provide complete and operating power and lighting circuits.

16A.2.2 The work further includes the provision of wiring circuits within the Treatment Plant and existing well houses for instrumentation and control.

16A.2.3 The work further includes removal of connections to existing well pump motors and starters, and provision of new service entrances, breakers and circuits as required for complete and operating power circuits to the new pumping equipment.

16A.2.4 Materials and methods of installation shall be in accordance with specification 9Y, except as indicated or specified otherwise.

16A.3 Electrical characteristics. Electrical service to the Water Treatment Plant and well houses shall be 120/208y volts, three phase, four wire, 60 cycle, grounded neutral.

16A.4 Drawings diagrammatic. The electrical drawings are primarily diagrammatic in nature, intended to indicate the purpose and connections of the conduit and/or circuits rather than the exact locations of the runs which may be modified by the Contractor to meet conditions at the time of work.

16A.5 Method of wiring. All wiring shall be in rigid conduit exposed on walls and ceilings or concealed in concrete construction as indicated.

16A.6 Additional supports. Wherever required to secure the location shown on drawings for the lighting fixtures, conduit, electrical devices or control equipment, the Contractor shall provide and install additional supports such as angle iron or channel construction, steel strap extension or by other approved means, effect the proper and rigid support of the electrical work.

16A.7 Wires and cables shall conform to the following where applicable, and meet the requirements of specification J-C-30. All wires shall be color coded. Color coding shall be integral with the sheath.

16A.7.1 No conductor smaller than No. 12 AWG shall be used for any purpose other than controls which shall be not smaller than No. 14 AWG.

16A.7.2 All wire in conduit installed in dry locations shall be type RHW or THW.

16A.7.3 All wire in conduit installed wholly or in part in damp locations, in or under the floor slab or underground, shall be type RHW with a neoprene jacket or type THWN.

16A.8 Conduit. Conduit shall be of the rigid type, except where flexible type is indicated, and shall be zinc-coated for both inner and outer surfaces. Standard lengths shall be threaded previous to treatment. All conduit shall be cut with a hacksaw and reamed to size. No bends shall be made of greater than 90 degrees and manufactured elbows shall be used on one-inch size and above. Conduit installed underground or in fill under concrete slabs shall be encased in concrete in accordance with specification 42Y.

16A.9 Outlet boxes. Flush outlet boxes, wherever used to terminate conduit at equipment or lighting fixture location, shall be 4-inch square hot dipped zinc-coated boxes with a cover in each case suitable for the respective purpose. Pendant fixture boxes shall have aligning covers. Surface mounted outlet boxes shall have threaded hubs.

16A.10 Pull and junction boxes. The Contractor shall provide and install all necessary or required pull or junction boxes. Such boxes shall be constructed of code gauge of steel standard for the respective dimensions and equipped with a turned-in flange to which the cover shall be mounted by screws into threaded holes. All parts shall be zinc-coated.

16A.11 Disconnect switches shall be provided where indicated and adjacent to each motor located out of sight or over 50 feet distance from its control. The unprotected disconnect switch shall be of high grade design. The carrying capacity shall be at least 115 per cent of the nameplate full load current of the motor.

16A.12 Local wall switches. Wall switches shall be single pole or three-way toggle type "T" rated, 20 ampere, 125 volt, in composition base. Covers shall have chrome finish.

16A.13 Convenience receptacles. Convenience receptacle outlets shall be single or duplex, as indicated, 15 ampere, 125 volts, grounding type, parallel slot, double-sided contacts with four terminal screws in composition base. Receptacles shall be grounded as specified in specification 9Y. Covers shall have chrome finish.

16A.14 Magnetic motor starters shall be of the quick-make and quick-break type having overload and low voltage release and with hand reset overload trip mechanisms. Starters shall conform to the latest applicable NEMA standards for type and class as specifically applied. All magnetic starters and motors will be furnished with the equipment under the MECHANICAL DIVISION but shall, unless integral with the equipment, be installed and wired by the Contractor. The schedule on the electrical drawings shows design values for horsepower, voltage, number of phases and associated wiring and controls. If the approved equipment differs from that indicated, the Contractor shall provide the correct wiring and control for same. Motors shall conform to specifications CC-M-636 and CC-M-641. Motors rated 1/2 horsepower and greater, unless otherwise specified, shall be rated for 208 volts, three phase. Motors of less than 1/2 horsepower shall be single phase, 120 volts.

16A.15 Power panel shall be of the dead-front safety type, surface mounted, equipped with circuit breakers conforming to the applicable sections of specification W-C-375. Circuit breakers shall be quick-make and quick-break type. Panel shall be suitable for operation on 120/208 volt, three phase, four wire system and provided with main circuit breaker or lugs, as indicated. Circuit breakers shall be of number and class indicated. Panel cabinet shall be constructed of code gauge steel, zinc-coated

after fabrication. Trims shall have a baked-on primer coat and two coats of baked enamel finish. The door shall be provided with lock and two keys. A directory holder with glass or plastic cover and metal frame shall be installed on inside of the door. A neatly typed directory, properly identifying each circuit and location, shall be installed in holder.

16A.16 Backboards at service entrance and distribution location. Wall mounted switches and panel shall be mounted on a backboard consisting of channel iron uprights secured to the building structure and surfaced with 3/4-inch grade AD exterior type Douglas fir plywood. Previous to mounting equipment, the backboard shall be given two coats of asphaltum varnish.

16A.17 Incandescent fixtures shall be of the highest quality of the types shown. Where the schedule refers to specification 9Y, number and modification symbols, the basic features shown and specified therein, shall be included in the design. Fixtures varying in minor design detail will be acceptable, if drawings are submitted and approved.

16A.18 Fluorescent lighting fixtures shall be of the highest quality of the types scheduled and shall conform to specification W-F-00414, class "B", equipped with louvers and top reflectors. Reflecting surfaces shall be baked white enamel, having a reflection factor of not less than 82 per cent. Fixtures shall be of the ceiling mounting type designed for direct lighting, except for side panels of translucent plastic and shall be of the plug-in type wherein the separable reflector section shall contain ballasts, lamp holders, male plug, and associated wiring. Ballast shall be thermally protected.

16A.19 Floodlight lampholders shall be medium base cast aluminum, factory wired, built with completely weatherproof articulated link between socket housing and mounting arm for smooth, firm universal adjustment. Holders shall have moulded gaskets to provide weatherproof seal between lamp and socket and shall have a baked enamel protective finish. Holders shall be listed by Underwriters' Laboratories, Inc. Lamp holders shall be mounted in groups of two as indicated. Each holder shall be equipped with a 150-watt reflector flood bulb.

16A.20 Control circuits. Complete and operating control circuits shall be provided for operation of the control devices specified in INSTRUMENTATION AND CONTROL section. Location of circuits, materials and workmanship shall be as indicated and herein specified. Number of individual circuits provided shall be as required by the equipment provided and connections shall be made in accordance with the manufacturer's approved wiring diagrams. Control circuits and telemetering circuits shall run in separate conduits.

16A.21 Grounding. Each service neutral wire shall be grounded to the underground pressure water pipe at entrance or exit from the building.

16A.21.1 The continuity of grounding shall be assured by use of conduit lock nuts inside and outside of metallic enclosures, the removal of insulating coatings at points of contact, and bonding across any insulated joints. Grounding connections through continual metal raceways or conductor armor back to service ground will be considered effective.

16A.21.2 All exposed metallic non-current carrying-materials of electrical equipment forming a part of the interior electrical system shall be effectively grounded, including conduit, metal enclosures of switching equipment, panelboard and motor frames.

16A.22 Telephone conduit. Conduit, terminal box and wall outlet box shall be provided as indicated for the future installation of telephone service.

16A.22.1 Conduit shall be as specified for electrical circuits and shall be wired with .109 AWG steel wire.

16A.22.2 Terminal cabinet shall be unprotected-type, and shall be made of heavy gauge steel according to Underwriters' Laboratories specifications, enameled both inside and out. A close fitting cover with flush handle and hinged on one long side shall be provided. Terminal shall have screw binding post for distribution wires and soldering terminals for inside wire.

16A.22.3 Wall outlet box shall be standard zinc-coated or cadmium-plated switch box approximately 4 x 2-1/8 x 1-7/8 inches.

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SECTION 16B. EXTERIOR ELECTRICAL

16B.1 Applicable publications. The following publications of the issues listed below, but referred to elsewhere by basic designation only, form a part of this specification to the extent indicated by the references thereto (where a number is suffixed to the specification number, it denotes the effective amendment to the specification):

BUREAU OF YARDS AND DOCKS

9Yh Electric apparatus, distributing systems, and wiring; including addendum no. 2

NON-GOVERNMENT

American Standards Association (ASA)

C29.2-1962 Wet-process porcelain insulators (suspension type)
C29.3-1961 Wet-process porcelain insulators (spool type)
C29.5-1961 Wet-process porcelain insulators (low and medium-voltage pin type)
O5.1-1963 Wood poles, specifications and dimensions for

American Wood Preservers' Association

Book of Standards

Institute of Electrical and Electronics Engineers, Inc. (IEEE)

National Electrical Manufacturers Association (NEMA)

Southern Pine Inspection Bureau

Grading Rules

16B.2 General requirements.

16B.2.1 The work includes the provision of a new feeder, transformer station, and service drop to Water Treatment Plant.

16B.2.2 The work further includes the provision of a transformer for Well House BB-44 and extension of secondary services and service drops to Wells Nos. BB-33 and BB-34.

16B.2.3 The work further includes the provision of underground control cabling between water treatment plant and raw water wells, elevated water tank and reservoir.

16B.2.4 Materials and workmanship shall be in accordance with specification 9Y except as indicated or specified otherwise.

16B.3 Electric service.

16B.3.1 Primary electric service shall be 12470 volts, three phase, three wire, 60 cycle.

16B.3.2 Secondary electric service and drop shall be 120/208Y volts, three phase, four wire, 60 cycle, grounded neutral.

16B.4 Conductors.

16B.4.1 Primary and secondary conductors shall be of size indicated and shall be bare copper, medium hard drawn.

16B.4.2 Service drop conductors shall be of size indicated and shall be triple-braid, weatherproof, soft drawn copper.

16B.4.3 Underground control cable shall be type RLJFJ having two No. 14 AWG stranded copper conductors; rubber, varnished cloth, or paper insulation; fillers and tapes, a lead sheath; a serving of impregnated jute; two servings of zinc-coated flat steel tape armor; and a final serving of impregnated jute.

16B.5 Transformers shall be outdoor oil-filled type designed for single phase 12470 volts, 120/240 volts with four 2-1/2 per cent taps below normal rated voltage 60 cycle. The transformers shall conform to the latest applicable standards of NEMA and IEEE.

16B.6 Lightning arresters shall be of the 9000-volt type for crossarm mounting. They shall be designed for outdoor service and of the encased valve type.

16B.7 Fused cutouts. There shall be a 15,000-volt fused cutout in each primary wire connected to the transformer station. The ampere ratings shall be in accordance with standards set up for good practice and adequate protection for the several conditions involved. The cutouts shall be of the open-dropout type for crossarm mounting. Flashover values shall be in accordance with NEMA specifications.

16B.8 Poles shall be American Standards Association, class as indicated, yellow pine, creosoted to twelve pounds retention by the empty cell process according to specification of the American Wood Preservers Association.

16B.9 Platform timbers shall be creosoted Southern pine dense structural 58 grade and grade-marked in accordance with the latest edition of Grading Rules of the Southern Pine Inspection Bureau. Creosote treatment of beams and platform timbers shall be in accordance with the American Wood Preservers Association Book of Standards. Treatment shall be by the pressure process and to a minimum retention of twelve pounds per cubic foot of wood.

16B.10 Crossarms shall be close grain Douglas fir (Coast), 3-1/2 inches by 4-1/2 inches, 8 feet in length, 6-pin type.

16B.11 Crossarm braces shall be 1/4 inch by 1-1/4 inches by 30 inches (flat steel bars galvanized after punching), punched for a 1/2-inch lag screw at the pole end and a 3/8-inch bolt at the arm end and shall be bolted to the front of arm after it has been carefully aligned. Braces shall be secured to the pole with 4-1/2-inch lag screws.

16B.12 Insulator pins. Steel crossarm pins shall have a one-inch lead thread and a minimum strength of 1,500 pounds, based on a ten degree deflection.

16B.13 Pole line hardware and accessories shall be hot-dipped, zinc-coated.

16B.14 Guys. Strand shall have a minimum breaking strength of 10,000 pounds and shall be seven-wire specification strand-type. Each guy shall be made up with three-bolt heavy duty clamps. Guard shall be half-round metal, 8 feet in length, bolted to guy.

16B.15 Anchors shall be of the expanding type not less than 135 square inches with holding power of 10,000 pounds in sand and equipped with 3/4-inch by 8-foot rods having thimbleye.

16B.16 Insulators.

16B.16.1 Suspension insulators. There shall be two 7-1/2 inch diameter suspension insulators for each primary phase conductor at every deadend. Insulators shall be of the wet-process type. The overall flash-over value of the insulators shall be not less than 65 KV dry and 35 KV wet, conforming to ASA C29.2.

16B.16.2 Spool insulators shall be of the wet process. The overall flashover value of the insulators shall be not less than 25 KV dry and 15 KV wet, conforming to ASA C29.3.

16B.16.3 Pin-type insulators shall be of the wet-process type. The overall flashover value of the insulators shall be not less than 70 KV dry and 40 KV wet, conforming to ASA C29.5, with a top groove of not less than one-inch diameter.

16B.16.4 Radio influence voltage shall have approximately the following values:

Type of Insulator	Test KV Rms to Ground	Max. Micro Volts at 1000 KV
Suspension Insulators (two in series)	25	100
Pin-type Insulators (each)	10	50