RR. PLANT

NOTICE:
Bids to be opened at 2:00
P.M., EST 11 FEB 1964
at the Atlantic Division,
Bureau of Yards and Docks,
U. S. Naval Station,
Norfolk 11, Virginia

NAVDOCKS
SPECIFICATION
NO. 54077/63

WATER TREATMENT AND STORAGE FACILITIES
WEAPONS TRAINING FACILITY

at the

Marine Corps Base, Camp Lejeune, North Carolina

CONTRACT NBy-54077

Appropriation: 17X1205.2541 MCON U-172

A priority rating shall apply to this contract upon award. The contractor will be required to follow the provisions of DMS Regulation 1 and of all other applicable regulations and orders of Business and Defense Services Administration in obtaining controlled materials and other products and materials needed to fill this contract.

All questions concerning the bidding or any other phase of the plans and specifications occurring prior to bid opening shall be presented to the Engineering Division, DIRLANTDOCKS, Building N-26, Room 345, U. S. Naval Station, Norfolk, Virginia, telephone MAdison 2-8211, extension 4481.

To inspect the site of the work before bid opening, prior appointment must be made with the Resident Officer in Charge of Construction, Jacksonville, North Carolina Area, Building 1005, Marine Corps Base, Camp Lejeune, North Carolina, telephone, Jacksonville, North Carolina, 346-2111, extension 7-5625.

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SECTION 1. GENERAL PARAGRAPHS

1.1 General intention. It is the declared and acknowledged intention and meaning to provide and secure Water Treatment and Storage Facilities, Weapons Training Facility, complete and ready for use.

1.2 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 supply and distribution mains, site improvements and other supporting utilities.

1.3 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 Resident Officer in Charge of Construction.

1.4 Form of contract. The contract will be executed on Standard Form No. 23, January 1961, Construction Contract; Standard Form No. 23A, April 1961, General Provisions; Standard Form No. 19A, January 1959, Labor Standards Provisions; and NAVDOCKS 113, June 1961, Additional General Provisions, with the following modifications: The phrase "including connection charges," is inserted after the word "utilities" in the fifth sentence of Clause 30, Government Utilities of NAVDOCKS 113. Clause 34 of NAVDOCKS 113 is amended by adding the following additional paragraph:

" '(b) In addition to his obligations under paragraph (a) above and under Clause 10 "Inspection and Acceptance," the contractor agrees to replace, repair or otherwise remedy at no cost to the Government any defects in the work arising from materials or workmanship not in conformance with the contract specifications which are discovered within one year from the Government's final acceptance of the contract work. The Government agrees to give the contractor notice of such defects promptly after their discovery and in no event later than one year after final acceptance. This obligation shall not delay final acceptance and final payment for the contract work.'

The present subsections (b), (c), and (d) are renumbered (c), (d), and (e) respectively."

Form 23A, paragraph (a) of Clause 19 is amended to delete the words "and Executive Order 10582, December 17, 1954 (3 CFR Supp.),".

Clause 2 of Standard Form 19A is deleted and the following clause is substituted therefor:

"WORK HOURS ACT OF 1962 -- OVERTIME COMPENSATION

(a) No contractor or subcontractor contracting for any part of the contract work shall require or permit any laborer or mechanic to be employed on such work in excess of eight hours in any calendar day or in excess of forty hours in any workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times his basic rate of pay for all hours worked in excess of eight hours in any calendar day or in excess of forty hours in such workweek, whichever is the greater number of overtime hours.

(b) In the event of any violation of the provisions of paragraph (a), the contractor and any subcontractor responsible for such violation shall be liable to any affected employee for his unpaid wages. In addition, such contractor or subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic employed in violation of the provisions of paragraph (a), in the sum of $10 for each calendar day on

which such employee was required or permitted to work in excess of eight hours or in excess of forty hours in a workweek without payment of the required overtime wages.

(c) The Contracting Officer may withhold, or cause to be withheld from any moneys payable on account of work performed by the contractor or subcontractor, the full amount of wages required by this contract and such sums as may administratively be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for liquidated damages as provided in paragraph (b)."

If this specification is included in a contract with an initial award amount of $25,000 or more and this contract is for work to be performed in the 50 states of the United States or in Puerto Rico, the following paragraph hereby is added to NAVDOCKS Form 113, Additional General Provisions:

"PRICE ADJUSTMENT FOR SUSPENSION, DELAY OR INTERRUPTION OF THE WORK

(a) The Contracting Officer may order the contractor in writing to suspend all or any part of the work for such period of time as he may determine to be appropriate for the convenience of the Government.

(b) If, without the fault or negligence of the contractor, the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Contracting Officer in the administration of the contract, or by his failure to act within the time specified (or if no time is specified, within a reasonable time), an adjustment shall be made by the Contracting Officer for any increase in the cost of performance of the contract (excluding profit) necessarily caused by the unreasonable period of such suspension, delay, or interruption, and the contract shall be modified in writing accordingly. No adjustment shall be made to the extent that performance by the contractor would have been prevented by other causes even if the work had not been so suspended, delayed, or interrupted. No claim under this clause shall be allowed (i) for any costs incurred more than 20 days before the contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply where a suspension order has been issued) and (ii) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of such suspension, delay, or interruption but not later than the date of final settlement of the contract. Any dispute concerning a question of fact arising under this contract shall be subject to the Disputes Clause."

1.5 Performance and payment bonds, executed on Standard Forms Nos. 25 and 25A respectively, will be required, as stipulated on the reverse side of Standard Form No. 20, January 1961, Invitation for Bids.

1.6 Time for completion. The entire work shall be completed within 270 calendar days after date of receipt of notice of award or any other communication authorizing the contractor to proceed.

1.7 Damages for delay in accordance with Clause 5 of Standard Form No. 23A shall be at the rate of $125 per calendar day. The Government will take no action pursuant to Clause 5, 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 the fault or negligence of the contractor. It is understood and agreed that such delays will be considered an act caused by the Government and as such will be excusable within the meaning of Clause 5, and the contractor will be entitled to a time extension by reason thereof.

1.8 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.

Y&D DRAWING NO.	TITLE
957500	Index and Location Plans
957501	Site Plan
957502	Treatment Plant, Foundation Plan and Details Structural
957503	Treatment Plant, Sections and Details, Structural
957504	Treatment Plant, Detention Tank, Structural
957505	Treatment Plant, Plan, Elevations and Details, Architectural
957506	Treatment Plant, Elevations, Sections and Details, Architectural
957507	Treatment Plant, Piping and Equipment, Mechanical
957508	Treatment Plant, Piping and Equipment Details, Mechanical
957509	Treatment Plant, Plumbing, Heating and Ventilation, Mechanical
957510	Reservoir, Plan, Sections and Details, Structural

Y&D DRAWING NO.	TITLE
957511	Reservoir, Sections and Details, Structural
957512	Reservoir, Piping and Details, Mechanical
957513	Yard Piping
957514	Treatment Plant, Interior Electrical, Plans and Details
957515	Treatment Plant, Exterior Electrical, Plan and Details
957516	Raw Water Collection and Distribution Mains
957517	Wells and Miscellaneous Controls
957518	Instrumentation and Controls

1.9 Prints furnished to contractor. Five one-half size prints of each drawing accompany this specification and 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.

1.10 Specifications and standards. The specifications and standards referenced in this specification (including addenda, amendments, and errata listed) shall govern in all cases where references to specifications or standards are made. In case of difference between these specifications or standards and this specification or its accompanying drawings, this specification and its accompanying drawings shall govern to the extent of such difference, otherwise the specifications and standards shall apply. Extra care shall be exercised to refer in requests for quotations, in orders, and in subcontracts to the specifications and standards and to all modifications thereof. The requirement for packaging, packing, 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 following 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 is suffixed to a referenced Federal or Military Specification, it denotes the effective amendment of the specification.

Referenced non-Government specifications or standards 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.

1.11 Factory inspection. (See Clause 10 of Standard Form No. 23A and Clause 26 of 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, provided notarized copies of factory test reports are furnished that show compliance with the specification requirements. Factory inspection will not be required for lumber provided it is grade-marked and trade-marked by the association under whose rules it is graded, or provided 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. 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 such inspection and tests are requested by the contractor.

1.12 Samples. As soon as practicable and before installation, the contractor shall submit for approval samples of the following materials and equipment.

1. Brick

2. Concrete masonry unit

1.13 Information required of the contractor. The contractor shall submit for approval, and in accordance with Clause 25(f) 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, fuse 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 fan - manufacturer's data including fan chacteristics

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

10. Gasoline and oil storage tank - shop drawings

11. Plumbing fixtures - 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.

1.14 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 Wage Determination Decision of the Secretary of Labor No. AB-29,471, which is attached hereto. 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 differences shall be referred to the Contracting Officer (the Chief of the Bureau of Yards and Docks 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 promptly comply 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.

1.14.1 Site work defined. Employment "directly upon the site of the work," referred to in 1.14 above, has been interpreted by the Secretary of Labor to include certain activities that, although physically located away from the geographical confines of the construction site are nevertheless considered on site since they are set up for, and operated as an integral part of the construction work. These activities include, but are not limited to, operation of sand and gravel pits, rock crushers, material processing plants, batching plants, and prefabrication plants that are established primarily to serve the needs of the particular contract work. Also, these activities include all hauling operations to and from the construction site when performed by employees of a contractor or subcontractor, but not when the hauling is performed by employees of a bonafide materialman who accomplishes such hauling in the due course of ordinary commercial supply operations. In the event of doubt as to whether particular anticipated work will be considered to be directly upon the site of the work within the meaning of the Davis-Bacon Act and this contract, bidders may obtain assistance from Regional Attorneys of the U. S. Department of Labor or from the Solicitor of Labor, U. S. Department of Labor, Washington 25, D. C.

1.14.2 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 prevailing 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 work day and work week, overtime compensation, health, and welfare contributions and available labor supply, and as to prospective changes or adjustments of wage rates of employment conditions in the area concerned which 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,nor the payment of higher wage rates than those 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 the subparagraph 1.14.3 below are satisfied.

1.14.3 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 which 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.

1.14.4 Apprentices employed pursuant to the wage determination contained in this contract must be registered in a bonafide 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.

1.14.5 Posting wage rates. Where compliance with Clause 1 of Form 19A 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.

1.15 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.

1.16 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.

1.17 Definitions. Where "as shown," "as indicated," "as detailed," or words of similar import are used, it shall be understood that reference to the drawings accompanying this specification is made 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, requirement, permission, approval or acceptance of the Officer in Charge is intended unless stated otherwise. As used herein, "provide" shall be understood to mean "provide complete in place," that is "furnish and install."

1.18 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 specifications, 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.

1.19 Methods and schedules of procedure. The work shall be executed in a manner and at such times that will cause the least practicable disturbance to the occupants of the buildings and to the normal activities of the Base. Before starting any work, the sequence of operations, the methods of conducting the work and the schedule of the work shall have been approved. Should the contractor desire to modify the schedule during the construction period, such modifications likewise shall be approved. If the contractor proceeds without obtaining prior approval of the Officer in Charge, at the option of the Officer in Charge, any work accomplished shall be removed and replaced.

1.20 Operation of Base utilities. The contractor shall not operate nor disturb the setting of any control devices in the Base 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.

1.21 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.

1.22 Changed conditions. Wherever changed conditions as defined in Clause 4 of Standard Form No. 23A 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 direction to do so must be obtained before quantities stated in the contract documents are exceeded.

1.23 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.

1.24 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/or debris resulting from demolition and removal operations, shall be removed by the contractor to designated areas at such times during the progress of the work as directed.

1.25 Lines and grades required for execution of the work shall be established by the contractor.

1.26 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 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.

1.26.1 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.

1.26.2 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.

1.26.3 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 forms will be furnished by the Officer in Charge.

1.27 Subcontractors and personnel. Promptly after the award of the contract, the contractor shall submit to the Officer in Charge, 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 address and telephone number 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.

1.28 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. These 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.

1.29 Safety requirements. A copy of the Department of the Army, Corps of Engineers, "Safety Requirements," referenced in Clause 24(d) of NAVDOCKS 113, may be examined on application to the office where the bids are being received. (Copies of this publication may be obtained upon application to the Office of Chief of Engineers, U. S. Army, Washington 25, D. C., at the established price.) Prior to commencement of 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.

1.30 Base regulations. The contractor will be required to comply with provisions of Marine Corps Base Orders issued by the Commanding General of this activity that pertain to his work. Information pertaining to these Base Orders will be supplied by the Officer in Charge prior to commencing work.

1.31 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 practices 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.

1.32 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.

1.33 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 NAVDOCKS Form 83. The schedule shall consist of a detailed breakdown of the contract price, giving the quantities of 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 this data without delay. 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. NAVDOCKS Form 83 will be furnished by the Officer in Charge.

1.34 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 NAVDOCKS Form 2311, which shall show, in summary form, the basis for arriving at the amount of the invoice, and

(b) Contract Performance Statement on NAVDOCKS Form 2312, 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. NAVDOCKS Forms 2311 and 2312 will be furnished by the Officer in Charge.

1.35 Construction Categories. The following construction categories shall apply to all work covered by this specification:

PROGRAM	CATEGORY PRIMARY	SECONDARY	DESCRIPTION
U-172	841	841 10	Water Treatment Facilities
		841 50	Wells and Storage Facilities
		2000	Supporting Features

The construction categories given above may be amended by the Officer in Charge, as necessary, during the course of the work.

1.36 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 2 and is assigned DO rating C-2. The contractor is hereby made a self-authorizing contractor as defined in Section 3(u) of that regulation and is required to use the self-authorization provision of Section 15 in obtaining controlled materials, as well as products and materials other than controlled materials needed to fill this rated order.

1.37 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 non-availability 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 material, 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.

1.38 Quarantine. The entire Camp Lejeune Reservation has 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 USDA Quarantine No. 72 and North Carolina State Quarantine No. 7 is required for operations hereunder. Pertinent requirements of the quarantine include the following:

1.38.1 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.

(a) 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.

(b) Nursery stock, plants and sod.

(c) Scrap metal.

1.38.2 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 are necessary to accomplish complete removal. Resulting spoil shall be wasted as directed.

1.39 North Carolina Sales and Use Taxes Clause for Construction Contracts Performed in North Carolina.

The North Carolina Sales and Use Taxes on materials, equipment and supplies used in the performance of this construction contract with the United States are included in the contract prices as State taxes in effect and applicable to the performance of this contract in accordance with the contract General Provision entitled: FEDERAL, STATE AND LOCAL TAXES

The Department of Justice contemplates litigation contesting the legality of the application of these taxes to construction contractors of the United States on the ground that they discriminate against the United States and those with whom it deals.

Notwithstanding any other provision of the contract it is hereby expressly provided that:

(1) The Government reserves the right to direct the successful bidder to institute proceedings to contest these taxes and the contract price shall be equitably adjusted to cover the costs to the contractor of such action, including any reasonable attorneys' fees.

(2) If the contractor is not required to pay or bear the burden or obtains a refund, in whole or in part, of these taxes, the contract price shall be correspondingly decreased or the amount of such relief or refund shall be paid to the Government, as directed by the Contracting Officer. The contract price also shall be correspondingly decreased if the contractor, through his fault or negligence or his failure to follow instructions of the Contracting Officer, is required to pay or bear the burden or does not obtain a refund of any such taxes, interest or penalty. Interest paid or credited to the contractor incident to a refund of taxes shall inure to the benefit of the Government to the extent that such interest was earned after the contractor was paid or reimbursed by the Government for such taxes.

(3) The contractor shall maintain accurate records of all payments of North Carolina Sales and Use Taxes on materials and supplies used in the performance of this contract.

1.40 Non-discrimination in employment.

1.40.1 Regulations of President's Committee. The Non-discrimination clause requires contractor compliance with the Rules and Regulations of the President's Committee on Equal Employment Opportunity, effective July 22, 1961, as amended December 14, 1961. The Rules and Regulations were published in the Federal Register on June 9, 1961 (26 F.R. 5184) and may be purchased for 15 cents per copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

1.40.2 Previous participation. The successful bidder will furnish to the Officer in Charge of Construction prior to award of the contract a written statement indicated whether or not the successful bidder has previously participated in a contract subject to the current Non-discrimination clause. The successful bidder will also assure that a similar written statement from each first-tier subcontractor is furnished to the Officer in Charge of Construction, such statement to be furnished not more than 30 days after award of each subcontract.

1.41 Interest. Notwithstanding any other provision of this contract, unless paid within 30 days, all amounts that become payable by the contractor to the Government under this contract (net of any applicable tax credit under the Internal Revenue Code) shall bear interest at the rate of six per cent per annum from the date due until paid, and shall be subject to adjustments as provided by Part 6 of Appendix E of the Armed Services Procurement Regulation, as in effect on the date of this contract. Amounts shall be due upon the earliest one of (i) the date fixed pursuant to this contract, (ii) the date of the first demand for payment, (iii) the date of supplemental agreement fixing the amount, or (iv) if this contract provides for revision of prices, the date of written notice to the contractor stating the amount of refund payable in connection with a pricing proposal or in connection with a negotiated pricing agreement not confirmed by contract support.

1.42 Project identification signboard. The contractor shall provide a signboard at a conspicuous location on the site of the work approved by the Officer in Charge. The field of the signboard shall be constructed of plywood not less than 5/8-inch thick, grade DFPA EXT A-B. Joints between plywood sheets shall be stripped on the back with two-inch by four-inch pieces, or shall be made with a noncorrosive metal device that will prevent relative movement or displacement between contiguous sheets. The signboard shall be banded all around with nominal one-inch by four-inch material and a cove mold on the front. It shall be framed on the back with a two by four at all edges and intermediate horizontal members of the same size at not more than three-foot intervals measured vertically. The plywood sheets shall be secured to the framing at 12-inch intervals using countersunk flat head wood screws, 1-3/4 inches long No. 8 or larger diameter. Countersunk screwheads shall be putty stopped. Framing members shall fit smoothly and tightly, and shall be jointed with zinc-coated steel framing anchors of a standard commercial design for the type of joint involved; the framing anchors shall be designed to develop both shear and tension and nails used shall be of the type recommended by the manufacturer of the anchors. The signboard shall be mounted about four feet above the ground on six-inch by six-inch wood posts or adequate steel section extending to the top of the signboard, spaced at not more than four feet on centers, and so that the end of the board does not extend more than two feet beyond the end posts. The posts shall be braced and anchored so that the entire installation is designed to withstand a windload of 30 pounds per square foot on either front or rear elevation, by established criteria. The signboard shall be bolted to the posts at each contact between framing members and posts using 1/2-inch diameter countersunk bolts and cast-iron or cut washers. Countersinks shall be putty stopped. All joints in moldings and banding shall be mitered and smoothly fitted. All wood framing members shall be selected, kiln-dried, straight-grained cypress. Posts shall be cypress or pressure-treated with pentachlorophenol. All wood parts of the signboard, posts, and bracing shall be brush-coated with a five per cent solution of pentachlorophenol in turpentine, and painted two coats of white lead and oil paint. Metal parts shall be primed with zinc-chromate and finish painted as specified for wood. The lettering shall be in black, and in either Gothic or Old Roman capitals. The letters and general format of the signboard shall be as shown and the lettering shall be done by skilled craftsmen of that specific trade. Margins shall be eight inches top, six inches bottom, and eight inches each side. The parenthetical figures appearing adjacent to lines and in spaces between lines indicate the height of letter and distance between lines, in inches.

SAMPLE SIGNBOARD COMPOSITION

(8)
S I T E O F (4)

(6)

WATER TREATMENT AND STORAGE FACILITIES (8)
WEAPONS TRAINING FACILITY

(6)

MARINE CORPS BASE (8)

(6)

CONTRACT NBy-54077 (3)

(6)

(3)	CONSTRUCTION AGENCY	CONTRACTOR	(3)
	(3)	(3)	
(2)	DIRECTOR, ATLANTIC DIVISION	NAME	(2)
	(3)	(3)	
(2)	BUREAU OF YARDS AND DOCKS	ARCHITECTS	(3)
	(3)	(3)	
(2)	FOR BUREAU OF YARDS AND DOCKS	PUBLIC WORKS OFFICE	(2)
		Camp Lejeune, N. C.	(2)

1.43 Government work and material. The Government will furnish the 30-inch third round concrete pipe to the contractor at a storage lot near Building 1317 in the Industrial Area.

1.44 Salvageable items removed from existing work shall be delivered as directed. Distance of haul shall not exceed 15 miles.

1.45 Cleaning-up. 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.

SECTION 2. EARTHWORK

2.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

NON-GOVERNMENT

American Association State Highway Officials - T180-57

American Society for Testing Materials - D1556-58T

2.2 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 of Clause 4 of Standard Form No. 23A 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.

2.3 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 four 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 raw water main in front of barracks on Range Road.

2.3.1 Clearing shall be performed within the following limits:

(a) Five feet outside of chain link fence.

(b) Twenty feet each side of power pole line.

(c) As necessary for construction in other areas.

2.3.2 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. Clearing for overhead power line construction shall also include the removal of all projecting limbs or branches within the clearing limits and all dead limbs, dead trees and leaning timber outside the clearing limits which may endanger or constitute an incipient hazard to the new line in falling.

2.3.3 Grubbing shall be performed within the entire area designated for clearing, except that grubbing is not required within the clearing limits for pole line construction. 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 six inches below trench bottoms; and to a depth of six inches below subgrade or natural ground within remaining areas.

2.3.4 Disposal of cleared and grubbed material.

(a) Trees from which saw logs, pulpwood, posts, poles or ties can be produced shall be considered merchantible timber. All merchantible timber shall be trimmed of limbs and tops, shall be sawed into merchantible lengths and stock piled 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.

2.4 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 four inches over the ground within the fenced area and in the areas where natural soil condition has been disturbed by this contract, except that topsoil will not be required where clearing has been performed for power line and for pipe lines from Range Road to G. W. Carver Street.

2.5 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.

2.6 Location and protection of existing utility lines.

2.6.1 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.

2.6.2 Where existing piping, utilities and underground obstructions of any type are indicated in locations to be transversed by new piping and other work provided hereunder, and are not indicated or specified to be removed, the elevation 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 for 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 No. 23A.

2.7 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.

2.7.1 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 Clause 4 of Standard Form No.23A respecting an adjustment for changed conditions shall apply.

2.7.2 Over excavation. 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.

2.7.3 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 six inches between the outside of the pipe and the sides of the trench or bracing, with a minimum width of trench of two feet. Trenches shall be tunneled under concrete sidewalks. 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 two feet.

2.8 Filling, backfill and grading.

2.8.1 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.

2.8.2 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 six-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.

2.8.3 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 six-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 a manner as to disturb pipe or structure.

2.8.4 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.

2.9 Borrow required shall be taken only from approved location. 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.

2.10 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.

2.11 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 T180-57. Determination of density of soil in place shall be made in accordance with ASTM Designation D1556-58T. Compaction tests will be performed by the Government at no expense to the contractor.

2.12 Pavement and shellrock surfacing cuts. Where necessary to cut pavement and shellrock surfacing 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 six-inch layers with each layer thoroughly tamped with a mechanical

tamper. All backfill shall be compacted to a desnity of 95 percent at optimum moisture content as specified. Repairs shall be made as follows:

(a) 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. The material for the asphaltic concrete shall be of the same composition as existing pavement.

(b) Shellrock surfacing. The top six inches from finished grade shall be crushed stone crowned over above finish grade and thoroughly compacted. Excess stone shall be removed and the new surface left level with the adjacent surface.

2.13 Vegetation.

2.13.1 The work includes seedbed preparation, liming, fertilizing and seeding of all areas indicated to receive topsoil.

2.13.2 Materials.

(a) Lime shall be dolomitic agricultural ground limestone containing not less than ten per cent magnesium oxide.

(b) Fertilizer shall be 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 the weight. If not used immediately after delivery, fertilizer shall be stored in a manner that will not allow it to harden or destroy its effectiveness.

(c) 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.

2.13.3 Seedbed preparation. The areas to be vegetated shall be prepared by plowing, heavy discing, or other approved equipment to thoroughly loosen the soil to a depth of four inches. After loosening the soil, all surface irregularities, where surface water could collect and pond, shall be smoothed out. A firm and compacted seedbed is required, and after smoothing, it shall be lightly compacted with a land roller, such as a cultipacker, before and after seeding. All tillage operations shall be as near on the contour as is practical.

2.13.4 Liming. Dolomitic ground agricultural limestone shall be uniformly applied at the rate of 2,000 pounds per acre 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 prepared seedbed.

2.13.5 Fertilizing. The fertilizer shall be uniformly applied at the rate of 1,000 pounds per acre to all areas to be vegetated. The fertilizer shall be incorporated into the upper three or four inches of prepared seedbed. This can be done just prior to the last tillage operation or just prior to seeding but in no case will it be applied more than three days before seeding or before the lime is applied.

2.13.6 Seeding. Seed shall be sown by hand or an approved seeder and distributed uniformly. The seed shall be planted no deeper than 1/4-inch. The seeding operation shall be as near on the contour as is practical but not up and down the slope. After seeding, the seeded area shall be compacted with a land roller, such as a cultipackder or an approved lawn roller by following the contour of the land. All seeding and compacting shall be done when weather conditions are favorable and not when seedbed is wet. It will be permissible to sow the seed and cultipack the soil all in one operation, if the proper equipment is used. Seed shall be sown between 1 April and 15 September. Should work operations be such that completion occurs outside of the above dates, lime, fertilizer and seed shall be turned over to the Government and an adjustment in the contract price will be made in accordance with Clause 4 of Standard Form 23A. Seeding shall be at the rate of 100 pounds per acre of the following seed:

Variety	Pounds
Bermuda (hulled)	100

2.13.7 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, and seeded wholly at the contractor's expense. This period shall extend for 30 days after the completion of the seeding.

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SECTION 3. CONCRETE PAVING

3.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

4Yf Mar 1961 Portland Cement Concrete Pavement (except for Airplane Traffic)

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

3.3 Materials, proportioning, mixing, conveying, placing and curing shall conform to the applicable requirements of Specification 4Yf, except as indicated or specified otherwise.

3.3.1 Concrete shall be Class E-1.5.

3.3.2 Reinforcement shall be standard wire mesh reinforcement of size indicated.

3.3.3 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 4. ASPHALTIC CONCRETE PAVEMENT

4.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL SPECIFICATIONS

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 State Highway Officials

M17-42 M156-57 T11-49 T96-56

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

4.3 Compacted crushed stone base course.

4.3.1 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 T96-56, Test Grading A, it shall show a loss of not greater than 55 per cent.

4.3.2 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.

4.3.3 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.

4.4 Asphaltic concrete surface course.

4.4.1 Materials. The fine aggregate shall conform to the requirements of Specification SS-S-71a, except that per cent wear as determined by the Los Angeles Test, AASHO T96-56, 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-731a, except that per cent wear as determined by the Los Angeles Test, AASHO T96-56, shall not exceed 55. The asphalt cement shall be Type AP-3, Specification SS-A-706b. Mineral filler shall conform to AASHO Designation M17-42.

4.4.2 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 PERCENT PASSING
1/2 inch	100
3/8 inch	95 - 100
No. 4	75 - 90
No. 10	60 - 80
No. 40	20 - 40
No. 80	10 - 20
No. 200	4 - 8
Bitumen	4.5 - 8.0

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 T11-49 using a detergent (sodium hexametaphosphate buffered with sodium carbonate.)

4.4.3 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	1000 pound (minimum)
Void content - per cent of total mix	3 - 8
Flow - hundredth of an inch	9 - 16

4.4.4 Mixing plant shall conform to the requirements of AASHO Designation M156-57.

4.4.5 Joints. Where new pavement abutts existing pavement, the existing surfacing course shall be cut back along uniform lines approximately six 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 aspahlt cement.

4.4.6 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.

4.4.7 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.

4.4.8 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.

4.4.9 Finished surfaces shall be uniform in texture and appearance and free of cracks and creases.

4.4.10 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 5. CONCRETE CONSTRUCTION

5.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

GOVERNMENT

13Yg Apr 1963 Concrete Construction

5.2 General requirements. Concrete work including reinforcement shall conform to the applicable requirements of Specification 13Yg, except as modified herein. Horizontal steel shall be returned 18 inches at corners unless otherwise indicated.

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

5.3.1 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.

5.3.2 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.

5.3.3 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 eight feet horizontally. Splices shall not occur less than every fourth bar vertically.

5.3.4 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 six inches for the side and end laps and sealed with approved adhesive. 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 two 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 13Yg for watertight construction.

5.3.5 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 non-slip finish, using a wood float. Pump room floor shall be finished as hereinafter specified for interior floor surfaces.

5.3.6 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 ten 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.

5.3.7 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.

5.4 Other concrete work for building and miscellaneous structures.

5.4.1 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.

5.4.2 Forms for exposed surfaces of the building foundation shall provide for a special grout finish.

5.4.3 Sub-grades. 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.

5.4.4 Expansion joints between vertical concrete surfaces and floor slabs laid on the earth shall be as shown on drawings and as described in Specification 13Yg.

5.4.5 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.

5.4.6 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 non-slip 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 non-slip 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 and landings shall receive sidewalk finish.

5.5 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.

5.6 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 three 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 6. PRECAST ROOFING SLAB

6.1 General requirement. The work includes the provision of precast light-weight concrete planks.

6.2 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 two-inch end bearing, shall be two 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 six-foot span based on a safety factor of four. All planks shall be as nearly perfect as good workmanship will permit.

6.3 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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SECTION 7. BRICK AND CONCRETE MASONRY

7.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

SS-C-192d	Cement, Portland
SS-Q-351	Quicklime, for Structural Purposes

NON-GOVERNMENT

American Society for Testing Materials

C33-61T	C90-59	C207-49
C55-55	C91-60	C315-56
C62-58	C144-52T	

7.2 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.

7.3 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 manufacturer's 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.

7.3.1 Common brick shall conform to ASTM C62-58; 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.

7.3.2 Concrete brick shall be Grade A, conforming to ASTM C55-55 and shall be natural color with surface texture matching that of the concrete masonry units. Size of brick shall conform to that specified for clay brick.

7.3.3 Concrete masonry units shall be of modular dimensions, and shall be either air, water, or steam cured and shall be Grade A conforming to ASTM C90-59. Units shall be stored at the site before use a minimum of 28 days for air cured units; ten days for steam or water cured units; and three 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.

(a) Aggregates for concrete masonry units shall conform, except as to grading, to ASTM C33-61T.

(b) 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.

7.3.4 Flue linings and thimbles shall conform to ASTM C315-56 and shall be free from fractures, large or deep cracks, blisters, and other defects. Sizes and shapes shall be provided as indicated.

7.4 Mortars.

7.4.1 Mortar for brick and concrete-masonry unit work shall be mixed in the proportions by volume of one part Portland cement, one part lime paste, and six parts sand, or of one part masonry cement and three parts sand. The aggregates shall be introduced and mixed in such a manner that the materials will be distributed uniformly throughout the mass, after which a sufficient amount of water shall be added gradually and the mass further mixed until a mortar of the plasticity necessary for the purpose intended is obtained. The mortar may be machine mixed in approved mixers of the type in which the quantity of water can be controlled accurately and uniformly. Mortar boxes, pans, and/or mixer drums shall be kept clean and free of debris or dried mortar. The mortar shall be used so that it will be in place before the initial setting of the cement has taken place; retempering of mortar in which cement has started to set will not be permitted. The color of the cement and sand used in the exposed exterior work shall produce without the admixture of any coloring matter, a mortar of uniform shade.

7.4.2 Portland cement shall be Type I, conforming to Specification SS-C-192d.

7.4.3 Masonry cement shall be Type II conforming to ASTM C91-60.

7.4.4 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, at the contractor's option be added in the dry form. Pulverized quicklime shall conform to Specification SS-Q-351, and shall pass a No. 20 sieve, and 90 percent shall pass a No. 50 sieve; hydrated lime shall be Type S conforming to ASTM C207-49.

7.4.5 Sand shall conform to ASTM C144-52T.

7.4.6 Water for mixing shall be fresh and clean, and free from excess acids, alkalies, and other deleterious matter.

7.5 Joints. All exposed joints shall be uniform in thickness. Joints in brickwork shall be not less than 3/8-inch nor more than 1/2-inch thick, and the joints in concrete masonry unit work shall not be more than 3/8-inch thick. All exterior exposed joints shall, when the mortar is thumbprint hard, be tooled slightly concave with a round or other approved jointer. 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. 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 from top to bottom of wall within a tolerance of plus or minus 1/2-inch.

7.6 Coursing. The actual thickness of brick walls or of brick-faced walls shall be governed by the size of the brick, and backing material used. Where the dimensions of the coursing are indicated, the thickness of joints shall be adjusted to meet the respective requirements; however, the joints shall be of the same thickness throughout the work. "Story poles" or "gage rods" shall be made prior to starting the work and used throughout the work.

7.7 Workmanship. Elevations shall be check with an instrument frequently at each story, sills, and heads of openings to maintain the walls level all around. Brick and concrete masonry units shall be so handled that their edges and faces will not be chipped, spalled, or cracked. All beds on which masonry is to be laid shall be cleaned and wetted properly. Common brick (clay or shale) shall be tested on the job prior to laying to determine if they will require wetting by drawing a circle with a wax pencil on the unit the size of a silver quarter; then with an ordinary medicine dropper, apply 20 drops of water to the surface of the unit inside the small circle. If the water is completely absorbed in less than 1-1/2 minutes, the units shall require wetting. Wetting when required shall be done the night before the units are to be laid; units shall be damp but free from any surface water when placed in the wall. The work shall be built level, square, plumb, and true. All drilling, cutting, and fitting required by other work and for making good after such work shall be done as necessary. Bolts, anchors, plugs, ties, lintels and other metal specified elsewhere in connection with the work shall, where practicable, be placed in position as the masonry work progresses. Chases of approved dimensions for pipes and for other purposes shall be provided where necessary. The tops of exposed walls and partitions shall be covered with tarpaulins or heavy waterproofed paper while work thereon is not in progress. All walls and partitions shall be bonded or anchored to each other

and to walls and columns, and partitions and interior walls shall be wedged at the tops where practicable. Unless specified otherwise, selected common brick shall be used for exterior wall facing except that over or underburned, warped, spalled, cracked, or broken brick shall not be used where exposed, but may be used as back-up and where concealed. Common brick, where exposed, shall be selected for the better face for stretchers, and the better end for headers. Bonding and coursing for masonry work shall be established before the work is started; changes in the bonding after work is started will not be permitted.

7.7.1 Brickwork shall be laid in common bond with headers every sixth course. Bats shall be used only for closures. 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 and 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 bricks and then throwing mortar or scrapings into the empty joints will not be permitted. Longitudinal joints within walls shall be formed as specified for head joints, or may be formed by applying the mortar to the surfaces of the bricks previously laid, and then shoving the brick into place. 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.

7.7.2 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.

7.7.3 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 courses 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.

7.8 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.

7.9 Samples of brickwork. Before brickwork is started, the contractor shall build, where directed, a sample panel of brickwork one-foot thick, six-feet long and four-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.

7.10 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, subject to approval, proper precautionary measures are taken. Brickwork may be started at 34 degrees F., on a rising thermometer. Temperatures shall be taken at the job site.

7.11 Cleaning. Upon completion, all masonry work shall be pointed when necessary. All exposed surfaces of exterior and interior common brick work shall be washed with a suitable solution of muriatic acid and rinsed thoroughly with clean water, and all other exposed surfaces of exterior and interior masonry work shall be scrubbed with warm water and soap and rinsed thoroughly with clean water. All other work that might be damaged, stained, or discolored shall be protected during the cleaning, and all work so affected by the process of cleaning shall be replaced.

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SECTION 8. STRUCTURAL STEEL WORK

8.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

22Ye Jan 1962 Structural Steelwork

FEDERAL

QQ-S-741a (1) Steel Plates, Shapes and Bars, Carbon, Structural

NON-GOVERNMENT

American Institute of Steel Construction - Steel Construction Manual

8.2 General requirements. Steel work including shop painting, except as otherwise specified, shall be in accordance with Specification 22Ye. 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 eight inch minimum bearing on solid masonry supports.

8.3 Structural steel shall conform to Specification QQ-S-741a, Type I or Type II.

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

8.5 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.

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

8.7 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 9. MISCELLANEOUS METAL WORK

9.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

22Ye Jan 1962 Structural Steelwork

9.2 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 No. 22Ye; welding shall be done in a manner that will prevent permanent buckling and all welds exposed in the finished work shall be ground smooth.

9.3 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 arises. 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.

9.4 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 No. 22Ye.

9.5 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.

9.6 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 or sulphur.

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

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SECTION 10. STEEL WINDOWS AND SCREENS

10.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

RR-S-141a (2) Screening, Wire, Insect

10.2 General requirements. Windows shall be of sizes and types indicated or specified.

10.3 Conformance to industry specifications. References herein to published specifications of the Steel Window Institute, and other industry standards, shall form a part of this specification. Where compliance with industry specifications is specified, the contractor shall furnish a certificate from the window manufacturer certifying that the windows provided are in accordance with the requirements of the applicable industry specifications. However, such certification shall not relieve the contractor from the responsibility of complying with the additional requirements of this specification. The requirements specified herein shall govern where there is a difference between this specification and the referenced industry specification.

10.4 Construction workmanship. Windows shall be constructed to produce the results hereinafter specified and to assure a neat appearance. Joints shall be of strength to maintain the structural value of members connected. Welded joints shall be solid, have excess metal removed, and dressed smooth on exposed and contact surfaces. The dressing shall be done so that no discoloration or roughness will show after finishing. Joints formed with mechanical fastenings shall be closely fitted and made permanently water-tight. Frames and sash, including ventilators, shall be assembled at the plant and shipped as a unit with hardware unattached.

10.4.1 Accessories. Windows shall be provided complete with all necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation of windows and for the operation of ventilators. Anchors used for steel windows shall be steel. All steel anchors shall be hot-dipped zinc-coated, or shall be phosphate-treated and given two coats of rust-inhibiting paint. Anchors and fastenings shall be built into, bolted to, or anchored otherwise to the heads, jambs, and sills of openings, and shall be fastened securely to the windows or frames. Anchors shall be the type recommended by the window manufacturer for the specific type of construction and shall be concealed. Screws, nuts, bolts, and other fasteners for ferrous material shall be cadmium or zinc-coated.

10.4.2 Hardware. The items, type, and function of hardware required shall be as specified. Hardware shall be of suitable design, and shall have sufficient strength to perform the function for which it is used; it shall be attached securely to the windows with non-corrosive bolts or machine screws; sheet metal screws shall not be used. Where fixed screens are specified, the hardware shall be especially adapted to permit satisfactory operation of ventilators. Exposed hardware shall be stainless steel, non-magnetic-type with a satin finish; white bronze with a satin finish; or yellow bronze with US 20 finish. Hinges shall be of steel, or malleable iron, with non-ferrous pins, or with steel pins and non-ferrous bushings or washers; the finish on hinges shall match the windows.

10.4.3 Provisions for glazing. Sash shall be designed for securing glass with metal beads or with glazing clips and glazing compound.

10.4.4 Mastic caulking. Metal-to-metal joints between members of metal windows, metal frames, mullions, and mullion covers shall be set in mastic of type recommended by the window manufacturer to provide completely weather-tight joints. Excess mastic shall be removed before it hardens.

10.4.5 Windows shall be steel projected type and shall conform to the Steel Window Institute's Recommended Standards for Steel Windows, except as modified herein.

(a) Shop finish on steel. After fabrication, all surfaces of windows, fins, mullions, cover plates, and screen frames shall be cleaned and phosphate treated and shop primed. The methods of cleaning, chemical treatments, and painting shall conform to the Steel Window Institute's General Specification requirements.

(b) Steel projected windows shall conform to the Steel Window Institute's recommended standards for commercial type, with the following modifications.

(1) Each ventilator shall have a cam-type lever handle fastener, except that ventilators 48 inches wide and over, and not pole operated, shall have two fasteners.

(2) Ventilators with locking rails more than 6 feet above the floor shall have hardware designed for pole operation. Where fixed screens occur at projected-out ventilators, underscreen push bar operators shall be provided.

(3) Where fixed sash units adjoin, or are in combination with projected windows, the frames for the fixed units shall be manufacturer's stock type as recommended for this purpose, unless indicated otherwise.

10.4.6 Insect screens shall be provided for ventilators of windows. The screens provided shall be of type standard with the window manufacturer,

except as specified otherwise. Screen frames shall be steel. Screens shall fit closely around entire perimeter of each ventilator or opening, shall be rewirable, easily removable from inside building, and interchangeable for same size ventilators of similar type windows. Hardware, guides, stops, clips, bolts, and screws shall be furnished as necessary for a secure and insect-tight attachment to window. Finish of screen frames shall be as specified for windows. Screen hardware shall be manufacturer's standard type and finish, unless specified otherwise.

(a) Type. Screens for projecting-type ventilators shall be stationary-type, attached directly to the windows, and located on inside. Sliding wickets or hinged wickets with friction catches, shall be provided in screens for out-opening vents without underscreen or through-screen operators. The wicket opening frames shall be of similar material and cross-section to the screen frames, and the framing bar shall run continuously between the two sides of the screen frames.

(b) Construction of steel screens. Steel frame screens shall conform to the recommended standards of the Steel Window Institute, as modified herein. The frames shall have removable splines of steel or vinyl. Screening shall be 18 x 18 mesh conforming to Federal Specification RR-S-141a, Type III. Screening shall be installed with weave parallel to frames and stretched sufficiently tight to present a smooth appearance. Edges of screening shall be concealed in the spline channel.

10.5 Installation

10.5.1 General requirements. Windows shall be installed and adjusted by experienced and qualified applicators, using only skilled window mechanics. Unless indicated or specified otherwise, windows shall be built-in as the work progresses, or they shall be installed, without forcing, into prepared openings. Windows shall be set at the proper elevation, location, and reveal, plumb, square, level, in alignment, and shall be braced, strutted, and stayed properly to prevent distortion and misalignment. Ventilators and operating parts shall be protected against accumulation of cement, lime, and other building materials, by keeping ventilators tightly closed and wired fast to frame. Screws or bolts in sill members, joints at mullions, and contacts of windows and sills, built-in fins, or sub-frames shall be bedded in mastic sealant of a type recommended by the window manufacturer. Windows shall be installed in a manner that will prevent entrance of water.

10.5.2 Anchors and fastenings. Ample provision shall be made for securing units to each other, to masonry, or to other adjoining or adjacent construction. Where windows are set in prepared masonry openings, the necessary anchorage or fins shall be placed during progress of wall construction. Anchors and fastenings shall be built into, anchored or bolted to the jambs of openings, and shall be fastened securely to the windows or frames and to the adjoining construction. Unless indicated otherwise, anchors shall be spaced not more than 18 inches apart on jambs and sills. Anchors and fastenings shall have sufficient strength to hold the member firmly in position.

10.5.3 Adjustments and tests after installation. After windows have been installed and upon completion of glazing and painting, all ventilators and hardware shall be adjusted to operate smoothly and to be weathertight when ventilators are closed and locked. Hardware and parts shall be lubricated as necessary. Projected sash shall have arms or slides lubricated and adjusted to proper tension.

10.5.4 Protection and cleaning

(a) Protection. Care shall be used in handling and hoisting windows during transportation, and at job site. Windows shall be stored at the site on edge and under cover. After installation, windows shall be protected from damage during subsequent construction activities.

(b) Cleaning. Metal surfaces of windows shall be cleaned, on both the inside and outside, of all mortar, plaster, paint spattering or spots, and other foreign matter to present a neat appearance and prevent fouling of weathering surfaces, weatherstripping, or the operation of hardware. Abraded surfaces of steel windows shall be satisfactorily cleaned and touched up. Stained, discolored, or abraded windows that cannot be satisfactorily repaired shall be replaced with new windows at no additional cost to the Government.

10.5.5 Shop drawings. Windows shall not be delivered to the project prior to the approval of shop drawings. Window schedules shall be submitted with shop drawings. Shop drawings shall indicate elevations of windows, full-size sections, thicknesses and gages of metal, fastenings, proposed method of anchoring, the size and spacing of anchors, details of construction, method of glazing, details of operating hardware, mullion details, method and materials for weatherstripping, method of attachment of screens and storm sash, and installation details. Where metal sub-frames, stools, casings, sills, trim, screens, and other related items are required, show drawings shall show details and methods of attachment for these items.

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SECTION 11. METAL DOORS AND FRAMES

11.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

32Yb June 1961 Metal doors, including addendum 1

11.2 General requirements. Metal doors and frames shall conform to the applicable requirements of Specification 32Yb, except as indicated or specified otherwise.

11.3 Hollow pressed steel frames shall be the full-welded type.

11.4 Hollow metal doors shall be Type III, industrial-type doors, and shall be a complete integral package unit with door, frame and hardware. Hardware shall be as specified in the HARDWARE SECTION.

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SECTION 12. ROOFING AND SHEET METAL WORK

12.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

7Yi Feb 1962 Roofing, Siding, Sheet Metal Work; Dampproofing and Membrane Waterproofing

FEDERAL

QQ-C-576a Copper Plates, Rolled Bars, Sheets and Strips
QQ-S-775b Steel, Sheet, Carbon, Zinc-Coated

12.2 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 7Yi, except as indicated or specified otherwise.

12.3 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.

12.3.1 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.

12.3.2 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-576a. Flange of gravel stop shall extend at least four 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-775b 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.

12.4 Performance of roofing. In addition to the requirements specified, roofing and flashing shall be completely weathertight. The contractor shall furnish in writing, warrantees 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.

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SECTION 13. THERMAL INSULATION

13.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

49Ya Dec 1961 Thermal Insulation for Buildings

FEDERAL

HH-I-526a Insulation Board, Thermal-Acoustical Mineral Wool (For Roofs)

LLL-I-535(1) Insulation Board, Thermal and Insulation Block, Thermal

13.2 General requirements. The work includes the provision of roof insulation with vapor barrier. Materials and method of installation shall be in accordance with Specification 49Ya, except as indicated or specified otherwise.

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

13.3.1 Rigid fiberboard (vegetable fiber) conforming to the applicable requirements of Specification LLL-I-535(1), 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.

13.3.2 Rigid mineral wool insulation board shall conform to the requirements of Specification HH-I-526a having a bituminous impregnated kraft paper covering on the upper exposed surface and on the ends and having a density of not less than 11 pounds per cubic foot.

13.4 Application. Application shall be as specified in Specification 49Ya for roof insulation on nailable concrete and poured or precast gypsum decks. A vapor barrier shall be provided.

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SECTION 14. CARPENTRY

14.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

28Ye Jul 1962 Carpentry and Woodwork

FEDERAL

RR-S-141a (2)	Screening, Wire, Insect
TT-W-571g (1)	Wood Preservation, Treating Practices
TT-W-572	Wood-Preservative, Water-Repellent

NON-GOVERNMENT

American Society for Testing Materials

C 220-61
C 221-61

Commercial Standards

CS 120-58

14.2 Materials and method of application shall conform to the applicable requirements of Specification 28Ye, except as specified or indicated otherwise. Moisture content shall not exceed 19 per cent for framing or 15 per cent for finish items.

14.3 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:

14.3.1 Framing, joist and blocking - No. 2 dimension Southern pine.

14.3.2 Sheathing - T&G No. 2 common short leaf Southern pine

14.3.3 Fascia and plates under gravel stops shall be No. 2 Southern pine.

14.3.4 Wooden covers, baffles and framing in detention tank shall be No. 1 common grade of cypress.

14.3.5 Plywood shall be interior Douglas fir, Grade A-B.

14.4 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-571g.

14.5 Asbestos-cement sheets. Corrugated asbestos-cement sheets for constructing mixing chamber shall conform to ASTM C221-61, Type A. Flat asbestos-cement sheets shall conform to ASTM C220-61, Type F. Bolts, nails and other fastening devices shall be hot-dipped zinc-coated or cadmium plated.

14.6 Doors shall be Grade 1F Ponderosa pine, conforming to the requirements given in Commercial Standard CS120-58. They shall be stock design and of the panel type.

14.7 Screen doors shall conform to the applicable requirements of Commercial Standard CS120-58 for Grade 1, except as specified otherwise. Door shall be not less than 1-3/8 inches thick. Stiles and top rails shall be not less than 3-5/8 inches. Bottom rail width shall be suitable for the respective design. Insect screening shall be 18 x 18 mesh, bronze insect screen conforming to Specification RR-S-141a Type III. A guard woven of 0.062 by 5/16 round edge flat aluminum wire on 1-1/2 inch centers, installed in an aluminum mounting frame, shall be provided in the lower panel of screen doors.

14.8 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 HARDWARE SECTION of this specification.

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SECTION 15. CAULKING

15.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

NON-GOVERNMENT

American Standards Association-A116.1-1960

15.2 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. Caulking shall be provided around the perimeter of the building where roof slabs rests on the masonry.

15.3 Materials shall be delivered to the job in the manufacturer's original, unopened containers with the brand, date of manufacturer 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.

15.3.1 Caulking compound shall be a two-component, polysulfied type conforming to ASA A116.1-1960, Class B, and the additional requirements specified herein. The caulking compound shall be supplied in premeasured 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 polysulfied-base compound or larger unit. The polysulfide container shall have sufficient space at top to allow for addition of the accelerator and for mixing. When properly mixed, the proportion of polysulfide in the total mixed caulking compound shall be not less than 50 percent, and under normal application conditions, including adequate ventilation, the caulking compound shall be considered non-toxic. When tested as prescribed herein, the cured caulking compound shall have a Shore A Durometer hardness of not less than 20 nor more than 50, and not more than 65 after heat aging; the tack-free time shall be not more than 72 hours from time of mixing, and the adhesion in peel shall be not less than ten pounds per inch of width. Notarized test certificates from an approved laboratory shall be provided, certifying that each lot of material furnished under this specification meets the test requirements and polysulfide contents specified.

15.3.2 Primer for use with polysulfide caulking compound shall be a quick-drying, colorless, non-staining sealer, of type and consistency recommended by the caulking manufacturer. Primer shall be provided on masonry, concrete, and wood surfaces, and where recommended by the manufacturer.

15.3.3 Backstops. Glass fiber roving, or neoprene, butyl, polyurethane, vinyl, or polyethylene foams free from oil or other staining elements, shall be used as backstops. Oakum and other types of absorptive materials shall not be used as backstops.

15.4 Surface preparation. Surfaces against which primer and caulking are to be applied shall be clean, dry to the touch, free from frost, moisture, grease, oil, wax, lacquer, paint or other foreign matter that would tend to destroy or impair adhesion. All loose particles or mortar shall be cleaned out just prior to caulking and grooves given a uniform coating of primer. Primer shall not be applied to exposed finish surfaces.

15.5 Application. The caulking compound shall be applied in accordance with the manufacturer's printed instructions; using a gun with nozzle of proper size to fit the joint width. The compound shall be forced into grooves with sufficient pressure to fill the grooves solidly. Caulking shall be uniformly smooth and free of wrinkles, and unless indicated otherwise shall be tooled as necessary and left sufficiently convex to result in a flush joint when dry. Where the use of gun is impracticable, suitable hand tools may be used. The caulking compound shall not be applied to joints when the air temperature is below 50 degrees F. or when it appears probable that temperatures below 50 degrees F. will be encountered before the caulking has set. The two-component caulking compound shall not be used when it becomes too jelled to be discharged in a continuous flow from the gun. Modification of the caulking compound by addition of liquids, solvents, or powders shall not be permitted. Only the amount of caulking which can be installed within four hours shall be mixed, but at no time, shall this amount exceed five gallons unit increments. Caulking around openings shall include the entire perimeter of each opening.

15.6 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.

SECTION 16. GLAZING

16.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

DD-G-451a (1) Glass, Flat and Corrugated, for Glazing, Mirrors, and Other Uses

16.2 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.

16.3 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.

16.3.1 Glass shall conform to Specification DD-G-451a, 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.

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

16.4 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.

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SECTION 17. HARDWARE

17.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

FF-H-106a (1)	Hardware, Builders, Lock and Door Trim
FF-H-111b	Hardware, Builders, Shelf and Miscellaneous
FF-H-116c (1)	Hinges, Hardware, Builders
FF-H-121c	Hardware, Builders, Door-Closing Devices

17.2 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 Specification Nos. FF-H-106a, FF-H-111b, FF-H-116c, and FF-H-121c. Hardware not specified otherwise shall have a U. S. 10 finish except that finish in toilet shall be U. S. 26. 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.

17.3 Schedule.

17.3.1 Doors 1 and 5 shall have:

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

17.3.2 Doors 2 and 3 shall have:

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

17.3.4 Door 4 shall have:

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

17.3.5 Screen door for 1 and 5 shall have:

1-1/2 pair butts, Type 2127USP, 4" x 4"
1 closer, Type 3010
1 pull, Type 1275
2 push bars, Type 472A
2 kick plates, Type 1226

17.3.6 Cabinet shall be provided with the following:

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

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SECTION 18. PLUMBING

18.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

31Yg Dec 1960 Interior Plumbing Systems, including Erratum 1

FEDERAL

DD-M-411 (1)	Mirrors, Plate Glass, Framed
WW-P-541b (4)	Plumbing Fixtures, Land Use
WW-T-799a (1)	Tubing, Copper, Seamless (For Use With Solder-joint or Flared-Tube Fittings)

18.2 General requirements. The work includes the provision of all new piping, piping for drains, 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 31Yg, except as modified herein.

18.3 Pipe, valves and fittings.

18.3.1 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 three 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 underground, except that cast-iron pipe and fittings shall be standard weight.

18.3.2 Water piping. Water piping shall be Type K, copper tubing conforming to Specification WW-T-799a and soldered brass or copper composition fittings using 50-50 lead-tin solder. Bronze gate shut-off 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 shut-off valve.

18.4 Fixtures, trimmings, fittings, accessories, and miscellaneous plumbing supplies, except as specified otherwise, shall be in accordance with Specification WW-P-541b, 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-plated, unless stated otherwise.

18.4.1 Fixtures, as follows, shall be provided where indicated:

(a) Water closet shall be Outfit No. VW-9, with CETW seat.

(b) Sink shall be Outfit No. EK24GF.

18.4.2 Accessories, as follows, shall be furnished and installed where directed:

(a) Faucets for sampling lines shall be Type 10.

(b) Paper holder shall be Type 434; coat hook shall be Type 419.

18.5 Insulation of cold water piping is not required.

18.6 Tests. All defects disclosed as a result of the following tests shall be remedied.

18.6.1 Water piping shall be subjected to a hydrostatic pressure test at operating pressure.

18.6.2 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.

18.7 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 19. HEATING AND VENTILATING

19.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

21Yd	Mar 1957	Steam Power Plant, Heating and Ventilating Equipment and Piping, including Erratum No. 1
34Yc	May 1957	Bituminous Coating Systems for Steel Surfaces

FEDERAL

WW-T-799a (1)	Tubing, Copper, Seamless (For use with Solder-Joint or Flared-Tube Fittings)

MILITARY

MIL-F-16081C	Fans, Ventilating, Propeller
MIL-G-17232A	Grilles, Registers, Diffusers and Deflecters, Metal

NON-GOVERNMENT

Air Moving and Conditioning Association
American Society of Heating, Air Conditioning and Refrigeration Association
National Board Fire Underwriters - Pamphlet Nos. 30, 31 and 90B
Underwriters' Laboratories, Inc.

19.2 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 21Yd, and NBFU Pamphlets Nos. 30, 31 and 90B. Items used in the installation shall have been approved by the Underwriters' Laboratories, Inc. and listed under the proper heading.

19.3 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 percent of the furnace output. Filter shall be of the throw-a-way 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 NBFU Pamphlet No. 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.

19.4 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 NBFU Pamphlet No. 90B. Clearances specified therein shall be maintained. Dampers shall be provided in each branch.

19.5 Grilles and registers. Grilles and registers shall be sized as noted, shall be of the adjustable deflexion type, and conform to applicable requirements of Specification MIL-G-17232A. An opposed blade damper shall be provided for each grille.

19.6 Fuel oil tank. The oil tank shall be 42 inches in diameter by at least 92-1/2 inches long. Tank shall be complete with fill pipe and vent, as shown. The installation shall conform to the requirement of NBFU Pamphlet No. 30, tank shall be constructed of at least 10-gauge black steel plate, and given a Type I coating conforming to Specification 34Yc.

19.7 Oil lines for the oil burners shall be Type K, soft-drawn copper tubing with compression fittings in accordance with Specification WW-T-799a.

19.8 The exhaust fan shall be of the propeller type, Type I, Class 1, Style A, in accordance with Specification MIL-F-16081C. Capacity shall not be less than 1000 cfm and 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, Air Conditioning and Refrigeration Association. Fan shall be mounted at the floor 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.

19.9 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.

SECTION 20. MECHANICAL EQUIPMENT

20.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

9Yh July 1962 Electrical Apparatus, Distributing System and Wiring

FEDERAL

GG-G-76b 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 with Accessories
MIL-H-17278A (1) Feeders, Chemical Solution, Water Purification, Fully Automatic, Manually Adjusted
MIL-P-17552B Pumps, Centrifugal, Water, Horizontal, General Service and Pumps, Centrifugal, Water Horizontal, Boiler Feed, Electric Motor or Steam Turbine Driven

NON-GOVERNMENT

American Standards Association
National Electrical Manufacturers' Association
National Board of Fire Underwriters - Pamphlet No. 30

20.2 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.

20.2.1 Service. This equipment shall perform the service of producing an effluent as specified from raw water, having an analysis as shown, in the quantities specified.

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

20.2.3 Raw water analysis is as follows:

Item	PPM
(a) Calcium (Ca)	53.0
(b) Magnesium (Mg)	3.0
(c) Sodium (Na) and Potassium (K)(as Na)	7.
(d) Silica (Sicl)	22.
(e) Iron (Fe) Total	6.
(f) Bicarbonate (HCO_3)(as Ca CO_3)	148.
(g) Carbonate (CO_3)(as Ca CO_3)	0.0
(h) Hydroxide (OH)(as Ca CO_3)	0.0
(i) Sulphate (SO_4)	1.
(j) Chloride (Cl)	15.
(k) Phosphate (PO_4)	0.0
(l) Dissolved solids	227.
(m) Total hardness (as $CaCO_3$)	160.
(n) pH	7.75
(o) Color	10.0

20.2.4 Effluent. The effluent, or service water, produced shall have a total hardness as $CaCO_3$ not to exceed 60 ppm and a total combined iron and maganese content not to exceed 0.3 ppm. The solids in solution shall not be greater than those in the raw water.

20.2.5 Capacity. The water treatment equipment shall have the capacity to produce a service water effluent as herein specified of not less than 625,000 gallons daily.

20.2.6 Proportioning equipment. Proportioning equipment shall be supplied 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.

20.2.7 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.

20.2.8 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.

20.2.9 Approved safety guards shall be provided on all moving parts of mechanical equipment.

20.2.10 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 limited to, the following: operating instructions, illustrations, drawings, detail description, installation instructions, adjustments, tests, parts list, etc.

20.3 Aerator. The aerator shall have a capacity of approximately 430 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 36 ppm to an average of 10 ppm, and shall be used to reduce hydrogen sulfide content.

20.3.1 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 430 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 non-clogging design to avoid corrosion or clogging.

20.3.2 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.

20.3.3 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 inclosed 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.

20.4 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.

20.4.1 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.

20.4.2 Mixer shall be a standard manufactured product 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 a minimum diameter of 14 inches with three blades, and shall have a rotational speed of approximately 420 rpm. The unit shall be designed to operate on 208-volt, 3-phase, 60-cycle current, and shall have outboard facilities for lubricating shaft bearing.

20.4.3 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-17278A for Type II, except that the feed rate shall be manually adjustable rather than automatic proportioning.

20.5 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 No. MIL-C-17226B, except as modified herein. One platform scale without wheels having a minimum capacity of 1000 pounds shall be provided for use with the two chlorinators as indicated.

3. RECESS FLOOR FOR CHLORINE

20.5.1 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.

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

20.5.3 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.

20.5.4 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.

20.5.5 Five copies of complete operating instruction and five of spare parts catalogue shall be furnished with the equipment.

20.5.6 Spare parts auxiliary equipment and maintenance tools shall be furnished as specified in Specification No. MIL-C-17226B.

20.6 Filters. The filter battery shall include three vertical, pressure-type units, sized for 430 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.

20.6.1 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.

20.6.2 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.

20.6.3 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).

20.6.4 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.

20.6.5 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.

20.6.6 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 Contracting Officer.

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

20.6.8 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-76b, Class 2, Type A, 6-inch brass case.

20.6.9 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.

20.6.10 Performance test. Each unit shall be tested after being put in operation, to determine conformance with this specification.

20.7 Water softening equipment. The equipment shall be water softeners conforming to the applicable requirements of Specification No. MIL-W-17121C, 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 tank, and all associated controls.

(a) Controls. The softening equipment shall be automatically controlled.

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

(c) Current. Power supply will be 120/208 volts, 60-cycle, 3-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) Salt storage tanks will not be required.

(h) 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 Contracting Officer.

20.8 Water pumps. Service water pumps and filter pumps shall conform to the applicable requirements of Specification MIL-P-17552B, 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).

20.8.1 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	118 feet
Service Water Pump No. 2	500 gpm	118 feet
Service Water Pump No. 3	750 gpm	130 feet
Filter Pump No. 1	430 gpm	70 feet
Filter Pump No. 2	430 gpm	70 feet

20.8.2 Stuffing boxes shall have packing rings.

20.8.3 Pumps shall be of the split-case, double-suction type.

20.8.4 Motors shall be designed to operate on 208-volt, 3-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.

20.8.5 Motor controllers. Motor starters except as specified otherwise shall conform to Specification 9Yh 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 HP and less shall be enclosed magnetic full-voltage across the line type. Motors larger than 30 HP 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.

20.8.6 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.

20.8.7 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.

20.8.8 Gasoline storage tank shall be constructed in accordance with NBFU Pamphlet No. 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.

20.8.9 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 properly supported in an approved manner.

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

20.8.11 Tests. Such field tests as required shall be made to assure that the equipment has been provided in conformity with the specifications.

20.8.12 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.

20.8.13 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.

20.8.14 Battery charger, electric type, shall be mounted on wall of pump house 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 six-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 corrison-resistant or shall be suitably protected against corrosion.

20.9 Brine pumps shall be in accordance with the applicable requirements of Specification No. MIL-P-17552B, 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.

20.9.1 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.

20.9.2 Motors shall be drip-proof, designed to operate on 120 volts, 60-cycle, single-phase current. Starters shall be magnetic full voltage across the line starter. Starter shall have hand-off-automatic switch and an alternator to alternate the starting sequence of the pumps.

20.10 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 limited to, the following: operating instructions, illustrations, drawings, detail description, installation instructions, adjustments, tests, parts list, etc.

20.11 Installation. Equipment provided 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. The contractor shall perform operational tests with the installed equipment as required to demonstrate a satisfactory facility.

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SECTION 21. PROCESS AND SERVICE WATER PIPING

21.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

FF-B-575	Bolts, Hexagon and Square
GG-G-76e	Gages, Pressure and Vacuum, Dial Indicating (For Air, Steam, Oil, Water, Amonia and Freon)
HH-G-76b	Gasket, Asbestos Metallic Cloth
QQ-L-156 (1)	Lead, Caulking
SS-P-351a	Pipe, Asbestos Cement
WW-H-171b	Hangers and Supports, Pipe
WW-P-421b(1)	Pipe, Cast-Iron, Bell and Spigot, Water
WW-P-441b(2)	Pipe Wrought Iron (Welded, Black or Zinc Coated)
WW-P-521d(1)	Pipe-Fittings, Malleable Iron, Wrought Iron and Steel (Screwed) 150 Pound
WW-T-799a(1)	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, Gate, Bronze, 125 and 150 Pound, Screwed and Flanged (For Land Use)

MILITARY

MIL-V-18436	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	A21-10 52
American Water Works Association	C100-55
	C500-61
	C504-58
	C601-54

21.2 Services covered

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

21.3 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.

21.4 Piping four inches and larger.

21.4.1 Treated water and plant and yard raw water piping shall be cast iron pipe, Class 150, outside coated, cement lined, conforming to Specification WW-P-421b, 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-421b 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.

21.4.2 Raw water piping, except for yard and plant piping shall be asbestos-cement pipe, Class 150, conforming to Specification SS-P-351a.

21.5 Piping three inches and smaller

21.5.1 All piping, except as specified otherwise, shall be zinc-coated wrought iron pipe conforming to Specification WW-P-441b. Gasoline piping shall be black.

21.5.2 Instrumentation tubing shall be Type K in accordance with Specification WW-T-799a.

21.6 Fittings and specials.

21.6.1 Fittings and specials for bell and spigot cast-iron pipe and asbestos-cement pipe shall be Class D, in accordance with AWWA Specification C100-55 with lead joints. At the option of the contractor, mechanical jointed fittings, as hereinafter specified, may be used with asbestos-cement pipe.

21.6.2 Fittings for mechanical jointed pipe and flanged jointed pipe shall be short-body fittings in accordance with American Standards Association Specification A21.10-52 and flange fittings provided with ASA Class 125 flanges.

21.6.3 Fittings for use with pipe three inches and smaller shall be zinc-coated malleable iron conforming to Specification WW-P-521d.

21.6.4 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-18969b.

21.7 Placing and laying

21.7.1 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.

21.7.2 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.

21.7.3 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.

21.8 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 No. WW-H-171b. 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 shall be securely blocked in the direction of flow. For pipe laid underground, this shall be accomplished with poured-in-place concrete bearing solidly against the pipe and affording a minimum of 3 square feet of bearing against undisturbed soil for 4-inch pipe and 8 square feet for larger pipe. This includes connections to existing mains and services indicated. 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.

21.9 Joints

21.9.1 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 molton 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 bells. The lead shall conform to Specification No. QQ-L-156.

21.9.2 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.

21.9.3 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.

21.9.4 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-76b, and shall be full-faced.

21.9.5 Screwed joints shall have the threads cut full and not more than 3 threads on the pipe shall remain exposed. Pipe lubricant shall be applied to the male threads only.

21.10 Valves

21.10.1 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 C500-61. 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 counter-clockwise rotation of the valve stem for non-rising stems; valves with rising stems shall open by a counter-clockwise rotation of the operating wheel.

21.10.2 Gate valves for use with pipe 3 inches and smaller shall be bronze wedge disc in accordance with Specification WW-V-54b, Type I, Class A.

21.10.3 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 No. MIL-V-18436, Type II, Style A.

21.10.4 Check valves for use with pipe 3 inches and smaller shall be bronze and shall conform to Specification No. WW-V-51a, Class A.

21.10.5 Rubber-seated butterfly valve shall conform to AWWA Standard C504-58, 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.

21.10.6 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.

21.10.7 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.

21.10.8 Mud valve shall be cast iron of type indicated with threaded stem, seat ring and gate ring of bronze. Valve shall be provided with coupling nut, extension stem, stem support and operating wheel, as indicated.

21.10.9 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.

21.10.10 Pressure gauges shall conform to Specification GG-G-76e, Class 2, Type A, 6 inch, brass case.

21.10.11 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 volts, 60-cycle, single-phase current, and shall be normally closed.

21.10.12 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 weather-proof cast aluminum enclosures. 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.

21.11 Rate of flow controller shall maintain the set rate within 3 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.

21.11.1 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.

21.11.2 Ends shall be flanged, faced and drilled in accordance with ASA Class 125 pound.

21.11.3 All ferrous surfaces shall have a protective coating of coal tar pitch varnish on inside and outside surfaces.

21.12 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.

21.13 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.

21.14 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 Board of Fire Underwriters. 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 wast 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 counter-clockwise. All working parts shall be bronze. Hose and pumper connection threads and operating nut shall be National Standard.

21.15 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 with the invert of the pumper connection 18 inches above grade. The connecting pipe will have the same depth of cover as the distributing mains. The hydrant shall be set upon a slab of stone or concrete not less than 4 inches thick and 15 inches square. The back of the hydrant, opposite the pipe connection, shall be firmly blocked against the vertical face of the trench with poured-in-place concrete to prevent the hydrant from blowing off the line. If the character of the soil is such that in the opinion of the officer in charge the hydrant cannot be securely blocked, bridle rods and rod collars shall be used. Bridle rods and rod collars shall be not less than 3/4-inch stock and shall be protected by a coat of bituminous paint. Not less than 7 cubic feet of broken stone shall be placed around the base of the hydrant to insure drainage. 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.

21.16 Connections to existing mains shall be made by means of tapping sleeves and valves. The valves shall meet the requirements of AWWA Standard C500-61, except that ends and seat rings may be oversized to permit use of full-size cutters. Joints in tapping sleeves shall be poured with lead and caulked.

21.17 Tests. Before being covered, the completed pressure piping shall be subjected to a hydrostatic pressure test of 200 pounds per square inch maintained for 2 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.

21.18 Sterilization

(a) 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 C601-54. 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.

(b) 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 22. INSTRUMENTATION AND CONTROLS

22.1 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:

22.1.1 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.

22.1.2 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.

22.1.3 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.

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

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

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

22.2 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.

22.2.1 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 121 feet which includes a suppression head of 98 feet and an operating range of 23 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.

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.

22.3.1 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, rain-proof case and all working parts shall be corrosion-resistant.

22.3.2 Receiver. The receiver shall be an indicating and recording meter register housed in a dust-tight, moisture-proof 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.

22.4 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.

22.4.1 Transmitter. The transmitter shall be a pedestal-mounted,

22.2.2 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 starter. 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 cut-off 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 cut-off 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.

22.3 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

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 10 feet. The transmitter shall indicate the depth at all times. The equipment shall be housed in a dust-tight, rain-proof case and all working parts shall be corrosion-resistant.

22.4.2 Receiver. The receiver shall be an indicating and recording meter housed in a dust-tight, moisture-proof 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.

22.4.3 Well pump controller. The well pump controller shall be provided to house switches for the three existing wells, a space for a future additional well and the areator blower. The unit shall be designed to permit manual selection of any combination of the three 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.

22.4.4 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.

22.5 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 two feet.

22.5.1 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 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. Immmediately 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.

22.5.2 Receiver. The receiver shall be an indicating, recording and totalizing meter register housed in a dust-tight, moisture-proof 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 nine 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.

22.6 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.

22.6.1 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 measure-

ment 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.

22.6.2 Receiver. The receiver shall be an indicating, recording and totalizing meter register housed in a dust-tight, moisture-proof 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 nine 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 and total amount pumped in thousands of U. S. gallons. The totalizer and chart elements shall be actuated by electric clock drives.

22.7 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.

22.8 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 limited to the follow-

ing: 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.

22.9 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. The contractor shall perform operational tests with the installed equipment as required to demonstrate a satisfactory facility.

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SECTION 23. INTERIOR ELECTRICAL

23.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

9Yh	July 1962	Electrical Apparatus, Distributing Systems and Wiring

FEDERAL

J-C-103b (2)	Cable, Power, Electrical (Rubber Insulated, Building Type) and Wire, Electrical (Rubber Insulated, Building Type)
W-F-414a	Fixture, Lighting (Fluorescent, Alternating Current, General Purpose)
W-P-115a	Panel, Power Distribution
WW-C-581d	Conduit, Electrical, Steel, Rigid, Zinc Coated

NON-GOVERNMENT

Underwriters Laboratories, Inc.

23.2 General requirements

23.2.1 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.

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

23.2.3 The work further includes removal of connections to existing well pump motors and starters, and provisions of new connections as required for complete and operating power circuits to the new pumping equipment.

23.2.4 Materials and methods of installation shall be in accordance with Specification 9Yh except as indicated or specified otherwise.

23.3 Electrical characteristics. Electrical service to the Water Treatment Plant shall be 120/208y volts, 3-phase, 4-wire, 60-cycle, grounded neutral.

23.4 Drawings diagramatic. The electrical drawings are primarily diagramatic 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.

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

23.6 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.

23.7 Wires and cables shall conform to applicable requirements of Specification J-C-103b.

23.7.1 All wire installed in conduit in dry locations shall be Type RH, except that service entrance shall be Type RHW.

23.7.2 All wire installed in conduit, installed wholly or in part in damp locations, outside, in or under floor slab or underground shall be Type RHW with neoprene jacket.

23.7.3 No conductor smaller than #12 AWG shall be used except for controls which shall be not less than #14 AWG.

23.8 Rigid steel conduit shall conform to Specification WW-C-581d and shall be zinc-coated on both inner and outer surfaces. Rigid steel conduit installed underground shall be encased in concrete; the concrete encasement on risers shall extend a minimum of six inches above the finished grade. All conduit shall be cut with 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 for connections to motors shall be the flexible type.

23.9 Outlet boxes. Outlet boxes wherever used to terminate conduit at equipment or lighting fixture location shall be hot-dipped zinc-coated boxes, sized to suit equipment, with a cover in each case suitable for the respective purpose. Pendent fixture boxes shall have aligning covers. All surface-mounted outlet boxes shall have threaded hubs.

23.10 Pull and junction boxes shall be zinc-coated, 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. For exposed work, junction boxes and conduit fittings shall be cast or malleable iron with threaded hubs.

23.11 Local wall switches. Wall switches shall be single-pole, toggle-type, "T"-rated, 20-ampere, 125-volt, in composition base. Covers shall have chrome finish.

23.12 Convenience receptacles. Convenience receptacle outlets shall be as indicated. Duplex receptacles shall be 15-ampere, 125 volts, grounding-type, parallel-slot, double-sided contacts with four terminal screws in composition base. Covers shall have chrome finish.

23.13 Panelboards shall be complete with cabinets and shall conform to the Underwriters Laboratories, Inc. Standard for Panelboards. Cabinets shall conform to the Underwriters Laboratories, Inc. Standard for Cabinets and Boxes. Cabinets shall be made from steel sheets zinc-coated by the hot-dip process. Fronts shall be finished to resist corrosion with not less than one priming coat and one pearl-gray finishing coat. Exposed parts of trim and doors shall be finished after erection as directed. Three keys shall be furnished, each of which shall operate all panelboard cabinet locks included in the project. Adjacent poles of single-pole devices shall be of opposite polarity with split-phase bussing. Circuits shall be numbered serially from top to bottom with odd numbers on the left. A suitable directory with a transparent protective cover shall be provided on the inside of the panelboard cover.

23.13.1 Main and power panelboards shall be of the automatic circuit-breaker type and shall conform to Specification W-P-115a.

23.13.2 Lighting panelboard shall be the switch-and-fuse type, as indicated, and shall conform to Specification W-P-115a. An extra set of fuses shall be furnished for the panelboard.

23.14 Backboards at service entrances and distribution locations. Wall-mounted switches and panels shall be mounted on a backboard consisting of channel iron uprights secured to the building structure and surfaced with 3/4-inch Grade A-D exterior-type Douglas fir plywood. Previous to mounting equipment, the backboard shall be given two coats of asphaltum varnish.

23.15 Incandescent fixtures shall be of the highest quality of the types shown. Where the schedule refers to Specification 9Yh, 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.

23.16 Fluorescent lighting fixtures shall be of the highest quality of the types scheduled and shall conform to Specification W-F-414a, 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.

23.17 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.

23.18 Motors and motor controllers, unless otherwise specified, shall be provided in conjunction with driven equipment as specified in the Mechanical Equipment section of this specification, but shall be wired, together with all controls under this section. The electrical drawings show 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 at no expense to the Government. Motors rated 1/2 horsepower and greater, unless otherwise specified, shall be rated for 240 volts, 3-phase. Motors of less than 1/2 horsepower shall be single phase 120 volts.

23.19 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.

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

23.20.1 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.

23.20.2 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.

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

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

23.21.2 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.

23.21.3 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 24. EXTERIOR ELECTRICAL

24.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

9Yh July 1962 Electric Apparatus, Distributing Systems, and Wiring

NON-GOVERNMENT

American Institute Electrical Engineers

American Standards Association

Poles
C29.2-1962
C29.3-1961
C29.5-1961

American Wood Preservers' Association - Manual of Recommended Practices

National Electrical Manufacturers' Association

Southern Pine Inspection Bureau - Grading Rules

24.2 General requirements. The work includes the provision of a new feeder, transformer station, and service drop to the building. The work further includes the provision of underground control cabling between water treatment plant and raw water wells, elevated water tank and reservoir. Materials and workmanship shall be in accordance with Specification 9Yh, except as indicated or specified otherwise.

24.3 Electric service.

24.3.1 Primary electric service shall be 12470 volts, three-phase, three-wire, 60-cycle.

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

24.4 Conductors.

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

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

24.4.3 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.

24.5 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 AIEE.

24.6 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.

24.7 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.

24.8 Poles shall be American Standard Association, class as indicated, yellow pine, creosoted to twelve pounds retention by the empty cell process according to specifications of the American Wood Preservers' Association.

24.9 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, Manual of Recommended Practice. Treatment shall be by the pressure process and to a minimum retention of 12 pounds per cubic foot of wood.

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

24.11 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.

24.12 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.

24.13 Pole line hardware and accessories shall be hot-dipped, zinc-coated.

24.14 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, eight feet in length, bolted to guy.

24.15 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 eight-foot rods having thimbleye.

24.16 Insulators.

24.16.1 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 flashover value of the insulators shall be not less than 65 KV dry and 35 KV wet, conforming to ASA C29.2-1962.

24.16.2 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 C29.3-1961.

24.16.3 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 C29.5-1961, with a top groove of not less than one-inch diameter.

24.16.4 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

24.17 Meter. Watt-hour demand meter shall be 3-stator, 3-phase, 60-cycle, 4-wire wye, socket-type for use with instrument transformers. The socket used shall have circuit-closing devices. Current transformers shall be outdoor-type of size indicated.

24.18 Grounding.

24.18.1 Ground rods. Each grounding electrode shall consist of three copper-encased, steel-sectional rods, not less than 5/8-inch O.D. and ten feet in length, driven to a depth of 31 feet. Sectional rods shall be provided with driving couplings.

24.18.2 Ground resistance. A grounding system shall be provided at the transformer location. Any one grounding system's resistance, previous

to connection to the facility to be grounded, shall not exceed ten ohms. Sequence of driving electrodes and sequence of testing electrodes to provide the specified ground resistance shall be as indicated. Bids shall be based on providing two electrodes, located and connected as indicated. Should a greater or lesser number of electrodes be required to obtain the specified ground resistance, the provisions of Clause 4 of Form 23A, respecting an adjustment for changed condition shall apply, subject to requirement of notification thereunder being given.

24.18.3 Pole butt grounding. All new poles shall be provided with a standard pole butt ground consisting of No. 6 copper wire secured to the pole in an approved manner and protected by wood moulding to a height of not less than eight feet above ground. The pole butt ground shall be connected to the neutral wire being carried on any new pole.

24.18.4 Ground wires shall be No. 4 AWG bare solid copper and shall be attached to ground rods by means of heavy duty solderless bronze clamps and protected for a height of eight feet above grade with wood moulding.

24.19 Non-interruption of service. By careful planning of the work, the contractor shall minimize interruptions to the normal operation of the existing distribution system. If an outage becomes unavoidable, notification shall be made to the Officer in Charge 72 hours previous to the proposed outage.

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SECTION 25. WELL PUMPING EQUIPMENT

25.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

WW-P-441b (2) Pipe Wrought Iron (Welded, Black or Zinc-Coated)

NON-GOVERNMENT

National Electrical Manufacturer's Association

25.2 General requirements. The work includes the removal of three existing well pumps, motors and starters, and the provision of three new well pumps, complete with motors and starting equipment. The work further includes the removal of auxiliary gasoline engine in Well House No. 227, and the provision of a new auxiliary gasoline engine. Equipment specified to be reused shall be adapted, reset, or realigned to fit the new equipment, and complete and operating installations provided.

25.3 Existing conditions.

25.3.1 Well House No. 45. The well pumping equipment includes a deep well turbine pump with depth of setting of 90 feet, right angle gear drive, 15 H.P. vertical hollow shaft motor with starting equipment, and an auxiliary gasoline engine. The pump,motor and starting equipment shall be renewed as specified. The right angle gear drive and gasoline engine shall be reused.

25.3.2 Well House No. 47. The well pumping equipment includes a deep well turbine pump with depth of setting of 65 feet and a 20 H.P. vertical hollow shaft motor with starting equipment. Pump, motor and starting equipment shall be renewed as specified.

25.3.3 Well House No. 227. The well pumping equipment includes a deep well turbine pump with depth of setting of 50 feet, right angle gear drive, a 10 H.P. vertical hollow shaft motor with starting equipment, and an auxiliary gasoline engine. The pump, motor and starting equipment, and gasoline engine shall be renewed as specified. The right angle gear drive shall be reused.

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

25.4.1 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 (Bottom of Bowls)
45	150 gpm	100 ft	80 ft
47	250 gpm	95 ft	65 ft
227	170 gpm	100 ft	50 ft

25.4.2 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.

25.4.3 Pump column. The column shall be genuine wrought iron conforming to Specification WW-P-441b, 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.

25.4.4 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.

25.4.5 Bearings. The pumping unit shall have sufficient guide bearing 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.

25.4.6 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 shut-off 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.

25.4.7 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.

25.4.8 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 5 times the area of the suction pipe shall be provided at the lower end of the suction pipe.

25.5 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. The speed of the motor shall not exceed 1800 rpm. The motor shall conform to NEMA standards.

25.6 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.

25.7 Auxiliary gasoline engine shall be a complete self-contained, multi-cylinder, air 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, exhaust pipe and muffler, and clutch take-off assembly.

25.7.1 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.

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

25.7.3 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.

SECTION 26. SANITARY SEWER

26.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, for a part of this specification to the extent indicated by the references thereto:

FEDERAL

SS-S-169 Sealer, Joint, Sewer, Mineral-filled, Hot-pour

NON-GOVERNMENT

American Society for Testing Material

C13-57T

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

26.3 Material.

26.3.1 Sewer piping shall be vitrified clay pipe conforming to the requirements of ASTM Designation C13-57T for standard strength clay sewer pipe.

26.3.2 Jointing material shall be hot-pour joint sealer conforming to Type I, Class 1 of Specification SS-S-169.

26.4 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.

26.5 Jointing. 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.

SECTION 27. DRAINAGE

27.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

13Yg	April 1963	Concrete Construction
42Yb	Jan 1961	Drainage, Sanitary, Electrical and Water Service Appurtenances

NON-GOVERNMENT

American Society for Testing Materials
C76-61T

27.2 General requirements. The work includes the provision of storm drainage piping and exterior drain lines from reservoir and building, complete with all appurtenances as indicated or specified.

27.3 Reinforced concrete pipe including pipe of flared end sections shall be in accordance with ASTM Designation C76-61T for Table II.

27.4 Cast-iron drainage pipe shall be extra heavy cast-iron soil pipe. Materials and installation shall be as specified in the PLUMBING SECTION of this specification.

27.5 One-third round concrete pipe will be furnished by the Government as specified in the General Paragraphs under Government Work and Materials.

27.6 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.

27.7 Jointing pipe

27.7.1 Bell and spigot pipe. Joints in bell and spigot concrete pipe shall be made with a mixture of one part portland cement and two parts sand. Just before inserting the spigot, sufficient mortar shall

be placed on the lower inner surface of the receiving bell to insure that the inner surfaces of abutting sections will be flush and even. The joints shall be entirely filled and packed with the mortar and sufficient additional mortar shall be used to form a bead around the joint.

27.7.2 Tongue-and groove concrete pipe. Joints in tongue-and-groove concrete pipe shall be made with cement mortar. The lower half of the groove of the previously laid section of pipe and the upper half of the tongue of the next section to be laid shall be plastered with freshly mixed mortar of proper consistency and in such quantity that when the pipe is shoved into place the mortar will completely fill the joint. The joint inside the pipe shall be smooth and the outside portion shall be mounted with cement mortar. The mortar shall be held in place by suitable means until it has set.

27.7.3 One-third round concrete pipe joints shall be bedded in mortar and the joints wiped clean to provide a smooth joint.

27.8 Drainage appurtenances including manholes and catch basins shall conform to the applicable requirements of Specification 42Yb. Concrete shall be Class D-1 in accordance with Specification 13Yg. Walls shall be common brick as specified in BRICK AND CONCRETE MASONRY section.

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SECTION 28. FIELD PAINTING

28.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

FEDERAL

TT-T-291a (1)	Thinner, Paint, Volatile Mineral Spirits
TT-T-801a	Turpentine, Gum Spirits, Steam Distilled, Sulfate Wood, and Destructively Distilled
TT-P-25a (1)	Primer, Paint Exterior (Undercoat for Wood, Ready Mixed, White and Tints)
TT-P-102a	Paint, Oil, Titanium-Lead-Zinc and Oil, Exterior Ready-Mixed, White and Light Tints
TT-E-543	Enamel-Undercoat, Interior, Tints and White
TT-E-508 (4)	Enamel, Interior, Semigloss, Tints and White
TT-P-95 (1)	Paint, Rubber-Base (For Swimming Pools)
TT-P-51e	Paint, Oil, Interior, Flat, White and Tints
TT-E-489c (3)	Enamel, Alkyd, Gloss (For Exterior and Interior Surfaces)
TT-E-506c	Enamel, Tints and White, Gloss, Interior
TT-P-86c	Paint, Red-Lead Base, Ready Mixed
TT-L-190a	Linseed Oil, Boiled (For Use in Organic Coatings)

MILITARY

MIL-P-15328b	Primer, Pretreatment (Formula No. 117 for Metals)

GOVERNMENT

Government Safety Code

28.2 General requirements. Surfaces to be painted shall be thoroughly clean and 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. 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.

28.3 Materials. Type of paint required in excess of five gallons shall be provided in accordance with the referenced specifications, otherwise, approved comparable quality commercial brands of paint may be used in lieu of the specification paints, utilizing the painting systems as specified herein. Paint and paint materials shall be delivered in unbroken original packages bearing the manufacturer's name and brand designations. Thinners shall be of the type required by the individual paint specifications; however, if none are specified, organic coating shall be thinned with mineral spirits conforming to Specification TT-T-291a, or turpentine conforming to Specification TT-T-801a.

28.4 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.

28.4.1 Wood surfaces shall be free from dust and in approved condition to receive the paint. 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. Puttying of cracks and nail holes 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. Wood doors shall be given the priming coat immediately following delivery to the job site.

28.4.2 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 2 to 8 ounces of trisodium phosphate per gallon of hot water and then rinsing thoroughly with fresh water. Efflorescence shall be removed from masonry surfaces by scraping, wire brushing, and washing with a 5 to 10 percent, 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.

28.4.3 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-15328B, applied to a dry film thickness of 0.3 to 0.5 mil. Primer paint shall be applied over the pretreatment coating as soon as practicable after the coating has dried.

28.5 Workmanship shall be first class in every respect. Paint, enamel, and varnish finish shall be applied carefully with good clean brushes. 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 required to produce finishes free of visible defects when viewed from a distance of five 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.

28.6 Scope of work

28.6.1 Wood surfaces

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

(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 semi-gloss enamel conforming to Specification TT-E-508.

28.6.2 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 (five feet high) shall be given one finish coat of flat oil paint conforming to Specification TT-P-51e. Dado shall be given two finish coats of semi-gloss enamel conforming to Specification TT-E-508.

28.6.3 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 red-lead paint or zinc-chromate primer for ferrous metals and zinc-chromate for zinc-coated surfaces 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 finished coats of synthetic enamel conforming to Specification TT-E-489c.

(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-190a.

(d) Metal surfaces, interior, except varnished surfaces shall be given two finish coats of semi-gloss enamel conforming to Specification TT-E-506c, 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-506c.

(f) Surface of metal work exposed in reservoir shall be given two coats of red lead paint conforming to Specification TT-P-86c, 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.

28.6.4 Clean-up. Paint shall be removed immediately where spilled or splattered 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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SECTION 29. FENCING

29.1 Applicable publications. The following publications of the issues listed below, but referred to hereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

BUREAU OF YARDS AND DOCKS

13Yg April 1963 Concrete Construction

FEDERAL

RR-F-183 (1)	Fence-Post, Gates, and Accessories
RR-F-191a	Fencing, Chain-Link, Fabric
RR-F-221b (1)	Fencing (Barbed Wire, Woven Wire, and Wire Netting)

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

29.3 Materials. Fence posts, gates and accessories shall conform to Specification No. RR-F-183. The fabric conforming to Specification No. RR-F-191a. The barb wire conforming to Specification No. RR-F-221b.

29.4 Fence posts, gates and accessories. Line posts, corner and gate posts shall be set in concrete footings. Footings for line post shall be 36" deep by 11" diameter and post set to bottom of concrete. Corner and gate post footing shall be 48" deep and 16" diameter and post set 42" in the concrete. Concrete footings shall be Class D-1 in accordance with Specification No. 13Yg. The footings shall extend about two 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° towards the outside and carrying three barbed wires.

29.5 Fabric shall be Type A, 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.

29.6 Barb wire shall be Type A, 4-point. Strand to be 12 ga., barb to be 14 ga., 3 wires shall be constructed on top of fabric. The uppermost barb wire shall be approximately 12 inches horizontally from the fabric line.

29.7 Installation. Fencing shall be installed in a workman-like 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.

SECTION 30. BIDS

30.1 Instructions to Bidders, Standard Form No. 22, January 1961 and Invitation for Bids, Standard Form No. 20, January 1961, shall be observed in the preparation of bids. Standard Form No. 22 is modified to change the word "may" in the second line of Article 4 to read "shall". Bidders shall affix their names and return addresses in the upper left corner of bid envelopes. Envelopes containing bids must be sealed.

30.2 Bid guarantee will be required as stipulated on the reverse side of Standard Form No. 20.

30.3 Items of Bids. Bids shall be submitted, in duplicate, on Standard Form No. 21, January 1961, Bid Form and in accordance with Standard Forms Nos. 20 and 22, upon the following item:

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

30.4 Telegraphic modifications of bids in accordance with Standard Form No. 22 may be made. Two signed copies of the telegram in a sealed envelope marked "Copies of telegraphic modification of bid for Water Treatment and Storage Facilities, Weapons Training Facilities, Specifications No. 54077/63," should be forwarded immediately to the office to which the written bids were submitted.

30.5 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 standard specifications mentioned, and other information necessary may be obtained from the Atlantic Division, Bureau of Yards and Docks, U. S. Naval Station, Norfolk 11, Va. The remainder of the standard specifications and other material referred to may be examined at that office or the Public Works Office, Marine Corps Base, Camp Lejeune, N. C., or the standard Government specifications may be obtained from the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania; requests for copies of specifications should indicate the contract for which required.

Atlantic Division, Bureau of Yards and Docks
U. S. Naval Station, Norfolk 11, Virginia
10 July 1963

W. C. G. CHURCH, RADM, CEC, USN
Officer in Charge of Construction

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