CONNECTICUT RIVER FLOOD CONTROL PROJECT

CHICOPEE, MASS.

CONNECTICUT RIVER, MASSACHUSETTS

SPECIFICATIONS

FOR

JONES FERRY PUMPING STATION

EQUIPMENT

ITEM C.5c - CONTRACT

1940

CORPS OF ENGINEERS, U.S. ARMY

U.S. ENGINEER OFFICE PROVIDENCE, R.I.

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR FURNISHING EQUIPMENT FOR JONES FERRY PUMPING STATION

CHICOPEE, MASSACHUSETTS

MARCH 20, 1940
(Issued May 7, 1940)

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R. I.

No. _____ Bidder _____ Invitation No. 699-40-332
(Do not write above this line)

STANDARD GOVERNMENT FORM OF INVITATION FOR BIDS
(Supply Contract)

War Department,
U. S. Engineer Office,
Providence, R. I.
May 7, 1940

SEALED BIDS, in duplicate, subject to the conditions named herein, will be received until 3 P.M. Eastern Daylight Saving Time, June 6, 1940, and then publicly opened, for furnishing pumping station equipment as called for in the accompanying schedule.

1. Drawings. - The drawings which will become a part of this contract are designated in Paragraphs 1-02 and 1-03 of the specifications. Where copies of drawings are requested, a deposit of $10.00 will be required to insure their return. This deposit should be in the form of a United States money order or certified check, made payable to "The Disbursing Officer, U. S. Engineer Office, Providence, Rhode Island." The $10.00 deposit for each complete set of drawings will be refunded upon return of said drawings in good condition within 60 days after date of opening bids.

2. Information required of bidder. - Each bidder shall submit with his bid and as a part of his proposal two sets of specifications of the equipment he proposes to furnish, including pump, engine and motor characteristic curves, detailed description, general drawings, and photographs or illustrations showing the general construction and principal dimensions of the equipment. The bidder shall also submit with his bid all the information asked for in the accompanying Data Sheets. Statements so made by the bidder are intended to be, and are, express warranties, and as such will form a part of any contract that may be entered into pursuant to said proposal. Failure on the part of a bidder to furnish all of such required information will render his bid informal and may cause its rejection.

3. Guarantee will be required with each bid as follows: Bid bond, Standard Form No. 24, will be executed in a penal sum approximately equal to and not less than 20 percent of the total amount of the bid. Individual sureties will justify in sums aggregating not less than double the penalty of the bid bond. (See Paragraphs 8 to 11, Instructions to Bidders.)

4. Performance bond will be required as follows: A performance bond with good and sufficient surety or sureties, for the protection of the United States, Standard Form No. 25, will be executed in a penal sum approximately equal to and not less than fifty percent (50%) of the full amount of the consideration of the contract.

5. Liquidated damages for delay will be prescribed. (See Paragraph 1-06 of the specifications, and Paragraph 5 of "Directions for Preparation of Contract" appearing on page 6 of U. S. Standard Form No. 32 (Revised)).

6. Partial payments will be made. (See Paragraph 1-07 of the specifications).

7. Articles on patents will be made a part of the contract. (See Paragraph 1-20 of the specifications.)

8. Preference for domestic articles will be made a part of the contract. (See bid form and Article 13 of the contract.)

9. Adjustment of contract prices by reason of changes in Federal, State, or local taxes will be made (see Paragraph 1-21).

10. Bids must be submitted upon the standard Government form of bid and the successful bidder will be required to execute the standard Government form of contract for supplies, U. S. Standard Form No. 32 (Revised).

11. Experience. - After the bids are opened, any bidder may be required by the contracting officer to state whether he is now or ever has been engaged on any contract or other work similar to that proposed, the year in which it was done, and the manner of its execution, and to give such other information as will tend to show his ability to prosecute vigorously the work required by these specifications. The bid of any bidder who does not comply promptly with such a request may be rejected.

12. Bid and contract. - a. The bid form has an entry for each item on which quotation will be given or payment made, and no other allowances of any kind will be made unless specifically provided for in the specifications or the contract, or adjustments under Article 3 of the contract.

b. The quantity of material delivered in the unit given and the unit price stated by the bidder in the accepted bid will determine the total payment to accrue under the contract. The unit price bid must allow for all collateral or indirect cost connected with it.

13. Award of contract. - a. Subject to the rights herein reserved, the work will be awarded as a whole to one bidder, or Items 1 and 2 will be awarded to separate bidders as may be deemed to be to the best interests of the Government. The work will be awarded to the lowest responsible bidder or bidders, proposing to furnish equipment conforming to the requirements of the specifications. Item 1 will include 42-inch pumps, gasoline engines and right angle gear units, and Item 2 will include the 16-inch pump and motor as described in Paragraph 1-01 b of the specifications.

b. Bidders may bid on the work as a whole or for either Item 1 or Item 2. Bidders shall fill in each space in the item on which they are bidding.

c. A bid may be rejected if the bidder fails to submit the information required with his bid or cannot show that he owns, controls by firm option, or can procure the necessary equipment or materials to make delivery at the time prescribed herein.

d. The right is reserved, as the interest of the Government may require, to reject any and all bids, and to waive any informality in bids received.

14. Walsh-Healey Act. - If the amount of the contract entered into pursuant to this advertisement exceeds $10,000.00, the provisions of the Act of June 30, 1936, Public No. 846- 74th Congress, and the regulations adopted by the Secretary of Labor pursuant thereto will apply. If the contract does not exceed $10,000.00, the provisions of the Act will not apply and Paragraph 15 of the Invitation, and Paragraphs 1-22, 1-23, 1-24, 1-25, and 1-26 of the specifications will be inoperative.

15. Manufacturer or regular dealer. - A bidder or contractor shall be deemed to be a "manufacturer" or "regular dealer" within the meaning of Section 1 (a) of the Walsh-Healey Act, if he falls within one of the following categories:

a. A manufacturer is a person who owns, operates, or maintains a factory or establishment that produces on the premises the materials, supplies, articles, or equipment required under the contract and of the general character described by the specifications.

b. A regular dealer is a person who owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles, or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and sold to the public in the usual course of business.

Except as exempted by the Secretary of Labor, every bid received from any bidder who does not fall within one of the foregoing categories shall be rejected.

16. Submission of bids. - Envelopes containing bids must be sealed, marked, and addressed as follows:

Bids for Jones Ferry Pumping Station Equipment. To be opened at 3 P.M. June 6, 1940. Invitation No. 699-40-332	To: The District Engineer, U. S. Engineer Office, 819 Industrial Trust Bldg., Providence, Rhode Island.

NOTE: - See Standard Government Instructions to bidders and copy of the Standard Government form of contract, bid bond, and performance bond, which may be obtained upon application.

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Invitation No. 699-40-332

WAR DEPARTMENT

APPROPRIATION: 21X3113 Flood Control, General

SPECIFICATIONS: For furnishing equipment for Jones Ferry Pumping Station, Chicopee, Massachusetts.

SPECIFICATIONS

SECTION I. GENERAL PROVISIONS

1-01. Work to be done. - a. The work provided for herein is authorized by the Flood Control Act approved June 28, 1938 (Public No. 761, 75th Congress).

b. The work to be done consists of designing, constructing, and furnishing in accordance with these specifications and the drawings mentioned in Paragraphs 1-02 and 1-03 hereof, the following equipment:

(1) Three 42-inch vertical, single-stage, propeller-type pumps complete with discharge piping, couplings, and swing check valves.

(2) Three 4-cycle, heavy-duty, stationary-type, internal combustion engines complete with silencers and exhaust piping, for driving the 42-inch pumps.

(3) Three right-angle gear units for connecting the pumps and gasoline engines.

(4) One 16-inch vertical, mixed-flow, volute-type pump complete with electric motor, inlet and discharge piping, gate valves, and check valves.

c. The equipment will be unloaded from the carrier, at Chicopee, Massachusetts, transported to the site, and installed by other agencies. Anchor bolts and other metal items to be embedded in concrete together with the necessary templates shall be shipped in advance of the delivery of equipment on the work, as directed by the contracting officer.

d. It is the intent of these specifications to secure for the Government the pumping units, gasoline engines, right-angle gear drives, piping, and valves complete in all respects and ready for installation, and the above condition shall be complied with whether all parts of the assemblies are specifically mentioned or not.

1-02. Drawings furnished by the Government. - The work shall conform to the drawings marked "Connecticut River Flood Control, Jones Ferry

Pumping Station Equipment, Connecticut River, Mass.," as indicated below, which form a part of these specifications and are filed in the United States Engineer Office, Providence, Rhode Island. These drawings show the general arrangement of the apparatus, and certain required and limiting dimensions, but are not to be taken as defining the detailed design of the equipment.

LIST OF DRAWINGS

Sheet No.	Title	File No.
1	Equipment-Project Location and Index	CT-4-2228
2	General Arrangement No. 1	CT-4-2229
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8	Gasoline Piping No. 1	CT-4-2235
9	Gasoline Piping No. 2	CT-4-2236
10	Engine Exhaust Piping	CT-4-2237

Ten sets of prints of the drawings prepared by the Government will be furnished the contractor upon request without charge. Additional prints will be furnished upon request, at the cost of printing.

1-03. Drawings required of contractor. - a. Detail. - Within 10 calendar days after receipt of notice to proceed, the contractor shall submit to the contracting officer for approval, assembly and detail drawings in duplicate to demonstrate fully that the equipment to be furnished under the contract will conform to the provisions and intent of these specifications. In the event that the contracting officer shall find that the drawings as submitted by the contractor are in accord with acceptable practice and meet the requirements of the specifications, the contracting officer will return one set of said drawings with his approval within 7 days after their receipt at the United States Engineer Office, in Providence, Rhode Island; otherwise said drawings will be returned to the contractor within the said 7-day period with a statement of the points wherein they have been found unsatisfactory, in which latter case the contractor shall proceed at once to revise said drawings until they have been found satisfactory by the contracting officer and are approved by him. After approval, the contractor shall furnish the contracting officer six prints of each approved drawing. Each print submitted for approval shall have, in the lower right-hand corner just above the title, a white space 3 inches by 4 inches in which the contracting officer can indicate the action taken. All of these drawings form a part of the contract, but approval of drawings by the contracting officer shall not relieve the contractor of full responsibility for the correct fitting of parts and satisfactory assembly.

b. Erection drawings. - Before delivery of the equipment, the contractor shall furnish the contracting officer six prints of erection drawings indicating the relationship of all match marks painted or stamped on the several parts.

1-04. Contractor's guaranty. - The contractor guarantees the equipment furnished by him against defects of design, material, and workmanship for a period of one year after the date of acceptance and any parts proving defective within that time shall be promptly replaced by him without cost to the Government.

1-05. Time of delivery. - Parts to be embedded in concrete shall be delivered at Chicopee, Massachusetts, within 90 calendar days, and the remainder of the equipment within 150 calendar days, time being computed from the date of receipt by the contractor of notice to proceed.

1-06. Liquidated damages for delay. - If the contractor fails or refuses to complete the delivery of all the equipment included in the contract within the time stated in Paragraph 1-05, plus any extensions duly granted under the terms of the contract, the contractor shall pay to the Government as liquidated damages the sum of twenty-five ($25.00) dollars per calendar day of delay.

1-07. Payment. - a. Eighty (80) percent of the contract price will be paid upon delivery of the equipment at Chicopee, Massachusetts, and receipt of all required drawings and properly executed invoices.

b. When the terms of the contract have been fully complied with, and all the equipment has been installed, tested, and accepted by the contracting officer, final payment will be made of the balance due under the contract.

1-08. Packing and shipment. - All parts likely to be lost or damaged in shipment shall be adequately boxed, or crated, and each box or crate shall be marked to show the parts contained therein. All exposed finished surfaces on large parts shall have wooden pads bolted on, or shall be otherwise properly protected. The contractor shall provide all lumber, bolts, etc., necessary for proper protection.

1-09. Marking. - All parts of the equipment shall be marked and match-marked for identification and to facilitate field assembly.

1-10. Weighing. - The contractor shall weigh all completed parts and accessories on accurate scales, and the complete list of all such net weights, exclusive of boxes, crates, or skids, shall be furnished the contracting officer. The net weight of each of the larger pieces shall also be painted on the piece or stated on a tag securely attached thereto.

1-11. Manufacturer's name plate. - The contractor shall attach a small brass name plate on the principal parts of each unit, giving the manufacturer's name and address, and the principal rating data of the equipment.

1-12. Work covered by contract price. - The contractor shall, under the contract unit price, prepare all necessary shop drawings; furnish all material and labor needed to complete the work specified herein and as required by the contracting officer to carry out the contract in good faith, which contemplates all equipment delivered complete, including accessories, in good working order, of good material, and with accurate workmanship, skillfully fitted and properly connected.

1-13. Inspection. - The work will be inspected in accordance with Article 4 of the contract by inspectors appointed by the contracting officer. The inspectors will make a rigid inspection of all materials and work done and any material or workmanship found to be defective or not in accordance with the plans and specifications will be rejected and shall be replaced by satisfactory material or workmanship without charge to the Government. The presence of the inspector will not relieve the contractor or his responsible agent of any responsibility for the proper execution of the work. The acceptance of any material or finished member by an inspector shall not prevent subsequent rejection if such material or member is later found to be defective.

1-14. Standard test and quality. - a. All materials, supplies, and parts and assemblies thereof, entering into the equipment to be furnished under these specifications, shall be tested, as specified or otherwise required, in conformity with the best modern approved methods for the particular type and class of work.

b. Unless waived in writing by the contracting officer, all tests and trials shall be made in the presence of an appointed inspector. When the presence of the inspector is so waived sworn statements, in duplicate, of the tests made and the results thereof, shall be furnished to the contracting officer by the contractor.

c. The costs of all shop tests and trials shall be borne by the contractor and shall be included in the contract unit price.

d. All materials, parts, and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture, and unused. Workmanship shall be of the highest grade and in accordance with the best modern standard practice.

1-15. Standard stock articles. - All materials, supplies, and articles furnished shall, wherever so specified, and otherwise wherever practicable, be the standard stock products of recognized reputable manufacturers. The standard stock products of manufacturers other than those specified herein will be accepted when it is proved to the satisfaction of the contracting officer that they are equal in strength, durability, usefulness, and convenience for the purpose intended.

1-16. Protection of stored materials. - All materials, supplies, and articles stored at the contractor's plant shall be adequately housed by the contractor or otherwise protected by him against deterioration and damage.

1-17. Service of erecting engineer. - a. The installation of the equipment is not included in this contract, but will be done by other agencies. However, the contractor shall furnish promptly upon written notice by the contracting officer, the services of a competent erecting engineer to supervise and direct the erection and installation of this equipment. The services of the erecting engineer will be paid for by the Government at an allowance of twenty-five dollars ($25.00) per calendar day from the time of departure from, to the time of return to, his home station; such allowance to cover salary, travel, and living expenses of the erecting engineer and any other costs occasioned by the furnishing of the service. No payment will be made for services of the erecting engineer in connection with alterations to any of the equipment occasioned by failure of such equipment to comply with the requirements of the specifications.

b. The erection and installation of the equipment by other agencies under the direction and supervision of the contractor's erecting engineer shall in no way relieve the contractor of sole responsibility for the equipment meeting all the requirements of these specifications and fulfilling all the contractor's guaranties.

1-18. Protests and appeals. - If the contractor considers any work demanded of him to be outside the requirements of the contract or if he considers any action or ruling of the contracting officer or of the inspectors to be unfair, the contractor shall without undue delay, upon such demand, action, or ruling, submit his protest thereto in writing to the contracting officer, stating clearly and in detail the basis of his objections. The contracting officer shall thereupon promptly investigate the complaint and furnish the contractor his decision, in writing, thereon. If the contractor is not satisfied with the decision of the contracting officer, he may, within thirty days, appeal in writing to the Chief of Engineers, whose decision shall be final and binding upon the parties to the contract. Except for such protests or objections as are made of record in the manner herein specified and within the time limit stated, the records, rulings, instructions or decisions of the contracting officer shall be final and conclusive. The Chief of Engineers has been designated by the Secretary of War as his duly authorized representative to make final decision and to take other action where the terms of the contract require that such decision or action shall be "by the Head of the Department concerned or his duly authorized representative." All appeals from decisions of the contracting officer authorized under the contract shall, therefore, be addressed to the Chief of Engineers, U. S. Army, Washington, D. C. The appeal shall contain all the facts or circumstances upon which the contractor bases his claim for relief and shall be presented to the contracting officer for transmittal within the time provided therefor in the contract.

1-19. Minor modifications. - The right is reserved to make such minor changes in the execution of the work to be done under these specifications as, in the judgment of the contracting officer, may be necessary

or expedient to carry out the intent of the contract, provided that the unit cost to the contractor of doing the work shall not be increased thereby; and no increase in unit price over the contract rate will be paid to the contractor on account of such changes.

1-20. Patents. - The contractor shall hold and save the Government, its officers, agents, servants, and employees, harmless from liability of any nature or kind, including costs and expenses, for or on account of any patented or unpatented invention, articles, or appliance manufactured or used in the performance of this contract, including their use by the Government.

1-21. Federal, State, County, and Municipal taxes. - a. Contract prices herein include any Federal tax heretofore imposed by the Congress which is applicable to the material on this contract. If any sales tax, processing tax, adjustment charge, or other taxes or charges are imposed or changed by the Congress after the date set for the opening of this bid and made applicable directly upon the production, manufacture, or sale of the supplies covered by this contract and are paid to the Government by the contractor on the articles or supplies herein contracted for, then the prices named in this contract will be increased or decreased accordingly, and any amount due the contractor as a result of such change will be charged to the Government and entered on vouchers (or invoices) as separate items.

b. The contract prices do not include any Federal taxes from which exemption is granted or as to which a credit or refund is provided for under the provisions of Section 401 of the Revenue Act of 1935 (Act of August 30, 1935; 49 Stat. 1014; 1025-1026), as amended, nor any tax imposed by a State, County, or Municipality upon the transaction of this procurement of these materials.

1-22. Representations and stipulations pursuant to Public Act No. 846 - 74th Congress. - a. The contractor is the manufacturer of or a regular dealer in the materials, supplies, articles, or equipment to be manufactured or used in the performance of the contract.

b. All persons employed by the contractor in the manufacture or furnishing of the materials, supplies, articles, or equipment used in the performance of the contract will be paid, without subsequent deduction or rebate on any account, not less than the minimum wages as determined by the Secretary of Labor to be the prevailing minimum wages for persons employed on similar work or in the particular or similar industries or groups of industries currently operating in the locality in which the materials, supplies, articles, or equipment are to be manufactured or furnished under the contract: Provided, that this stipulation with respect to minimum wages shall apply only to purchases or contracts relating to such industries as have been the subject matter of a determination by the Secretary of Labor.

c. No person employed by the contractor in the manufacture or furnishing of the materials, supplies, articles, or equipment used in the performance of the contract shall be permitted to work in excess of eight hours in any one day or in excess of forty hours in any one week, unless such person is paid such applicable overtime rate as has been set by the Secretary of Labor.

d. No male person under sixteen years of age and no female person under eighteen years of age and no convict labor will be employed by the contractor in the manufacture or production or furnishing of any of the materials, supplies, articles, or equipment included in the contract.

e. No part of the contract will be performed nor will any of the materials, supplies, articles, or equipment to be manufactured or furnished under said contract be manufactured or fabricated in any plants, factories, buildings, or surroundings or under working conditions which are unsanitary or hazardous or dangerous to the health and safety of employees engaged in the performance of the contract. Compliance with the safety, sanitary, and factory inspection laws of the State in which the work or part thereof is to be performed shall be prima-facie evidence of compliance with the subsection.

f. Any breach or violation of any of the foregoing representations and stipulations shall render the party responsible therefor liable to the United States of America for liquidated damages, in addition to damages for any other breach of the contract, in the sum of ten dollars ($10.00) per day for each male person under sixteen years of age or each female person under eighteen years of age, or each convict laborer knowingly employed in the performance of the contract, and a sum equal to the amount of any deductions, rebates, refunds, or underpayments of wages due to any employee engaged in the performance of the contract; and, in addition, the agency of the United States entering into the contract shall have the right to cancel same and to make open market purchases or enter into other contracts for the completion of the original contract, charging any additional cost to the original contractor. Any sums of money due to the United States of America by reason of any violation of any of the representations and stipulations of the contract as set forth therein may be withheld from any amounts due on the contract or may be recovered in a suit brought in the name of the United States of America by the Attorney General thereof. All sums withheld or recovered as deductions, rebates, refunds, or underpayments of wages shall be held in a special deposit account and shall be paid, on order of the Secretary of Labor, directly to the employees who have been paid less than minimum rates of pay as set forth in such contracts and on whose account such sums were withheld or recovered; Provided, that no claims by employees for such payments shall be entertained unless made within one year from date of actual notice to the contractor of the withholding or recovery of such sums by the United States of America.

g. The contractor shall post a copy of the stipulations in a prominent and readily accessible place at the site of the contract work and shall keep such employment records as are required in the Regulations under the Act available for inspection by authorized representatives of the Secretary of Labor.

h. The foregoing stipulations shall be deemed inoperative if this contract is for a definite amount not in excess of ten thousand dollars ($10,000).

1-23. Schedule of minimum wage rates applicable to this contract under subparagraph 1-22 b above. - No determination of minimum rates applicable to this contract has been made by the Secretary of Labor. Subparagraph b of the stipulations contained in Paragraph 1-22, above, is therefore inoperative to this contract.

1-24. Employees affected. - The stipulations set forth in Paragraph 1-22 above shall be deemed applicable only to employees engaged in or connected with the manufacture, fabrication, assembling, handling, supervision, or shipment of materials, supplies, articles, or equipment required under the contract and shall not be deemed applicable to office or custodial employees.

1-25. Overtime. - The rate of pay for overtime under subparagraph c of the stipulations, set forth in Paragraph 1-22 above, shall be one and one-half (1-1/2) times the basic hourly rate or piece rate received by the employee. If in any one week or part thereof an employee is engaged in work covered by the contractor's stipulation, his overtime shall be computed after eight hours in any one day or after forty hours in any one week during which no single daily total of employment may be in excess of eight hours without payment of the overtime rate.

1-26. Records of employment. - Pursuant to the act referred to in Paragraph 1-22 above, and the regulations adopted pursuant thereto, the contractor shall maintain the following records of employment which shall be available for the inspection and transcription of authorized representatives of the Secretary of Labor.

a. Name, address, sex, and occupation of each employee covered by the contract stipulations.

b. Date of birth of each such employee under twenty-one years of age.

c. Wage and hour records for each such employee including the rate of wages and the amount paid each pay period, the hours worked each day and each week and the period during which each such employee was engaged on a Government contract, with the number of such contract. Compliance with this subsection shall be deemed complete if wage and hour records for all employees in the plant are maintained during the period between the award of any Government contract and the date of

delivery of the materials, supplies, articles, or equipment; Provided, that where no separate records for employees engaged on Government contracts are maintained, it shall be presumed, until affirmative proof is presented to the contrary, that all employees in the plant from the date of award of any such contract until the date of delivery of the materials, supplies, articles, or equipment were engaged on such Government contract. Such records shall be kept on file for at least one year after the termination of the contract.

1-27. Interpretation of specifications. On all questions relating to the acceptability of material, machinery, classification of materials, the proper execution of the work, and the interpretation of the specifications, the decision of the contracting officer shall be final, subject to appeal as provided for in Article 12 of the contract.

1-28. Final acceptance and payment. - When all the work called for under this contract has been completed, the contracting officer will make a thorough examination of same, and, if it is found to comply fully with the requirements of the contract, it will be accepted and final payment will be made.

1-29. Approval. - The contract shall be subject to the written approval of the Division Engineer, North Atlantic Division, and will not be binding until so approved.

SECTION II. 42-INCH PUMPS (Item 1-a)

2-01. Work included. - a. The contractor shall design, manufacture and deliver three 42-inch vertical propeller type pumps complete with couplings, discharge piping, valves, and accessories necessary to make a complete installation including the discharge wall pipe and blank flange for a future pump unit. The pumps will be used for pumping surface run-off and diluted sewage during periods of high river stages, for protracted periods, and intermittently for testing purposes with possible long periods of idleness between operations.

b. Each pump shall be direct-connected through a right angle gear unit to a gasoline engine of suitable power. The pumps will be installed as shown on the drawings by other agencies.

2-02. Operating conditions. - The pumps shall be designed for satisfactory operation and shall meet all the requirements of the specifications under the following conditions:

Elevation bottom of sump	Elevation motor room floor	Minimum sump water elevation	Maximum sump water elevation
37.5	60.0	46.0	52.0

2-03. Pump characteristics. - a. General. - The pumps shall be the vertical, open propeller, single stage submerged type designed to handle storm water and diluted sewage. All parts shall be of such design, strength, and proportions as to perform in a successful manner the work required. The pumps shall operate smoothly and quietly without excessive vibration, or cavitation, throughout the range of head specified. The pumps shall be designed to start and run dry without injury.

b. Capacity. - Each pump shall deliver not less than 42,000 g.p.m. at a total head of 10 feet and not less than 34,000 g.p.m. at a total head of 19.5 feet. The characteristics of the pump shall be such that the power required to operate it between zero head and a total head of 19.5 feet shall not exceed the rated horsepower of the engine as defined in Paragraph 3-03, and the published overload rating of the engine shall not be exceeded when the pump is operating at full speed against a total head of 25.5 feet. The rotative speed of the pump shall not exceed 500 r.p.m.

2-04. Pump bowl. - The bowl of each pump shall be made either of close-grained cast iron or fabricated sheet steel having the same composition as that stated in Paragraph 2-07. The minimum wall thickness, if of cast iron, shall be 1.25 inches, and if of sheet steel, .50 inch. Suitable eye-bolts or lugs shall be provided to facilitate handling of the bowl.

2-05. Diffusion vanes. - Diffusion vanes shall be provided to guide the water into the discharge column. The hub of the diffusion vanes shall form the support for the propeller guide bearings as well as the lower end of the shaft cover pipe.

2-06. Propeller. - The propeller shall be cast in one piece of acid-resisting bronze free from imperfections and having a tensile strength of not less than 40,000 pounds per square inch. The material shall conform to the provisions of Federal Specification QQ-B-691a for "Bronze Castings," Composition 5. The propeller shall be securely locked to the shaft in such a manner as to prevent damage in case the direction of rotation should become reversed for any reason. The propeller shall be finished all over to a smooth surface and to correct shape and contour, and shall be dynamically and statically balanced to avoid vibration.

2-07. Discharge column. - The discharge column shall be made of cast iron or of steel having corrosion resisting qualities equal to that possessed by steel of the following analysis:

Carbon	Maximum 0.10%
Manganese	0.10 to .30%
Phosphorus	0.10 to .20%
Sulphur	0.05% maximum
Silicon	0.50 to 1.00%
Copper	0.30 to 0.50%
Chromium	0.50 to 1.50%
Yield Point	Not less than 50,000 lbs. per sq. in.
Tensile Strength	Not less than 65,000 lbs. per sq. in.

If made of steel, it shall be not less than 3/8 inch thick. If made of cast iron, it shall be of a thickness not less than that of the corresponding size Class "B" cast iron pipe of the American Water Works Association. The discharge column shall be designed for suspension from the base plate, and shall be so proportioned as to support safely the bowl and suction bell, and to withstand the hydraulic pressure, thrust, and any other load to which it may be subjected during transportation, erection, or operation. The column shall be made of sections not more than 10 feet in length. A pipe sleeve shall be provided to form an enclosure to protect the shaft, couplings, and intermediate bearings from direct contact with the discharge effluent. Where this sleeve emerges above the base plate, provision shall be made for packing the drive shaft so that floor drainage or dirt will be excluded from the pipe sleeve and intermediate bearings. Should the vertical section of the discharge pipe be continued to the base plate, adequate and approved provisions shall be made to prevent water leakage at the base plate. Hand holes of liberal proportions shall be provided so as to permit ready access to any vanes or similar obstruction in the discharge column and elbow. All covers shall match the interior contour of the adjoining surfaces.

2-08. Shafting. - The pump shafts shall be constructed of corrosion resisting metal conforming to the requirements of Navy Specifications 46S18C for Steel, corrosion resisting; Bars, Rods and Forgings, Grade 7, or Copper Nickel Alloy conforming to requirements of Federal Specification QQ-C-541 for Copper, Nickel Alloy; Bars, Plates, Rods, Shapes,

Sheets, Strips, Tubing (seamless) and Wire, Type I, Class A, B, or C, or shall be of cold rolled steel sleeved with material specified above at the lower section where the pump shafts turn in the lower bearings. Intermediate shafts shall be constructed of cold rolled steel. The shafts shall be of sufficient diameter to transmit the torque with a factor of safety of not less than eight (8) based on the ultimate strength of the material. The shafts shall be furnished in not more than two sections, and the separate sections shall be connected by means of an approved shaft coupling. In the design and arrangement of the shaft assembly, provision shall be made for making any necessary vertical adjustments to the shaft after it has been assembled in the pump unit and without interfering with its alignment.

2-09. Bearings. - The bearings supporting the shaft between the pump and gear unit shall be of high-grade bronze, and of the removable sleeve type. The number and spacing of bearings shall be clearly indicated on the contractor's drawings. The weight of the propeller, the pump shaft and intermediate shaft, and their couplings, in addition to the thrust imposed by the pump, shall be carried independently by a roller or ball thrust bearing incorporated in the gear unit. The guide bearings shall be of ample dimensions to withstand any load that will be imposed on them in the operation of the pumps, even should the rotation of the shaft become reversed. They shall be capable of operating continuously without objectionable rise in temperature under all variations of the load and shall be enclosed in sectional sleeves, fully protected from coming into direct contact with the water. All guide bearings except the lower pump bearing shall be oil lubricated by means of automatic mechanical type lubricators which will feed lubricant to bearings only during actual operation and shall be provided with sight feed. The lower bearing shall be grease lubricated and shall be serviced through an alemite or zerk fitting for forced lubrication. All lubricators and pressure fittings shall be brought to a position above the operating room floor where they can be conveniently serviced.

2-10. Base plates. - Gear unit base plates shall be cast or fabricated from structural and plate steel. They shall be sturdily built, constructed to support the entire weight of the gear unit, pump and column pipe, plus the maximum hydraulic thrust, and of sufficient size to span the opening shown on the drawings.

2-11. Cover pipe. - The cover pipe for the shaft shall be of extra heavy wrought iron, shall be sectionalized, and shall be adequate to support rigidly the intermediate shaft bearings. Provisions shall be made to prevent water from working up the cover pipe and eventually out of the oil cups.

2-12. Suction bell. - Each pump shall be equipped with a cast iron or fabricated steel bell mouth suction head to guide the water to the propeller. It shall be flanged at the top and bolted to the pump bowl flange and shall be properly designed to prevent vortex and to reduce entrance losses to a minimum. Each bell shall be provided with lifting studs to permit easy removal.

2-13. Discharge piping. - a. The discharge piping shall be Class A American Water Works Association standard cast iron flanged pipe or the equivalent pipe fabricated from steel as described in Paragraph 2-07, with flanges faced and drilled to the 125-pound American Standard. All flanged connections shall be bolted together with American Standard machine bolts having square heads and hexagonal nuts. The flexible couplings shall be "Dresser" style 38 steel coupling or equal.

b. At the point where the discharge pipe passes through the sump wall, a wall pipe section shall be provided with an intermediate flange cast or welded on the pipe to come in the center of the wall. The intermediate flange shall be of the same diameter and thickness as the standard pipe flange.

2-14. Check valves. - The check valves shall be "Chapman" Table No. 23, or equal, tilting disc, non-slam check valves suitable for 50 pounds per square inch cold water working pressure. The body and disc shall be fitted with bronze seat rings, and the hinge pin and hinge pin bushings shall be of stainless steel. The body shall have smooth flow lines without pockets or recesses, and the net area of the waterway through each check valve shall not be less than the net area of the pipe line in which it is installed. Flanges shall be drilled in accordance with the 125-pound American Standard.

2-15. Accessories. - The pumps shall be provided with a complete set of wrenches and special tools mounted in an approved metal case; and four complete sets of instruction bulletins.

2-16. Shop assembly. - Each pump shall be completely assembled in the shop, all adjoining parts properly fitted, and working clearances checked before shipment is made. All parts of the pumps shall be properly match-marked prior to dismantling for shipment, and shall be referenced to the assembly drawings furnished by the contractor. All like parts for the pumps and appurtenances shall be interchangeable.

2-17. Shop tests. - a. Capacity and efficiency tests shall be made on one pump at the manufacturer's plant if feasible, and if not, a model test shall be made to insure compliance with these specifications. Readings shall be taken at not less than 5 points at uniform intervals to obtain curves of capacity, efficiency and horsepower over the complete range of heads specified. Certified tests on duplicate pumps may, subject to approval by the contracting officer, be accepted in lieu of capacity tests. If a model is used for the test, the model shall be exactly homologous in all respects with a propeller at least 12 inches in diameter, and it shall be tested at the same specific speed as the prototype. Tests shall be witnessed by a representative of the contracting officer. The results of the tests shall be prepared in typewritten form with characteristic curves.

b. The cost of all labor, material, equipment, and other facilities necessary for conducting the shop tests shall be borne by the contractor.

2-18. Field tests. - After installation, each pump will be tested for a sufficient period of time to insure that it is in satisfactory operating condition. Any adjustments required to secure satisfactory operation shall be made by and at the expense of the contractor.

2-19. Painting. - a. General. - All items of equipment shall be painted in the shop in the most thorough manner to prevent corrosion. Surfaces of metal parts to be painted shall be entirely cleaned of all scale, rust, dirt, oil or other foreign substances, by scrapers, wire brushes, sand blast, mineral spirits or other approved cleaning agents not less than 30 minutes nor more than 5 hours prior to the application of new paint. All painting shall be done either by brush or spray in a neat, thorough and workmanlike manner. All surfaces shall be warm and dry before applying any paint.

b. Equipment located on or above the engine room floor. - All exterior parts of the equipment located on or above the engine room floor shall be cleaned and prepared for painting in accordance with the requirements of Paragraph 2-19 a. The priming coat of paint shall be applied in accordance with the manufacturer's standard practice. Prior to shipment the equipment shall be given two coats of machinery enamel, similar and equal to "Lustral" as manufactured by the Sherwin-Williams Company. The color shall be as selected by the contracting officer.

c. Equipment below engine room floor. - All exterior surfaces of the equipment that is to be installed below the engine room floor and the interior surfaces of the column and discharge piping shall be prepared for painting as required in Paragraph 2-19 a, and, except for the 16-inch pump (see Paragraph 5-18), shall be given one coat of an approved asphaltic primer conforming to the requirements of Federal Specification SS-A-701, and one coat of asphalt varnish. The asphalt varnish shall be similar and equal to "Anchor" asphalt paint manufactured by the Barrett Company of New York, and shall meet the requirements of Federal Specification TT-V-51, Type B, for Asphalt Varnish.

d. Protection of surfaces not painted. - Shafts and surfaces finished for working contact shall not be painted but shall be protected with a coat of white lead and tallow or other approved slushing compound.

SECTION III. GASOLINE ENGINES (Item 1-b).

3-01. Work included. - The contractor shall furnish in accordance with the drawings and specifications three gasoline engines suitable for driving the 42-inch pumps through right angle gear reduction units. The engines shall be furnished complete with silencers, exhaust lines, connections to water and fuel lines, and flexible couplings to the gear reduction units.

3-02. General description. - a. Each engine shall be a four-cycle, internal-combustion, heavy-duty, stationary type having not less than 6 cylinders. Each engine shall be of late design and a current model, standard with the manufacturer and shall be the product of a reliable manufacturer who can show at least 5 years' experience in the manufacture of engines for similar duty.

b. Each engine shall be equipped with two starting motors and a storage battery for self-starting and all incidental ignition equipment, miscellaneous wrenches for special nuts and a suitable detachable hand crank, and complete operating equipment.

3-03. Design. - a. Each engine shall operate at a governed speed not exceeding 1,200 r.p.m. when driving the pump at its rated speed as defined in Paragraph 2-03 b. At this speed the engine shall have a published continuous rating with auxiliaries attached of not less than 115 percent of the maximum horsepower required at the engine side of the gear reduction unit to drive the pump at the 19.5-foot head condition. It shall also have an overload rating sufficient to drive the pump at the 25.5-foot head condition.

b. The design of the engine shall be such that, when delivering its maximum horsepower at governed speed, the stresses set up in the several parts shall not exceed safe working stresses for the materials used, and shall conform to the best modern practice in the design of high-grade machinery. The design shall insure that no torsional critical speed exists within the operating speed range.

c. The detailed design of the engines shall be such that all working parts shall be readily accessible for inspection and repair, easily duplicated, and readily replaced with each and every part of the equipment of the machine properly designed and suitable for the uses and service required.

3-04. Construction details. - The principal parts of the engine shall be as follows:

a. Bed-plate. - The bed-plate shall be of cast iron or structural steel accurately machined for mounting the engine.

b. Crankcase. - The engine shall be equipped with a cast

iron pedestal-base type crankcase equipped with large removable side plates for easy inspection and adjustment of all working parts of the engine.

c. Cylinders. - The cylinder block shall be separate from the crankcase, and shall be cast in one piece or in pairs of cylinders.

d. Crankshaft. - The crankshaft shall be a one-piece alloy steel forging properly heat-treated. It shall be dynamically and statically balanced. All bearing surfaces shall be of sufficient area and accurately ground to conform to standard practice for such work. The crankshaft shall be drilled to provide oil feed from the pressure system to the connecting rod bearings.

e. Camshaft. - The camshaft shall be of forged alloy heat-treated steel, with integral cams. The cam faces and bearing surfaces shall be carburized, hardened and ground finished to size.

f. Connecting rods. - The connecting rods shall be of high-grade forged alloy-steel, properly heat-treated.

g. Pistons. - Pistons may be of light-weight cast iron, or alloy, and of such construction as to provide uniform expansion of piston skirt. Each piston shall be equipped with at least four rings, three above the piston pin and one below. The piston pin shall be of tubular hardened steel, accurately ground and securely locked in place.

h. Push rods and guides. - Push rods shall be of hardened steel and accurately ground. The push rod guides shall be bronze and of the removable type.

i. Main bearings. - All crankshaft bearings shall be accurately fitted and provisions made to eliminate side thrust on bearing cap studs. Bearings shall be bronze-backed, babbitt-lined, removable, and replaceable. Oil, under pressure, shall be suitably admitted to the inside of each main bearing shell.

j. Valves. - The valves shall be of special steel, of large area, accurately fitted, and ground to fit the valve insert seats. The valve seats shall be fitted with valve seat inserts.

k. Flywheel. - The flywheel shall be of gray iron or steel, statically and dynamically balanced. It shall be securely attached to the crankshaft ahead of the flexible coupling.

l. Coupling. - The flexible coupling connecting the engine to the gear reduction unit shall be of the flexible, resilient cushion type similar and equal to Falk Steelflex Coupling. The coupling shall be suitable for transmitting 300 percent of the normal operating torque of the engine. A suitable guard shall be provided for the coupling.

m. Exhaust. - (1) The exhaust manifold shall be a close-grained gray iron casting water-jacketed for its entire length and provided with suitable flange connections having straight pipe thread for exhaust pipe. A water-cooled bronze flexible exhaust shall be provided as shown on the drawings. The exhaust shall be similar and equal to that manufactured by The Packless Metal Products of Long Island City, New York.

(2) Each engine shall be provided with an exhaust silencer for mounting on the roof as shown on the drawings. The silencer shall be similar and equal to the Model MU-2 manufactured by the Maxim Silencer Company, or the equivalent silencer manufactured by the Burgess Battery Company.

(3) Each exhaust silencer shall be provided with a rain hood as indicated on the drawings. Rain hoods shall be made of 16-gauge, galvanized sheet iron in accordance with Federal Specification QQ-I-696. Insulating sleeves shall be provided for placing in the concrete, as shown on the drawings.

n. Cooling system. - The engines shall be water-cooled with water obtained from the city water system. A temperature regulated valve shall be installed in the cooling water intake to regulate the flow of cooling water through the engine. The regulator shall be equal to that manufactured by the Fulton Sylphon Company. There shall be provided a pressure temperature-operated switch so arranged that it will open the ignition circuit in the event the oil pressure is not adequate for safe operation of the engine or in the event the cooling water temperature exceeds that at which the switch is set to operate.

o. Lubrication system. - The engine shall be equipped with force feed lubrication to the main bearings, camshaft bearings, connecting rod bearings, valve operating mechanism, and gear trains. The oil shall be supplied under pressure by a positive gear-driven pump. The pump shall be removable from the engine without the necessity of dismantling the engine. A hand pump shall be provided for forcing oil to all bearings prior to starting engine. Oil filters shall be of full flow type construction, readily removable for cleaning. Oil cooling heat exchangers shall be provided.

p. Ignition and starting system. - (1) A 12-volt battery-type dual ignition system shall be provided, with two independently driven distributors, two heavy-duty ignition coils, and two spark plugs in each cylinder, fired simultaneously. The starter push button switch of each engine shall be so designed that the current from one engine battery will not flow to aid the battery of another engine when the starting motor on the engine is operated.

(2) Two 12-volt, heavy-duty electric cranking motors shall be provided for starting each engine. Each starting motor shall be controlled by a 12-volt magnetic switch, the two switches being actuated simultaneously by a push button switch on the engine panelboard.

The cranking motors shall be capable of cranking the engine at sufficient speed to insure starting when the engine is connected to the pump through the gear-reduction unit, with the pump casing full of water, and with a 32 degree F. ambient engine room temperature. Suitable provision shall be made to prevent operation of the engine cranking motors except when the spark control lever is in full-retard position.

(3) A 12-volt storage battery shall be provided. The battery shall have sufficient capacity to provide 3-minute continuous cranking of complete unit under operating conditions with an ambient engine-room temperature of 32 degrees F.

The battery shall have special plate construction for severe or unusual conditions. Each positive plate shall be composed of multiple insulated containers filled with active materials, the containers to run vertically, horizontally or diagonally, permitting free passage of electrolyte from one face of the plate to the other; each container shall be slotted or perforated to permit diffusion of the acid electrolyte into the containers. The electrolyte shall be of the low-gravity type with a specific gravity of about 1.210 to 1.220.

The battery shall conform to the specifications for United States Government award by Treasury Department, Procurement Division, Branch of Supply, for lead-acid storage batteries, Class 17, Item B-8680.

A suitable shelf or platform with an acid-proof rubber or lead tray shall be provided on or located adjacent to the engine base for mounting the battery.

q. Fuel system. - (1) The engine shall operate satisfactorily and comply with these specifications when using gasoline fuel conforming to Federal Specification VV-G-101a and having an octane rating of 65-70. The fuel system shall conform to the requirements of the National Board of Fire Underwriters.

(2) The carburetors shall be of the heavy-duty type equipped with chokes, air filters, and flame arresters. Each engine shall be equipped with two engine-driven diaphragm type gasoline pumps suitable for pumping the gasoline from the tanks to the engine. The tanks and supply piping will be furnished by others and will be installed at the locations shown on the drawings. Also each engine shall be provided with a hand-operated fuel pump with a pressure-relief bypass with spring-loaded valve set to unload at 4 pounds per square inch. Connections to gasoline lines shall be made with flexible seamless bronze hose with woven wire protection and packless couplings. The carburetors and gasoline piping shall conform to the requirements of the Underwriters Laboratories.

3-05. Governor. - a. A governor shall be mounted directly on the

engine and arranged for force-feed lubrication. It shall be of the non-hunting, precision type, capable of maintaining the engine speed within 5 percent of rated speed during part-load changes from full-load to no-load.

b. The engine shall be provided with an automatic ignition cut-out switch that will shut the engine down when the engine speed exceeds that normally controlled by the governor. The cut-out switch shall be adjustable and provided with manual reset.

3-06. Miscellaneous equipment. - a. Instrument panel. - A polished metal panelboard shall be installed on each engine and the following instruments and equipment mounted thereon:

One tachometer

One main oil line pressure gauge

One lubricating oil filter inlet gauge

One lubricating oil filter outlet gauge

Cranking motor-push-button switch

Ignition switch

Temperature gauges

b. Tools. - One set of special wrenches or tools shall be provided and mounted in a suitable cabinet.

3-07. Drawings. - The contractor shall furnish drawings and specifications for the proposed engines for approval. The drawings shall include the engine, and all accessories, with dimensions of concrete base for mounting. Accessories shall be listed on the drawings by catalog number with name of manufacturer; and shall be accompanied by cuts and the manufacturer's specification for the accessories, all properly numbered to agree with the list as shown on the drawings.

3-08. Shop assembly. - All work shall be neatly and accurately done and shall be in accordance with the highest standards of practice for equipment of the type to be furnished. The engine shall be accurately aligned on the bed-plate and securely attached thereto. Provision shall be made for lifting the engine by a crane.

3-09. Inspection and tests. - a. Each engine unit will be inspected and tested in the shop by an authorized representative of the contracting officer. A typewritten record of the tests, including observations, calculations, results, and graphs shall be submitted to the contracting officer by the manufacturer, together with a sworn statement from the person supervising the tests. The engine shall be

tested for satisfactory operation under the following conditions:

(1) The engine shall be run continuously for twenty-four (24) hours at full load, which shall be equal to the continuous horsepower rating required by Paragraph 3-03 a, followed by a one-hour run at the overload required by the pump at maximum head condition.

(2) The valve setting and governor control shall be checked by means of a tachograph, with the entire unit operating under various loading conditions ranging from no-load to the maximum load of the pump rating.

(3) All tests shall be made using gasoline of a grade not higher than specified in Paragraph 3-04 q.

(4) Immediately after running tests for the engine, the contracting officer or his representative may require that the engine be opened for inspection.

b. Field tests and trials shall be made after installation under the supervision of and as directed by the contracting officer. They shall be of sufficient loading and duration to demonstrate to the satisfaction of the contracting officer that the complete unit as installed is in conformity with the specifications. Any alterations necessary to bring the engines up to the requirements of the specifications shall be made by and at the expense of the contractor.

c. The cost of all testing shall be borne by the contractor, except for the Government's representatives, and shall be included in the contract price for the item.

3-10. Painting. - Shop painting shall be in accordance with the provisions in Paragraph 2-19b. Such retouching as may appear necessary in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound.

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SECTION IV. RIGHT ANGLE GEAR UNITS (Item 1-c).

4-01. Work included. - The contractor shall furnish three right angle gear units for continuous transmission of the power from the horizontal gasoline engines to the vertical pump shafts of the 42-inch pumps. Each unit shall be ready for connection to its respective engine and pump.

4-02. Type and rating. - The gear unit shall be the self-contained type designed for transmitting power from the horizontal engine shaft through spiral bevel gears, or a combination of spiral bevel and single helical gears to the vertical pump shaft. The horsepower rating shall be in accordance with the recommended practice of the American Gear Manufacturers' Association, and the unit shall have a service factor of not less than 1.25 times the power required to drive the pump under the 25.5-foot head condition stated in Paragraph 2-03. The gear unit shall be a standard unit that is regularly manufactured for service similar to that required by these specifications.

4-03. Housing. - The housing of the gear unit shall be of rigid, compact design, with a base made of close-grained cast iron. The cover of the housing shall be of close-grained cast iron, or fabricated steel plate. The design of the housing shall be such that all bearings are supported in the base section, and the cover may be removed without disturbing the bearings, gears or oil piping. All joints shall be machine finished, oil tight, and dust proof. Suitable cover-plates shall be provided that will permit easy access to the interior for examination and adjustment of the parts.

4-04. Gears. - The spiral bevel gears shall be of the precision generated, curved tooth type, made of alloy steel and heat-treated and lapped. Single helical gears shall be precision generated with 30 degrees helix angle, made of alloy steel and lapped. The gear shall be designed to give the proper ratio and transmit the power without undue strain. Gears and pinions shall be supported between bearings, and so mounted that they will be in precise alignment at all times.

4-05. Shafts. - The shafts shall be made of forged, heat-treated steel and shall be of ample size to provide against deflection. The shafts shall be supported in anti-friction bearings of the radial thrust type. A thrust bearing of ball or roller type shall be incorporated which will support the weight of the rotating parts and the hydraulic thrust of the pump. The bearings shall be of ample size and rating for the duty required of them. Provision shall be made to provide vertical adjustment for the pump shaft (see Paragraph 2-09). The slow speed vertical shaft shall be of hollow shaft design connected at the top through a clamp coupling to the vertical pump shaft. The coupling shall be provided with suitable shear pins designed to allow engine and gears to run free in case the pump should clog.

4-06. Lubrication. - A lubricating system shall be furnished providing a continuous flow of oil to all bearings, and spray lubrication at point of engagement of the gears. The lubrication system shall be capable of supplying sufficient oil to lubricate all parts when the unit is running at a speed corresponding to approximately one-half of the rated speed of the engine. The oil system including all oil piping shall be self-contained within the gear unit, with adequate oil supply carried in the base of the gear housing. The circulating oil pump shall be self-priming, so located that inspection can be made without disconnecting oil piping. An oil level indicator and an oil flow indicator shall be provided. The unit shall be self-cooling without the use of cooling water and when operating continuously under rated load, the temperature of the lubricating oil shall not exceed 160 degrees F. at an ambient of 70 degrees F. Oil seals shall be provided at the shaft outlet but no stuffing box or glands shall be used.

4-07. Field tests. - After installation, each unit will be operated and tested for a sufficient period of time to demonstrate that it is in satisfactory operating condition and meets the requirements of these specifications. Any alterations necessary to bring the gear units up to the requirements of the specifications shall be made by and at the expense of the contractor.

4-08. Painting. - Painting shall be in accordance with the provisions in Paragraph 2-19 b. Such retouching as may appear necessary in the opinion of the contracting officer, shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound.

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SECTION V. 16-INCH PUMP (Item 2)

5-01. Work included. - The contractor shall furnish one 16-inch vertical pump. The pump shall be furnished complete with electric motor, all intermediate shafting, couplings, bearings, inlet and discharge piping, gate valves, and check valve.

5-02. Description of pump. - a. The pump shall be a vertical, mixed-flow pump of the bottom-suction, horizontal-discharge, volute type designed for handling sewage and storm water. A pump of the axial flow type will not be accepted.

b. The pump shall operate smoothly and quietly, and without excessive vibration or cavitation. All parts shall be so designed and proportioned as to have ample strength, stability, and stiffness. Ample room shall be provided for inspection, repair, and adjustment.

5-03. Operating conditions. - The pump shall be capable of satisfactory operation, and shall meet all the requirements of these specifications under the following operating conditions:

Minimum low water elevation	= 49.00 feet
Elevation of pump room floor	= 45.33 feet
Elevation bottom of suction intake	= 46.00 feet

5-04. Capacity. - a. The pump shall be guaranteed to deliver 6,800 g.p.m. against a 22-foot total head and shall be so designed that it will operate at maximum efficiency against a total head of about 18 feet. At no point from zero head to shut-off head shall the motor be overloaded beyond its allowable service factor, as defined in Paragraph 5-14 c.

b. The pump shall operate at a constant speed under all conditions of head and this speed shall not exceed 900 r.p.m. The specific speed shall be within conservative limits which shall not in any case exceed the maximum for the conditions specified or established by the Hydraulic Institute, insofar as they may apply. The direction of rotation and the location of the intake and discharge shall be as shown on the drawings.

5-05. Casing. - a. The pump casing shall be of the volute type, made of high-grade cast iron of ample strength to withstand safely all stresses that will be imposed during erection and operation. The casing shall be tested and made tight in the contractor's shop under a hydrostatic test pressure of 2-1/2 times shut-off head of the pump.

b. The casing shall be provided with a removable top head that will permit the removal of the impeller from the top of the

pump without disturbing the suction or discharge connections. The head may be made solid or in halves and bolted together. The head shall be provided with a concentric shoulder joint where it is bolted to the casing, so as to secure proper alignment. The casing shall be constructed without stationary guide vanes or diffusion vanes.

c. Hand holes shall be provided in the casing and suction nozzle to provide access to both sides of the impeller. The interior surfaces of the covers shall be shaped to continue the contour of the interior of the casing. The hand-hole covers shall be provided with lever handles for hand operation, so that they can be quickly swung open, reclosed, and bolted.

d. The casing shall be provided with eye bolts for lifting and tapped holes for drains. The high point of the casing shall be fitted with a vent pipe connection and valve, so that air or gas may be relieved from the main body of the pump. A suitable connection shall be provided for draining the pump when the valves in the suction and discharge lines are closed. Flanges shall be cast solid and shall be faced and drilled to conform to the 125-pound American Standard. Flanges shall be spot-faced on the back for all bolt holes.

e. The suction nozzle shall be a special flanged 90° cast iron base elbow reinforced with vertical ribs and of sufficient strength to carry the entire load from the pump.

5-06. Impeller. - The impeller shall be of the enclosed mixed-flow, single suction type cast in one piece of cast steel, bronze, or of a special alloy cast iron containing not less than 1-1/2 percent nickel and having a tensile strength of not less than 30,000 pounds per square inch. The impeller shall be finished all over to a smooth surface and shall be statically and dynamically balanced. The impeller shall be securely locked to the shaft in such a manner as to prevent damage in case the direction of rotation should become reversed for any reason. The impeller shall have openings of a sufficient size to pass spheres 3-1/2 inches in diameter.

5-07. Wearing rings. - Bronze wearing rings shall be provided both on the impeller and the casing. The rings shall be machined and constructed to minimize the leakage through them and shall be designed for easy removal and replacement. The design and position of the wearing rings shall be such that wedging of solids flowing along with the water will be avoided.

5-08. Pump shaft. - a. The pump shaft shall be forged of high-grade, open-hearth steel thoroughly annealed and accurately machined to finished dimensions. It shall be of ample size to transmit the loads without whip, vibration, or undue deflection at all speeds from zero to maximum. The first critical speed of the pump rotor, consisting of the shaft, impeller, and couplings, shall be not less than 150 percent of the normal running speed.

b. The portion of the shaft within the pump coming in contact with water shall be protected by a removable bronze sleeve extending through the stuffing box. This sleeve shall be securely fastened to the shaft and held tight against the impeller hub. The sleeve shall be securely fastened to the shaft so that either forward or reverse rotation of the pump will not cause it to loosen. The bronze sleeves shall be properly machined and ground to finished dimensions.

5-09. Stuffing box and gland. - Leakage along the pump shaft shall be prevented by means of an approved stuffing box and gland, designed to take sufficient packing to insure tight joints without undue pressure on the shaft. The stuffing box shall be provided with a bronze lantern ring to furnish lubrication and sealing with grease. The packing gland shall be of bronze of the split type to allow removal without disturbing any other parts of the pump. The gland bolts shall be of the swing type made of bronze with bronze nuts.

5-10. Bearings. - The pump bearings shall be two in number and shall be of the anti-friction, grease lubricated type. The bearings shall be designed for heavy duty continuous service and shall be of ample capacity to carry the load. Bearings shall be of the radial ball or roller bearing type and each ball bearing shall be provided with at least two rows of balls. The thrust bearing shall be a combined radial and thrust bearing and shall be capable of carrying, without undue stress in any of its parts, the weight of all rotating parts and the maximum unbalanced hydraulic thrust of the pump. The bearings shall be mounted in the main frame and shall be readily removable. The bearings shall be designed to operate under all conditions of operation that may be expected including the flooding of the pump room and shall include a reservoir for 24 hours' supply of lubricant.

5-11. Intermediate shaft. - The intermediate shaft for connecting the electric motor to the pump shall be made in two sections. The lower section shall be of sufficient length to permit complete disassembling of the rotating element without disturbing the pump casing or the electric motor. The coupling connecting the lower length of intermediate shaft to the pump shaft shall be of rigid, forged, flanged type. The coupling between the lower length of intermediate shaft and the upper length of intermediate shaft shall be a flexible coupling of the rubber-bushed, or other approved type. The coupling between the electric motor and the intermediate shaft (upper length) shall be of the rigid, forged, flanged type. All the intermediate shafting shall be of cold rolled steel thoroughly annealed and accurately machined to finished dimensions.

5-12. Accessories. - There shall be furnished one complete set of all necessary special wrenches mounted in an approved metal case.

5-13. Shop test. - a. The pump shall be subjected to and successfully pass in the shops of the manufacturer, hydrostatic pressure and actual running tests. All shop tests shall be subject to witness by the contracting officer or his authorized representative. The contractor

shall give notice in writing at least five days prior to the date on which any pumping unit will be ready for test.

b. The hydrostatic test pressure shall be not less than two and one-half times the shut-off head of the pump, as shown by the characteristic curve. The running test shall be made with the unit driven by the manufacturer's test motor.

c. The test shall be conducted in accordance with the test code of the Hydraulic Institute and shall show before acceptance of the units that the pumps have general characteristics of head, capacity and efficiency as shown by the characteristic curve submitted by the contractor. A certified copy of the test log sheet and test curves shall be furnished the contracting officer.

5-14. Electric motor. - a. General. - The pump motor shall be of the vertical, drip-proof, wound-rotor type induction motor with ring base for fastening it to its foundation. Unless specified otherwise, all electrical materials, workmanship and tests shall be in conformity with the latest standards of the National Electrical Manufacturers Association and the American Institute of Electrical Engineers.

b. Characteristics. - The motor shall be suitable for continuous duty, adjustable-varying-speed service and shall have a breakdown torque of not less than 200 percent of full-load torque. The operating characteristics shall be similar or equal to the General Electric Company's type MT or the Westinghouse Electric and Manufacturing Company's type CW.

c. Rating. - The motor shall be designed for service at 220 volts, 3-phase, 60 cycles A.C. and shall be rated at 50 horsepower. The temperature rise when running continuously at rated horsepower and voltage shall not exceed 40 degrees C. above an ambient of 40 degrees C. The motor when operated at its rated voltage and frequency shall be capable of operating continuously at 115 percent of its rating without exceeding safe temperatures with an ambient temperature not greater than 40 degrees C.

d. Frame. - The stator frame shall be of high-grade cast iron, cast steel, or welded steel construction. It shall present a neat, modern, appearance.

e. Stator and rotor cores. - The cores shall consist of laminations of high-grade, non-aging, annealed, electrical silicon steel. The laminations shall be insulated with baked-on enamel or with other equally effective insulation, in order to reduce eddy-current losses to a minimum. The laminations shall be of the single circular or the segmental type firmly held together by means of compression between end rings. During assembly the laminations shall be carefully inspected to see that only clean-cut punchings and those free from burrs are used.

f. Stator windings and insulation. - The motor shall have special moisture-proof insulation of a type designed and constructed to withstand severe humidity conditions and, so far as practicable, to operate after long periods of idleness without previous drying out. A detailed description of the manufacturing process and of the materials used in insulating the stator windings shall be submitted to the contracting officer for approval before manufacture of the motor is commenced. If, in the opinion of the contracting officer, the insulation is not of the highest quality and if the methods of manufacture are not of the best modern practice, the motor will not be accepted. The following specifications describe the minimum requirements for acceptance, and are not intended to restrict or prohibit the use of materials or methods which may give equal or better performance under the service conditions described above.

(1) Open-slot construction with form-wound coils shall be used. They shall be wound with rectangular wire having adequate covering for turn to turn insulation, consisting of cotton, paper, cellulose acetate or a combination of these. The formed coil shall be given not less than 4 dips in insulating varnish and baked after each dip in an oven with regulated temperature control, or shall be vacuum impregnated with asphaltic compound.

(2) The insulation to ground shall be processed on the coil; slot tubes or cells are not acceptable. The insulation shall be of adequate thickness and breakdown strength throughout the length of the coil. Mica shall be used in the slot portion and shall be of adequate thickness to withstand a dielectric test of 4,800 volts to ground for one minute.

(3) Before the coils are placed in the slots each coil shall be given a high frequency turn to turn insulation test of 2,500 volts.

(4) Form wound coils shall be of such uniformity that they will be alike in shape and size, and interchangeable. The coils shall be held in place by wedges of micarta or equal material.

(5) After the winding has been completed the stator shall be given not less than 4 coats of insulating varnish and baked after each coat, or shall be given vacuum impregnation treatment followed by not less than 2 varnish and baking treatments.

g. Rotor insulation. - Subparagraph f (above), referring to insulation on the stator winding shall also apply to the winding of the rotor where it specifies the type of insulation and the treatment before and after the insulated conductors are placed in the rotor slots.

h. Shaft. - The rotor shaft shall be made of high-grade steel, finished all over and of ample size to handle safely the maximum torque which the motor is capable of producing.

i. Slip-rings. - The slip-rings for the rotor shall be of bronze or brass, accurately ground to size, and polished smooth. The insulation between the rings and the rotor shaft, and the spacing between adjacent rings shall be such as to prevent flashovers during the operation of the motor.

j. Brushes and holders. - The brushes shall be designed for the service intended, and shall be self-lubricating and free from abrasive materials. The brush holders shall be of bronze, durable in construction and shall provide the proper amount of pressure on the brushes.

k. Bearings. - The thrust bearing shall be of the ball, or ball and roller type and shall be of sufficient capacity for all loads imposed upon it. It shall be located in the upper end shield and shall be oil lubricated. The lower guide bearing shall be of the sleeve type, and shall be oil lubricated.

l. Terminal boxes and leads. - Insulated terminal leads shall be brought out from the stator and rotor and shall be provided with two-piece terminal lugs for connections to the external leads to the stator and rotor. Drip-proof conduit terminal boxes shall be supplied for housing the stator and rotor lead connections.

m. Treatment to resist corrosion. - All screws, bolts, nuts, pins, studs, springs, washers, and other similar fittings shall be of corrosion-resisting material or shall be heavily coated with a suitable non-ferrous metal. Shafts shall be cadmium plated, or treated in some other equally effective manner to resist corrosion.

n. Tests. - (1) Certified results of all tests in typewritten form shall be furnished, in triplicate, to the contracting officer.

(2) The contracting officer reserves the right to have a representative witness the construction and tests of the motor.

(3) Performance curves, in triplicate, shall be furnished the contracting officer. These curves shall be plotted from the results of values obtained from the test of this motor. Performance curves shall indicate the torque, horsepower, power factor, efficiency, and current plotted against r.p.m. as an abscissa, with varying amounts of resistance in the secondary.

5-15. Gate and check valves. - a The gate valves shall be Crane No. 791, Chapman No. 58-1/2, or equal, iron-body brass-trimmed, non-rising stem, double-disc gate valves. The valves shall be rated at 50 pounds per square inch cold water working pressure and shall be provided with position indicators. By-passes will not be required. The valves shall be flanged, with flanges drilled in accordance with the 125-pound American Standard.

b. The check valve shall be "Chapman" Table No. 23, or equal, tilting disc, non-slam check valve suitable for 50 pounds per square inch cold water working pressure. The body and disc shall be fitted with bronze seat rings, and the hinge pin and hinge pin bushings shall be of stainless steel. The body shall have smooth flow lines without pockets or recesses, and the net area of the waterway through the check valve shall not be less than the net area of the pipe line in which it is installed. Flanges shall be drilled in accordance with the 125-pound American Standard.

5-16. Inlet and discharge piping. - The inlet and discharge piping shall be Class "A" American Water Works Association standard cast iron flanged pipe or flanged and spigot pipe as shown on the drawings with flanges drilled to 125-pound American Standard. The design of the intake and discharge castings shall be subject to the approval of the contracting officer. All flanged connections shall be provided with full-face garlock fibreoid gaskets or equal. The flanged connections shall be bolted together with American Standard machine bolts having square heads and hexagon nuts. A drain shall be provided in the suction line.

5-17. Field tests. - After installation, the pump will be operated and tested for a sufficient period of time to demonstrate that the equipment is in satisfactory operating condition and that it meets the requirements of these specifications. The tests will be made to demonstrate proper balance and mechanical performance and will be made at whatever pumping heads are available. Any alterations necessary to bring the pump, electric motor, inlet and discharge piping, or valves, up to the requirements of the specifications shall be made by and at the expense of the contractor.

5-18. Painting. - a. The provisions of Paragraphs 2-19 a and d shall apply.

b. The provisions of Paragraph 2-19 c shall apply, except that the exterior surfaces of the pump shall be painted gray in accordance with the provisions of Paragraph 2-19 b.

U. S. ENGINEER OFFICE,
Providence, R. I.,
May 7, 1940.

Invitation No. 699-40-332

STANDARD GOVERNMENT FORM OF BID
(Supply Contract)

Opening Date for This Bid

June 6, 1940, at 3:00 P.M., Eastern Daylight Saving Time.

The District Engineer,
U. S. Engineer Office,
819 Industrial Trust Bldg.,
Providence, Rhode Island.

Place _____

Date _____

In compliance with your invitation for bids dated May 7, 1940, to furnish materials and supplies listed on the accompanying schedules, the undersigned, _____, a corporation organized and existing under the laws of the State of _____ an individual trading as _____ of the City of _____ hereby proposes to furnish, within the time specified, the materials and supplies at the prices stated opposite the respective items listed on the schedules and agrees, upon receipt of written notice of the acceptance of this bid within 60 days after the opening of the bids, to execute, if required, the standard Government form of contract, U. S. Standard Form No. 32 (Revised), in accordance with the bid as accepted, and to give bond, if required, with good and sufficient surety or sureties, for the faithful performance of the contract, within 10 days after the prescribed forms are presented for signature.

Discount will be allowed for prompt payment as follows:
10 calendar days _____ per cent; 20 calendar days _____ per cent;
30 calendar days _____ per cent; or as stated in the schedules.

(Time will be computed from the date of delivery of the supplies to carrier when final inspection and acceptance are at point of origin, or from date of delivery at destination or port of embarkation when final inspection and acceptance are at those points, or from date correct bill or voucher properly certified by the contractor is received, if the latter date is later than the date of delivery.)

SCHEDULE

Item No.	Articles or Services	Quantity	Unit	Unit Price	Amount
1-a	42-Inch Pumps	3	each	$_____	$_____
1-b	Gasoline Engines	3	each	_____	_____
1-c	Right-Angle Gear Units	3	each	_____	_____
	Total Item 1	. . . . .	. . .	. . . .	$_____
2	16-Inch Pump and Motor	1	each	_____	_____
	Total Items 1 and 2	. . . . .	. . .	. . . .	$_____

Prices quoted are based on delivery f.o.b. at Chicopee, Mass.

NOTE:-- The amounts stated above will be subject to verification by the Government. In case of variation between unit bid prices and amounts stated by bidder, the unit prices will be considered to be his bid.

Domestic Material: It is hereby warranted that, in the event award is made to the undersigned, the unmanufactured articles, materials or supplies furnished the Government will have been mined or produced in the United States, and the manufactured articles, materials and supplies will have been manufactured in the United States all from articles, materials or supplies mined, produced or manufactured, as the case may be, in the United States, except as noted below or otherwise indicated in this bid.

Exceptions _____
(If none, so state)

Manufacturer _____

Regular dealer _____

_____
(Full name of bidder)

_____

_____
(Address)

NOTE:- See Government Instructions to Bidders and copy of the Standard Government Form of Contract, Bid Bond and Performance Bond which may be obtained upon application.

DATA SHEETS

The bidder shall submit with his proposal the following information regarding the equipment he proposes to furnish. Statements so made by the bidder are intended to be, and are, express warranties.

DATA SHEET

42-INCH PUMPS

Manufacturer's name _____

Model _____ Type _____

Capacity at 25-foot total head _____ g.p.m.

Speed in r.p.m. _____

Maximum horsepower required at 25-foot head _____

Diameter of shaft in inches _____

Suction bell material _____

Weight of complete pump assembly _____ lbs.

Weight of heaviest piece _____ lbs.

Will test be made on model or full-size pump _____

If on model, state size and conversion factor to be used for computing efficiency _____

DATA SHEET

GASOLINE ENGINES

Manufacturer's name _____

Model or type _____

Number of cylinders _____

Bore _____

Stroke _____

Guaranteed continuous developed horsepower at speed required for rated speed of pump _____ hp. at _____ r.p.m.

Fuel consumption at rated speed and maximum continuous developed horsepower _____

Total weight of engine _____

DATA SHEET

RIGHT ANGLE GEAR UNITS

Manufacturer's name _____

Model or type _____

Horsepower rating at operating speed _____

Efficiency of unit at rated power and speed _____

Ratio of gear reduction _____

Total weight _____

DATA SHEET

16-INCH PUMP

1. Pump:

   a. Manufacturer's name _____

   b. Guaranteed capacity at 22-foot total head _____

   c. Speed in R.P.M. _____

   d. Shut-off head _____

   e. Diameter of main drive shaft in inches _____

   f. Weight of complete pump assembly exclusive of intermediate shaft, pounds _____

DATA SHEET

ELECTRIC MOTOR FOR 16-INCH PUMP

a. Manufacturer _____

b. Type and rating _____

c. Efficiency at full load _____; 3/4 load _____; 1/2 load _____

d. Weight of motor _____

DATA SHEET

VALVES

1. 16-Inch Gate Valves:

   a. Manufacturer _____

   b. Type or model number _____

2. 42-Inch Check Valves:

   a. Manufacturer _____

   b. Type or model number _____

3. 16-Inch Check Valves:

   a. Manufacturer _____

   b. Type or model number _____