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MARINE BARRACKS

NEW RIVER, N.C.

SPECIFICATION

FOR

30

ELECTRICAL WORK

FOR

WATER STORAGE, TREATMENT AND PUMPING PLANT

DIVISION TRAINING AREA

SPECIFICATION NO. 502

PROJECT P-108-4

SECTION 30-B

CARR AND J. E. GREINER COMPANY

ARCHITECT - ENGINEERS

MARCH 26, 1942

WATER STORAGE, TREATMENT AND PUMPING PLANT

ELECTRICAL WORK

SECTION - 30B

30B-01. SCOPE OF WORK:

The electrical work contemplated under this specification, unless otherwise specified herein, consists of furnishing and installing electrical material shown on the drawings or included in this specification; and providing electric service and connections to equipment furnished by others, complete and ready to operate.

The electrical contractor, hereafter known as the contractor, shall perform electrical work starting at the distribution pole, extending to new electrical manhole, continuing to new unit substation on the roof, thence to safety switches of power circuits and lighting panelboard, and including all interior wiring to motors, controls and lighting fixtures; consisting of a pole-mounted primary fused disconnecting switch, primary cable, rigid conduit duct and service entrance, safety switches, panelboard, wiring troughs, pull boxes, branch wires and conduits, telephone conduit, conduit fittings, lighting fixtures and other necessary electrical supplies.

The contractor shall constantly refer to the progress schedules and shop drawings of others and shall closely co-ordinate the electrical installation with work of plumbing, heating, ventilating, general construction, water softening equipment, filtration, chlorinating equipment, recording and measuring instrument, and pump contractors; so that the electrical work can be accomplished without conflict or interference and with a minimum of cutting, patch plastering and building repair.

30B-01. (Cont'd).

The electrical material and installed wiring shall be properly protected from damage by weather or other causes, and all damaged material or wiring shall be replaced without delay or extra compensation for material and labor at the request of the Resident Officer-in-Charge.

All necessary revisions in the electrical layout to meet the requirements of the latest approved erection drawings shall be made by the contractor as directed by the Resident Officer-in-Charge.

Any apparent conflicts or omissions between this specification, the approved drawings or the work of other contractors shall be reported to the Resident Officer-in-Charge before the contractor proceeds with the work in question.

Any deviation from the drawings or specifications must have prior approval of the Resident Officer-in-Charge before the work can be done.

30B-02. MATERIAL AND WORK BY OTHERS:

(a) Under advance specification "A" waterpumping equipment will be furnished and set in place by others; and they will furnish control devices for installation by the electrical contractor including selector switches, magnetic motor starters, thermal overload relays, tank controls, automatic controls, pushbutton stations, and all necessary accessories to make complete, ready to operate pumping units as follows:

30B-2 (Cont'd).

Pump unit No. 1, 1500 GPM, combination electric and gasoline engine drive, normally driven by a three phase, 220 volt, 75 horsepower induction motor or in an emergency driven by a gasoline engine having a battery energized, 6 volt, direct current system for ignition and self-starters, and a 110 volt trickle charger.

Pump unit No. 2, same as unit No. 1., using same batteries and trickle charger.

Pump unit No. 3, 1500 GPM, driven by a three phase, 220 volt, 75 horsepower motor.

Pump unit No. 4, provide facilities for future unit similar to pump unit No. 3.

The electrical contractor shall connect and test all above units, except No. 4, and shall furnish and install safety switches, conduits, conduit fittings, outlet boxes, and wire - for all four pump units.

(b) Under advance specification "F" wash water pumping equipment for backwashing filter beds will be furnished and set in place by others, including a 220 volt, 75 horsepower motor; and they will furnish control devices for installation by the electrical contractor consisting of magnetic motor starters, thermal overload relays, control stations and a pressure recording gauge with a 110 volt, 60 cycle, synchronous electric clock mechanism; the electrical contractor shall furnish and install all necessary conduits, conduit fittings, outlet boxes, wire and safety switch.

30B-02. (Cont'd).

(c) Under advance specification "C" venturi meters for raw water and treated water will be furnished and set in place by others, including two register, indicator, recorder panels, each having two 110 volt synchronous motors for rotating record charts; the electrical contractor shall make connections, and shall furnish and install all necessary conduit, conduit fittings; outlet boxes and wire.

(d) Under advance specification "B" two chlorinators with automatic controls will be furnished and set in place by others, including three solenoid valves designed for single phase, 110 volt, 60 cycle service; the electrical contractor shall make all necessary connections, and shall furnish and install conduit, wire troughs, conduit fittings and wire.

(e) Under advance specification "C" all motor-driven mixing, stirring and other electrically operated devices for the water softening plant will be furnished and set in place by others, including three phase, 220 volt, 60 cycle motors and float switches; and they will furnish magnetic starters and control equipment for installation by the electrical contractor; the electrical contractor shall furnish and install safety switches, conduit, conduit fittings and wires for above.

(f) The heating contractor shall furnish and set in place motor-driven unit heaters, and condensate pumps including motors and float switches; and shall furnish thermostats, selector switches, motor starters, and thermal overload relays for installation by the electrical contractor; safety switch for condensate pump, porcelain receptacle and

30B-02. (Cont'd).

50 watt lamp in pit, conduit, fittings and wire shall be furnished and installed by the electrical contractor.

30B-03. APPLICABLE SPECIFICATIONS:

Where detailed requirements for material and workmanship are omitted as a whole or in part, the standard specifications given below shall govern, except where modified by this specification and/or its accompanying drawings.

BUREAU OF YARDS AND DOCKS SPECIFICATIONS

No. 9Ye	(Modified)	Electric apparatus, distributing systems and wiring.

FEDERAL SPECIFICATIONS

No. J-C-106a	(Modified)	Cable and wire, rubber insulated, building type, superaging grade (0-5000 volt service)
No. E-WW-C-566	(Modified)	Conduit; flexible, steel
No. WW-C-571	June 6, 1933	Conduit; steel, rigid, enameled
No. W-F-406	(Modified)	Fittings; cable and conduit
No. W-F-791	May 31, 1932	Fuses; cartridge, inclosed non-renewable
No. W-F-831		Fuses; plug, non-renewable
No. W-L-101C	1942 supplement with emergency alternate	Lamps; electric, incandescent, large, tungsten filament
No. W-P-146	July 14, 1936	Panelboards, equipped with fuse connections or switch and fuse connections.
No. W-R-151	Nov. 6, 1934	Receptacles, attachment plugs, current taps and connectors.
No. W-S-893	(Modified)	Switches; snap, multiple type, and combination devices, flush type with wall plates.

30B-03. (Cont'd).

No. W-0-806	(Modified)	Outlet-bodies; iron (cast or malleable) with covers and accessories (for shore use)
No. W-0-821	(Modified)	Outlet boxes; steel, with covers and accessories.

Modification of above is authorized by the Resident Officer-in-Charge and the latest list of "Alternatives and/or options for materials subject to allocation" issued by the Bureau of Yards and Docks, Navy Department, to obtain commercial standard materials approved by the 1940 National Electric Code and N.E.M.A. and to conserve raw materials of strategic value, except that existing stocks of finished material may be utilized.

30B-04. DRAWINGS:

The exact location of outlets shall be approximately as shown on the drawings, revisions shall be approved by the Resident Officer-in-Charge. The following drawings accompany this specification and shall be considered part of the contract requirements.

Drawing No.	Title
MB-1736	Main pumping plant - electrical layout
MB-2700	Distribution Transformer - Main Pumping Plant

30B-05. NEW MANHOLE AND UNDERGROUND SERVICE:

New electric manhole shall conform to drawing No. MB-1736 and Navy Department Specification No. 9Ye. Cable pulling irons shall be installed in the manhole wall opposite duct entrances and manhole floor shall pitch toward drain which will be at one side rather than in center. Bottom and walls shall be of 1 : 2 : 4 concrete poured

30B-05. (Cont'd).

monolithically to insure dryness. Drain pipe shall extend not less than ten feet beyond manhole wall terminating in a cubic yard of crushed rock.

The duct line shall consist of rigid steel conduit with bushed ends, encased in a 1: 2: 4 concrete envelope with $3\frac{1}{2}$ inch minimum cover around duct.

The service cable from pole to transformer shall be three conductor No. 4 A. W. G. Type "H" shielded, lead sheathed and paper insulated for 22,000 volts, connected to a high voltage pothead in the unit substation and terminating on pole mounted fused type, gang operated, 15,000 volt disconnecting switch having 25 ampere fuses.

Lightning protection shall be provided for the primary service consisting of three pole mounted, outdoor type, distribution lightning arresters designed for 15,000 volt, grounded neutral systems, in accordance with specification no. 700, including all addenda.

30B-06. DISTRIBUTION TRANSFORMER:

Under specification No. 30-A there will be furnished one 300 kva., three phase, oil-filled transformer with high voltage primary pothead and secondary wiring trough which will be set in place and connected by the contractor in accordance with drawing Nos. MB-1736 and MB-2700

The three primary windings shall be delta-connected internally and connected to a three conductor, 12,470 volt, No. 4 A.W.G. pothead.

The three secondary windings shall be delta-connected internally for three wire, three phase, 60 cycle service for power and a fourth wire shall be brought out from the mid-point of one

30B-06. (Cont'd).

secondary winding to give three wire, 220/110 volt service for single phase power and lighting.

30B-07. FACILITIES FOR WATTHOUR METER:

The contractor shall furnish and install facilities for a two element, polyphase watthour meter equipped with four dial register; and shall provide necessary current transformers, and shall be equipped with shorting-out devices on secondary side of current transformers.

The watthour meter to be furnished in the future shall operate on the 5 ampere secondaries of the instrument transformers and shall be designed for three phase, 220/110 volt, 60 cycle, 4 wire delta connected service consisting of three delta connected wires and a tap wire from the midpoint of one of the secondary windings of the 300 kva. transformer. Current transformers for General Electric type V-6-A, Cat. No. 97 x 133 or equal.

30B-08. MAGNETIC CONTACTORS FOR BLACKOUT:

Blackout contactors, relays and switch shall conform to drawing No. MB-751 and specification No. 700 including all addenda, and shall be furnished, installed and tested for satisfactory operation by the contractor.

30B-09. SAFETY SWITCHES:

The contractor shall furnish and install safety switches within sight of each motor, non-fused disconnecting type where starting equipment has thermal overload protection and properly fused type for unprotected starters. Switches shall be type "C" N.E.M.A.,

30B-09. (Cont'd).

designed for 220 volt service with ampere capacity as indicated or necessary, and enclosed in enameled general purpose enclosures.

Disconnecting switches for the wash water pump and the four pumping units shall be 600 ampere, 220 volt, three blade type with three renewable fuses, having 250 ampere, 220 volt capacity fusible elements.

Safety switches will not be required for unit heater motors.

30B-10 PANELBOARDS AND CABINETS:

The lighting and single phase power panelboards shall be deadfront type, with main non-fused disconnecting switches and branches consisting of single pole, tumbler switch and plug fuse units conforming to Federal Specification W-P-146; having a copper neutral bar and adequate size lugs for feeder wires. Fuses shall be 15 ampere size made in accordance with Federal Specification No. W-F-831.

The single phase power panelboard shall be a single row, narrow type and the lighting panelboard shall have two rows.

The cabinets shall be made of 0.109 inch thick sheet for surface mounting with $1\frac{1}{4}$ - $1\frac{1}{2}$ inch conduit knockout in the top center and 3/4 inch conduit knockouts in top and bottom. Gutter space shall be not less than 4 inches wide.

Trims of cabinets shall be door-in-door type with T-Handle locks and latches on each door, and having semi-flush hinges. Finish of cabinets and trims shall be not less than five coats of lacquer in a color to be approved by the Resident Officer-in-Charge.

30B-11. LIGHTING CIRCUITS AND FIXTURES:

The wiring for lighting circuits shall be three wire, single phase, 110/220 volts, 60 cycles, in colored braid, rubber-insulated No. 12 A. W. G. wire or larger to conform with Federal Specification No. J-C-106a for 600 volt wire or the equivalent wire of the 1940 National Electric Code known as "R-H", heat resistant wire. The wire connected to the 110 volt mid-point tap of one secondary winding of the transformer shall be referred to as the neutral wire and shall be colored white, the other two wires shall be black for side "A" and red for side "B". Wires larger than No. 6 A.W.G. need not be colored.

The lighting load shall be equalized in the branches by the contractor, that is, connections to consecutive outlets shall alternate with side "A" and "B" respectively, and the watts of side "A" to neutral shall closely approximate the watts total of side "B" to neutral. No branch lighting circuit shall exceed 1500 watts from side to neutral.

Enameled rigid conduit with threaded joints and 3/4 inch minimum diameter conforming to Federal Specification No. WW-C-571 shall be used for lighting circuits. Conduit fittings and 4 inch x 4 inch x $1\frac{1}{2}$ inch outlet boxes conforming to Federal Specification Nos. W-F-406 and W-O-821 a respectively shall be used. Cadmium plating and zinc-coating on fittings and outlet boxes will not be required.

Lighting fixtures furnished and installed by the contractor shall conform with fixture schedule on the drawing and the applicable sections of Navy Department Specification No. 9Ye, except that lacquered

30B-11 (Cont'd).

steel or urea gum fixture shells will be accepted in lieu of brass.

The contractor shall furnish and install 110 volt lamps for fixtures, inside frost type conforming to latest supplement of Federal Specification No. W-L-101c.

All receptacles shall be duplex type and local switches shall have non-breakable composition bodies, both shall be designed for 15 ampere, 110 volt service and conforming with Federal Specification Nos. W-R-151 and W-S-893 as modified to permit the use of plastic and plastic on steel receptacle and switch plates.

Porcelain keyless receptacles, designed to fit cover of a 4 inch x 4 inch x $1\frac{1}{2}$ inch outlet box, with 25 watt blue colored incandescent lamp shall be used for emergency blackout lighting fixtures marked "BOL" on the drawing.

A single weather-proof receptacle and cap made in accordance with plate No. 12, Navy Department Specification No. 9Ye, with approved alternate for cadmium plated brass plate shall be furnished and installed 48 inches above transformer pad.

30B-12. POWER WIRING:

Power wiring shall be installed as shown on the drawings or necessary for satisfactory operation of the equipment. Separate circuits shall be provided for each motor with wires of adequate size, proper number and with identifying colored braid for three wire, 220 volt, 60 cycle three phase service or two wire, 110 volt, 60 cycle, single phase service, installed in rigid steel conduit with threaded

30B-12. (Cont'd).

joints. Outlet boxes shall be 4 inch x 4 inch x 1½ inch. Wire shall conform to Federal Specification J-C-106a.

Steel wiring troughs and pull boxes shall be furnished and installed where indicated on the drawings. Wiring trough "A", 18" x 12" x 15'-0", and wiring trough "B", 12" x 12" x 28'-0", shall be drilled in the field for conduit connections; and wiring trough "C", 2½" x 2½" x 23'-0", shall have 3/4 and 1 inch conduit knockouts on top and bottom at about six inch intervals along entire length, and a hinged and latched front for easy access to the wiring.

Control and recorder wiring shall be No. 12 A.W.G. R. H. wire. Wiring for water softening equipment shall conform to the requirements of the manufacturers as indicated on the approved shop drawings.

Conduits installed for future apparatus shall be capped to keep out dampness.

30B-13. WELL MOTOR REMOTE CONTROLS:

The contractor shall furnish and install a metal cabinet with twenty "start and stop" push button stations with individual cardholders. These stations shall be used for remote control of well motors and shall be three wire or two wire type to conform with the requirements of the well motor starters. Cards shall be type written and shall clearly identify each well motor.

Control wires shall be lead sheathed, rubber covered, type RL, No. 12 A. W. G. copper wire or larger if necessary, furnished in twin or triple conductor cable as needed, and installed in 1 inch

30B-13(Cont'd)

rigid conduit and 4 inch diameter rigid steel under ground ducts.

30B-14. TELEPHONE CONDUIT AND OUTLET:

A utility outlet box and 3/4 inch rigid conduit shall be installed concealed in the second floor office for future telephone wiring. The outlet box, complete with one-hole plastic plate, shall be installed where shown on drawing No. MB-1736 and the 3/4 inch conduit shall extend from the outlet box to the rear exterior of the building terminating in a bushing for connection to future telephone drop wire.

30B-15. GROUNDING:

Separate grounds shall be furnished and installed by the contractor for the pole mounted lightning protectors, the transformer case of the unit substation, and the half-coil tap of the secondary winding. If flexible steel conduit is used for from end of rigid conduit to 75 horsepower motor, then an approved ground will be required at each such installation.

The ground connection shall be made with bare No. 2 stranded wire and a driven 1 inch diameter x 6 feet ground rod. Resistance shall not exceed 25 ohms. Top of rod shall be buried 2 feet under the soil surface.

Neutral bars of lighting and single phase power panelboards shall be insulated from the cabinets.

30B-16. TESTS:

After wiring and fixtures are installed, the electric circuits shall be tested for grounds, crosses, short-circuits, backfeeds,

30B-16. (Cont'd).

poor insulation and improper switch control with a 250-500 volt megger in the presence of a Navy Department electrical inspector. Insulation resistance shall conform to the following limits without fixtures or one-half these values with fixtures and lamps:-

Under 25 amperes	1,000,000 ohms
25 to 50 amperes	250,000 ohms
51 to 100 amperes	100,000 ohms
101 to 200 amperes	50,000 ohms

The wiring for 12,470 volts shall be tested as above, faults cleared, and then operating voltage shall be applied with all equipment connected for 30 minutes, and results shall be reported on the daily inspection form.

All faults shall be cleared at the expense of the contractor to the satisfaction of the Resident Officer-in-Charge.

WATER SOFTENING EQUIPMENT

SPECIFICATION 502

ADVANCE SPEC. "C"

1. INTENT:

It is the intent of this specification to obtain bids and guaranteed operating results on two different types of water softeners: (a) Those using the Lime-Soda process, wherein lime alone or lime and soda are introduced and mixed with the raw water and the insoluble compounds are removed by sedimentation and filtration; (b) Softeners using lime alone or in combination with soda, after which the removal of the insoluble compounds is accomplished by contact with a suitable catalyst followed by filtration.

General Conditions

2. QUALIFICATIONS; MANUFACTURERS & EQUIPMENT:

All of the equipment under this section shall be furnished complete by one manufacturer who is regularly engaged in the design and manufacture of equipment of this character.

Consideration will be given only to such treatment processes and equipment as have been thoroughly tried over a period of 2 or more years, and have proven successful under conditions comparable to those for which it will be used under these specifications. Bidders on this equipment shall submit exact information as to the treatment process and equipment which they propose to furnish together with a list of at least five comparable installations as above specified.

Bids will be considered only from manufacturers who maintain competent engineering service and who shall furnish such service to verify

the correctness of the installation, start the plant into operation and advise and instruct the Government's representative in the proper care, maintenance and operation of the plant.

3. OPERATOR TO BE FURNISHED:

The manufacturer to whom the award is made shall furnish a thoroughly skilled and competent operator to start and adjust the equipment and thereafter to take charge of the operation of the same for a period of 60 consecutive calendar days. The operator shall report for duty upon 48 hours notice from the Government and shall furnish his own keep and transportation to and from the site of operation. It shall be the duty of the manufacturer's agent to keep exact records of operation, to instruct the Government's employees in the operation, care and maintenance of the equipment and to leave with the Government's representative complete operating instructions.

4. GUARANTEEE & PERFORMANCE BOND:

Manufacturers shall clearly state the amount of lime, alum and/or other chemicals, including catalyst, required to treat one million gallons of raw water as specified under Paragraph 5. Lime shall be specified in terms (98% pure $CaOH_2$) and alum in terms of water soluble aluminum sulphate equivalent to not less than 17% alumina.

The Manufacturer, to whom the award is made, shall furnish bond in the full amount of the purchase price of the equipment to guarantee satisfactory operation and performance as stated in Paragraph 5.

The bond shall be executed by a Surety acceptable to the Government and shall remain in full force for a period of one year from the date

of starting the equipment into operation.

Bidders shall state the cost of the performance bond. This item shall be deductable from the purchase price of the equipment, if the Government shall elect to waive bond requirements.

5. CHEMICAL CHARACTERISTICS & REQUIREMENTS:

The equipment offered shall be adequate for treating 3 million gallons per 24 hours. The table below shows the characteristics of the raw water and the degree of softening required in the treated water, after filters and without recarbonation.

	Raw Well Water	Treated Water
Total hardness as $CaCO_3$	180 p.p.m.	68 p.p.m.
Calcium hardness " "	172 "	61 "
Magnesium " " "	8 "	7 "
Methyl Orange Alk. " "	194 "	74 "
Phenolthalein " " "	0 "	30 "
Caustic " " "	0 "	0 "
Free CO_2	20-30 "	0 "
pH	7.2- 7.7 "	9.4 "
Iron as Fe	1-3 "	0.1 "
Turbidity	15 "	0.2 "
Temperature	63° F.	

Turbidity before filtration shall not exceed 10 p.p.m.

6. DETERMINATION OF OPERATING RESULTS:

Operating results will be based upon laboratory determinations made in accordance with Standard Methods of Water Analysis of the

American Public Health Association: latest edition.

In the event that the normal chemical constituents of the raw water, at the time of any analysis, vary with the quantities as stated in Paragraph 2, a proportionate allowance shall be made to cover the difference between raw and treated water.

7. LIME-SODA PRECIPITATION PROCESS:

The apparatus in the softening tank shall include primary and secondary mixing and reaction chambers; a separation chamber; and means for producing a double circulation, one part of which shall be confined to the primary mixing chamber and the other part passed out of it through the secondary mixing chamber and the separation chamber with return flow to the primary mixing chamber.

The raw water and the chemicals required for treatment shall be combined in the primary mixing chamber with large volumes of continually returned slurry formed as a result of treatment, in a manner which provides intimate contact, hastens chemical reactions and carries them to completion with a minimum consumption of treating chemicals. Clarified water shall be displaced upwardly from the separation chamber to the clarified water outlet weir at the top of the tank.

8. SOFTENER STRUCTURE:

There shall be provided in the softening tank: (1) the necessary steel plates and structural shapes required for forming and supporting the primary and secondary mixing and reaction chambers, the outlet launder, the walkway and motor supports, and the slurry concentrator; (2) the

circulating propellers with shaft, bearings, electric motor and reducer; and (3) the piping, valves and fittings required for the sludge pick-up, drain and slurry removal lines, together with softener inlet and outlet connections. The plates and shapes herein specified shall be furnished in the fewest number of pieces practicable and shall be shipped knocked down, with all members rolled and punched, ready for field bolting and/or welding. Detail drawings and complete instructions shall be furnished with the equipment for its assembly and erection.

9. CAPACITY:

Equipment shall be capable of operation at rates of flow up to 2080 g.p.m.

10. STEELWORK:

Steel plates generally shall be 1/4-inch, properly braced and reinforced as required to withstand all imposed loads. Where needed the thickness of plates or other structural members, shall be increased to give adequate safety throughout. Steel shall be in accordance with Navy Department Specification No. 48-S8c, August 1, 1934.

11. PAINTING:

All steel plate and members shall be given a thorough coating of Ferric Oxide 65.2%; Lead Chromates 10.5%; and Silicates 24.3%.

12. WELDING:

All welding shall be in accordance with Bureau of Yards and Docks Specification No. 22Yb, October 1939.

13. PIPE CONNECTIONS AND WATERWAYS:

The equipment shall include all flanged ends, bell end, or

threaded pipe connections required to provide for influent, effluent, chemicals, waste, drains, and any other pipe connections ordinarily required. Flanges shall be 125 lb. American Standard faced and drilled. All pipe, valves, flumes, or other water passages required for operation inside of the softener shall be furnished to correct dimension by the equipment manufacturer.

14. MECHANICAL & ELECTRICAL EQUIPMENT:

The assembly shall include all mixing, stirring, and other devices, together with electric motors, starters, switches, reduction gears and other apparatus required and directly connected with the softener. Electric motors shall be wound for 208 volts, 3 phase, 60 cycles, 40° C. temperature rating in accordance with U.E.M.A. and Bureau of Yards and Docks Specification No. 9 Ye, June 1, 1939. Where intended for out-of-door use, all electrical equipment shall be completely weatherproof.

15. CHEMICAL FEEDERS:

Two dry chemical feeders of not less than 2-1/2 cu. ft. hopper capacity each shall be provided for alum. Two dry chemical feeders of not less than 5 cu. ft. hopper capacity shall be provided for hydrated lime.

Feeders shall be positive in action, shall not arch or clog, and shall have accurately calibrated dials or beams for adjustment of rate of feed.

Lime feeders shall have adjustable capacities from a minimum of 12.5 lbs. per hour to a maximum of 360 lb. per hour, and alum feeders from 1.5 to 60 lbs. per hour.

Lime feeders shall be constructed throughout to withstand the action of alkaline chemicals. Alum feeders shall be constructed throughout to withstand the action of acid chemicals.

Feeders shall have individual motor drives and shall be equipped with extension hoppers to be mounted above the build-on hoppers and connected thereto through chutes equipped with shut-off gates, the shut-off gates to be operated by means of rack and pinion gears and manual cranks. The extension hoppers shall extend through the chemical storage floor, which is approximately 10 ft. above the feeder room floor.

16. DISSOLVING BOXES:

Each dry feeder shall discharge into its individual mixing or dissolving box which shall also serve as a pump suction box. Each box shall be provided with a connection for make-up water supply and with a 1/2-inch float operated make-up water control valve.

Dissolving boxes for alum shall be especially constructed to induce rapid mixing and dissolving of the chemical by the swirling motion or agitation of the incoming make-up water.

17. MIXING BOXES:

The mixing boxes for lime shall be of steel with bowl-shaped bottoms and shall be equipped with electric motor driven propeller type mechanical agitators.

18. CHEMICAL PUMPS:

For delivering the alum solution to the point of application, there shall be provided, for each feeder, an electric motor driven, all bronze centrifugal pump with a capacity of approximately 5.0 g.p.m.

against a total head of 30 ft. Pump and motor shall be mounted on a cast iron base with provision for bolting to a concrete foundation. The pump discharge shall be fitted with a 1-1/2 inch brass check valve and 1-1/2 inch brass gate valve.

For delivering the lime mixture to the point of application, there shall be provided, for each feeder, a displacement type pumping unit suitable for handling the lime mixture. The pump and motor shall be mounted on a cast iron base with provision for bolting to a concrete foundation. The lime pump discharge shall be fitted with an iron gate valve.

19. ELECTRIC MOTORS:

All electric motors for feeders, pumps and other apparatus, shall be wound for 208 volts, 3 phase, 60 cycles and shall be in accordance with Bureau of Yards & Docks Specification No. 9 Ye, 40° rating.

20. AUTOMATIC PROPORTIONER:

There shall be furnished an automatic proportioner, to vayy automatically the rate of chemical feed in proportion to the rate of raw water flow. The proportioner shall be actuated by the differential head of the raw water venturi tube, and shall consist essentially of an actuator or differential converter connected directly with the venturi meter which shall transmit and govern by electrical control the rate of application of chemicals for each feeder.

21. BASIN LEVEL CONTROLLER:

The water level in and the flow of raw water to the treatment plant shall be regulated by a master control valve to be installed between the venturi meter and the softener, as shown on the plans. The control

valve shall be hydraulically operated by means of a pilot valve actuated through proper linking to a float riding the water level in the softener.

The control valve shall be 16-inch bell ends, double disc, square-end gate type, fully bronze mounted having guide surface extending the full length of the gate, especially designed for long life under conditions wherein it will be operated partially closed. The valve shall be suitable for operation with 25 lbs. per square inch water pressure against the gates and 50 lbs. pressure in the cylinder. The cylinder shall be seamless bronze with cast iron heads. The piston shall be double cup, best quality oak chrome leathers with cast iron backing plates and bronze piston and tail rod.

The actuator shall consist of a 12-inch diameter cylindrical copper float (with screw cap for oil loading) provided with guide rod, adjustable collar and control lever system to actuate and control automatically the flow of water so as to maintain levels within 2 inches above and below mean elevation as indicated on the plans. The operation shall be smooth, steady, and free from surging.

The float chamber or tank shall be 1/8-inch welded steel with brackets for wall mounting. The tank shall have a 1-inch threaded pipe connection in one end for connection with the softener channel. The pilot valve shall be piston operated, equipped with operating crank and with compensating mechanism.

ALTERNATE

WATER SOFTENING - CATALYTIC PROCESS

22. SCOPE:

The equipment offered under this process shall be adequate for treating three million gallons of water per 24 hours. The equipment shall be furnished in three units, each of one million gallons per 24 hours capacity. The assembly shall include the main shells or tanks, equipped with structural steel supports and connections for influent, effluent, chemical feed, waste catalyst, and all other openings required for operation.

The assembly shall include chemical feed equipment, chemical pumps, individual rate of flow controllers, and all other accessories required for operation and as herein specified.

General Conditions

23. QUALIFICATIONS, MANUFACTURERS AND EQUIPMENT:

The qualifications covering equipment and manufacturer shall be as stated in Paragraph 2.

24. OPERATOR TO BE FURNISHED:

The manufacturer shall furnish an operator and incidental services in accordance with Paragraph 3.

25. GUARANTEE AND PERFORMANCE BOND:

Guarantee and performance bond shall be in accordance with Paragraph 4.

26. CHEMICAL CHARACTERISTICS AND REQUIREMENTS:

The chemical characteristics of the water supply to be treated are as shown under Para. 5 of this specification.

The treated water shall be equal to the chemical characteristics as shown in Paragraph 5 of this specification, except that the Methyl Alkalinity shall be 74 p.p.m.

27. DETERMINATION OF OPERATING RESULTS:

The determination of operating results shall be in accordance with Paragraph 6.

28. CATALYTIC PROCESS:

The process shall be carried out in tanks, preferably conical in shape, and of such dimensions as will produce the required initial and final velocities of flow for obtaining the must effective results.

The process shall include the addition of lime to the raw well water and its upward passage through the tanks containing the catalyst, the contact period to be such that the precipitates will cling to or "plate out" on previously formed precipitates. Mechanically driven agitators or paddles shall not be required for proper operation. The raw water and chemicals shall be introduced at the bottom of the cone. Treated water shall leave the tank at its top through a collecting system designed to give uniform flow throughout its entire travel within the tank.

29. SOFTENER STRUCTURE:

The tanks shall be of sufficient capacity to provide ample contact period between incoming water and catalyst for the removal of hardness, iron and other mineral content at the stated rate of flow and to the degree specified in Paragraph 5.

The tanks shall be fabricated from 1/4-inch steel plates with watertight welded joints.

Each tank shall be supported by structural steel legs equipped with steel plate shoes for bolting down to a concrete base slab.

The assembly shall be strong and rigid with structural members of ample strength to safely carry all imposed loads and stresses including wind load. Structural steel shall be in accordance with Navy Dept. Specification No. 48-S8c, August 1, 1934. The various parts of the equipment shall be factory fabricated to such dimension as will permit easy transportation with the least possible amount of field work. Welding shall be in accordance with Bureau of Yards & Docks Specification No. 22Yb, October, 1939.

30. PIPE CONNECTIONS:

The influent connection shall be 6 inches internal diameter. The effluent connection shall be 10 inches diameter. The waste catalyst outlet shall be not less than 4 inches diameter. The chemical inlets shall be not less than 2 inches diameter. All pipe connections shall be equipped with 125 lb. flanges, faced and drilled American Standard.

31. PAINTING:

Before shipment all metal parts shall be thoroughly primed with the following mixture: Ferric Oxide, 65.2%; Lead Chromates, 10.5%; Silicates, 24.3%.

32. RATE OF FLOW CONTROLLERS:

Positive rate of flow controllers shall be furnished for installation in the 8-inch influent line of each softener. Controllers shall be for a normal discharge of 700 g.p.m. with manual adjustment to

rates of flow 50% above or below normal. Control valves shall be hydraulically operated by self contained diaphragm mechanism mounted on the venturi tube. Valve bodies and working parts shall be of non-corrosive materials accurately machined and fitted to give long life.

33. RATE OF FLOW INDICATORS:

Each softener unit shall be equipped with a manometer type rate of flow indicator calibrated to read directly in gallons per minute. Manometers shall be of rugged construction for out-of-door use and shall be furnished complete with mercury or liquid and all immediate pipe, fittings, and control valves.

34. LIME FEED EQUIPMENT: *See Addendum #1*

For the application of hydrated lime solution, tanks and chemical pumps shall be used.

Four tanks shall be furnished each to measure 6 ft. 6 inches diameter by 5 ft. 6 inches deep at the center. Tanks shall have ~~bowl~~ *Flat* ~~shaped~~ bottoms and shall be constructed of 3/16 inch steel plate, reinforced as required to maintain true shape during transportation and when in service.

Tanks shall be of welded construction, perfectly watertight arranged for service as follows:

Two tanks will be placed on the lower floor level with their bottoms at Elevation 24.5 and their tops at Elev. 30.0 These tanks shall have 4 short legs each for mounting directly on a concrete floor.

Two tanks will be installed directly above with their tops at Elevation 39.5 and their bottoms at Elevation 34.0. This pair of tanks

shall have 4 structural steel legs each, which shall straddle the two tanks set at the lower level. Lime slurry will be mixed and fed from the high level tanks to the low level tanks, and will be pumped from the low level tanks to the softeners.

See Addendum #1

Each tank shall be equipped with a propeller type agitator driven by a vertical shaft motor. Motors shall not exceed 1750 R.P.M. and shall have ample power for starting after being shut down with the tank full of slurry. An automatic low level cut out shall be provided to stop the motor and agitator before the tank is completely empty.

Agitator assembly shall be self contained in each tank, with motor rigidly mounted on top and with ample guides and shaft bearings to produce smooth trouble free operation without vibration. Agitators shall maintain a uniform suspension of lime.

The two high level tanks shall each have one bottom connection with 2-1/2 inch standard pipe threads. The two low level tanks shall each have one 2-inch standard pipe thread connection 6 inches above the bottom. One 2-inch ball float cock shall be provided for each low level tank to maintain proper liquid level.

High level tanks shall be equipped with tight-fitting covers, charging doors and hydraulically operated dust evacuators.

35. LIME FEED PUMPS:

Four identical plunger type chemical pumps shall be furnished for discharging lime slurry to the softeners. Pumps shall have positive and easily regulated rates of discharge actuated by adjusting length of stroke. The rate of discharge shall be clearly shown on a graduated scale.

Pumps shall be capable of adjustment 50% above or below the normal rate of discharge which the manufacturer shall specify as best suited for his treatment process when using 5% slurry from hydrated lime of good quality.

Pumps shall be constructed throughout to give the highest possible efficiency without clogging. All parts shall be from materials best suited to withstand the action of lime slurry.

36. ALUM FEED EQUIPMENT:

Alum feed equipment if required shall consist of two identical units, equipped with dissolving tanks, of sufficient combined capacity for 8 hours treatment of 5 million gallons without recharging. Dissolving tanks shall be steel with non-corrosive linings and shall be equipped for mounting on concrete floor. Standard threaded 1-inch pipe taps shall be provided for supply to pump suctions. Tanks shall be equipped with low level contact switches for stopping the chemical pumps taking suction therefrom.

The manufacturer shall fully describe equipment of this character, if the same is required for his process, including all details of assembly, operation and character of materials used throughout. Alum feed shall be adjustable to 50% above or below normal and shall be capable of maintaining an accuracy of 2% above or below the rate of dosage selected.

37. ALUM FEED PUMPS:

Alum feed pumps shall take suction from the dissolving or solution tanks and shall discharge into the softeners. Pumps shall be equipped with electric motors operating at not to exceed 1750 R.P.M. Pumps shall be constructed throughout of acid-proof bronze or other

SECTION 24

VENTURI VAULT

24-01. Venturi Vault:

The treated water venturi meter shall be placed in a concrete vault at the location shown on the drawings. The vault shall be constructed of Class D-1 concrete with standard finish. The top slab shall be in two parts and shall be removable. A light weight cast iron frame and cover shall be provided in the top slab and cast iron manhole steps shall be set in the side wall directly beneath the opening, as shown on the drawings.

24-02. Venturi Vault Drain:

A 4-inch cast iron trapped drain with cast iron strainer shall be set in the bottom of the vault and a 4-inch vitrified drain pipe shall be run from the trap to Manhole 88-G as shown on the drawings.

24-03. Sleeves:

Pipe sleeves 2-inch diameter shall be left in the vault walls through which to carry the 1-inch differential pipes.

24-04. Painting:

The venturi tube and connecting pipes within the concrete vault shall be coated with coal tar base enamel.

Painting shall be in accordance with Section 42.

SECTION 24

VENTURI VAULT

24-01. Venturi Vault:

The throated water venturi meter shall be placed in a concrete vault at the location shown on the drawings. The vault shall be constructed of Class D-1 concrete with standard finish. The top slab shall be in two parts and shall be removable. A light weight cast iron ring and cover shall be provided in the top slab and cast iron manhole steps shall be set in the side wall directly beneath the opening, as shown on the drawings.

24-02. Venturi Vault Drain:

A 4-inch cast iron trapped drain with cast iron strainer shall be set in the bottom of the vault and a 4-inch vitrified drain pipe shall be run from the trap to Manhole 68-0 as shown on the drawings.

24-03. Blow-off:

The blow-off 8-inch diameter shall be left in the vault walls through which to carry the 1-inch diffenential pipes.

24-04. Piping:

The venturi tube and connecting pipe within the concrete vault shall be painted with coal tar base enamel.

All piping shall be in accordance with Section 42.

SECTION 24

VENTURI VAULT

24-01. Venturi Vault:

The treated water venturi meter shall be placed in a concrete vault at the location shown on the drawings. The vault shall be constructed of Class D-1 concrete with standard finish. The top slab shall be in two parts and shall be removable. A light weight cast iron frame and cover shall be provided in the top slab and cast iron manhole steps shall be set in the side wall directly beneath the opening, as shown on the drawings.

24-02. Venturi Vault Drain:

A 4-inch cast iron trapped drain with cast iron strainer shall be set in the bottom of the vault and a 4-inch vitrified drain pipe shall be run from the trap to Manhole 88-G as shown on the drawings.

24-03. Sleeves:

Pipe sleeves 2-inch diameter shall be left in the vault walls through which to carry the 1-inch differential pipes.

24-04. Painting:

The venturi tube and connecting pipes within the concrete vault shall be coated with coal tar base enamel.

Painting shall be in accordance with Section 42.

SECTION 24:

VENTED VAULT.

24-01. Vented Vault:

The trapped water vault shall be placed in a concrete vault at the location shown on the drawings. The vault shall be constructed of class D-4 concrete with standard finish. The top slab shall be in two parts and shall be removable. A light weight cast iron frame and cover shall be provided in the top slab and cast iron manhole steps shall be set in the wall directly beneath the opening, as shown on the drawings.

24-02. Vented Vault Drain:

A 6-inch cast iron trapped drain with cast iron strainer shall be set in the bottom of the vault and a 4-inch vitrified drain pipe shall be run from the trap to Manhole 88-G, as shown on the drawings.

24-03. Sleeves:

Pipe sleeves 2-inch diameter shall be left in the vault walls through which to carry the 1-inch diameter pipes.

24-04. Painting:

The vented tube and connecting pipes within the concrete vault shall be coated with coal tar base enamel.

Painting shall be in accordance with Section 42.

13-04. Register-Indicator-Recorder:

The register-indicator-recorder instrument procured under Spec. 502, Advance Spec. "D", shall be installed on the pump room balcony at the location shown on the drawings and shall be connected with the differential pipes from the venturi meter after the same have been thoroughly flushed and are free from sediment and air. The instrument shall be set and adjusted in accordance with the manufacturers' drawings and instructions and shall receive final check and adjustment by the manufacturers' representative so that the registration is within the specified range of accuracy. Electrical connections shall be made to the recording instrument in accordance with Section 30.

13-05. Painting:

The venturi meter and connecting pipes outside of the building shall be thoroughly coated with an approved coal tar base enamel applied in accordance with Section 42.

SECTION 14

WATER SOFTENING

14-01. Scope of the Work:

Three 1-M.G.D. water softening units, of the catalytic process type, together with chemical feed apparatus and appurtenances have been procured under Specification 502, Advance Spec. "C". This equipment is to be erected complete with all appurtenances as shown on the drawings and is to be operated for a period of 60 days by the manufacturers' representative, during which period correct dosage of chemicals and operating routine will be established.

The three softener units shall be set up and all pipe connections shall be made in exact accordance with the dimensions and elevations as shown on the drawings. The manufacturers' representative shall check the entire installation and shall put the plant into operation after erection has been completed.

14-02. Influent and Effluent Piping:

Piping shall be bell and spigot or flanged cast iron as indicated on the plans. Bell and spigot pipe shall be Class "B" or Class 100. Bell and spigot fittings shall be Class "D" for 12-inch and smaller and Class "B" for larger sizes. Flanged pipe and fittings shall be Class "B" with 125 lb. American Standard flanges faced and drilled.

Pipe, fittings, and valves shall be made up and joined as specified under Section 8.

14-03. Pipe Supports:

Pipe supports shall be made of the material as indicated on the

SECTION 15

WATER SUPPLY

1501. Scope of the Work.

Three 3-wire, D. water softening units, of the newly le process type, together with chemical feed apparatus and appurtenances have been procured under Specification 503, Alternate Spec. "C". This equipment is to be erected complete with all appurtenances as shown on the drawings and is to be operated for a period of 60 days by the manufacturers' representative, during which period correct dosage of chemicals and operating routine will be established.

The three softener units shall be set up and all pipe connections shall be made in exact accordance with the dimensions and elevations as shown on the drawings. The manufacturers' representative shall check the entire installation and shall put the plant into operation after erection has been completed.

1502. Pipework and Fittings.

Piping shall be hard and seamless or flanged cast iron as indicated on the plans. Bell and spigot pipe shall be Class "B" or Class 150. Bell and spigot fittings shall be Class "B" for 125-lbsh and smaller and Class "D" for larger sizes. Flanged pipe and fittings shall be Class "B" with 125 lb. screwed Standard flanges faced and drilled.

Pipe, fittings, and valves shall be made up and joined as specified under Section 9.

1503. Valves, Hydrants.

Valves shall be of the material as indicated on the

14-03. (Cont'd)

drawings and shall be placed as shown, including piers, saddles, and brackets.

14-04. Gate and Check Valves:

Gate valves shall be iron body, bronze mounted, double disc, A.W.W.A. standard non-rising stem or outside screw and yoke equipped with hand wheels, as shown on the drawings. Valves shall be suitable for 50 lbs. working pressure and shall be flanged or bell end as indicated.

Check valves shall be standard iron body, bronze mounted, with flanged ends suitable for 50 lbs. working pressure.

14-05. Waste Piping and Valves:

Waste piping for draining spent material from the softeners shall be of standard weight black steel threaded pipe with malleable or cast iron fittings. Valves shall be iron body, bronze mounted, double disc or solid wedge with flanged ends suitable for 50 lbs. working pressure.

14-06. Rate-of-Flow Controllers:

Three rate-of-flow controllers have been procured under Specification 502, Advance Spec. "C". These controllers are self-contained units with flanged ends. They shall be set in accordance with the manufacturers' recommendations and shall be checked and adjusted by the manufacturers' representative.

Each controller shall be equipped with a manometer to indicate the rate of flow in gallons per minute.

14-07. Drainage:

A cast iron floor drain with perforated or grating type cover

Sheet Steel Ro...

A cast iron floor drain with adjustable or flushing type cover...

14-03. Pipe Joints:

Drainage work shall be piped as shown, including plugs, caps, and bushings, and by others.

14-04. Valves and Check Valves:

Brass valves shall be iron body, bronze mounted, double disc, rising stem, standard non-rising stem or outside screw and yoke equipped with wheels, as shown on the drawings. Valves shall be suitable for 50 lbs. working pressure and shall be flanged or bell end as indicated.

Check valves shall be standard iron body, bronze mounted, with flanged ends suitable for 50 lbs. working pressure.

14-05. Pipe to Piping and Valves:

Brass nipples for drinking sprays material from the manufacturers shall be of standard weight black steel shrouded pipe with malleable or cast iron fittings. Valves shall be iron body, bronze mounted, double disc or solid wedge with flanged ends suitable for 50 lbs. working pressure.

14-06. Back-of-Flow Counterators:

Three vacuum-of-flow controllers have been procured under Specification 1065, Maximum Speed, "C". These controllers are self-contained units with flanged ends. They shall be set in accordance with the manufacturers recommendations and shall be checked and adjusted by the manufacturers representative.

Each controller shall be equipped with a manometer to indicate the rate of flow in gallons per minute.

14-07. Part 7 - Pe:

14-07. (Cont'd)

shall be installed together with 4-inch cast iron drain line and cleanout as shown on the drawings.

14-08. Overflow Tank:

An overflow tank constructed of 3/16-inch welded steel plate with double weirs, an 18-inch flanged inlet, a 16-inch flanged future connection and one 12-inch flanged drain shall be installed as shown on the plans. The 16-inch flange shall be blanked off. The two overflow weirs shall be adjustable for vertical movement, the normal crest shall be El. 36.0, the maximum and minimum elevations, 36.1 and 35.8 respectively. Piping to overflow tank shall be as shown on the drawings.

14-09. Chemical Feed Equipment:

Chemical feed equipment has been procured under Spec. 502, Advance Spec. "C", including Addendum No. 1, in which the lime mixing tanks have been changed from bowl shaped to flat bottoms.

Low speed agitators will be used in lieu of high speed agitators originally specified.

The upper level tanks will be equipped with tight fitting covers, charging doors and dust evacuators. The low level tanks will not be so equipped. The assembly will include 4 chemical feed pumps of the displacement type complete with electric motors and drive mechanism.

14-10. Lime Mixing and Feed Tanks:

Two tanks shall be placed on the lower floor level with their tops at Elev. 30.0. These tanks shall be furnished with 4 short legs each for mounting directly on the concrete floor.

14-09. (Contd)

all be installed together with 4-inch cast iron drain line and clean-out as shown on the drawings.

14-08. Overflow Tank:

An overflow tank constructed of 3/16-inch welded steel plate with double walls, an 18-inch flanged inlet, a 16-inch flanged future connection and one 12-inch flanged drain shall be installed as shown on the plans. The 16-inch flange shall be blanked off. The two overflow weirs shall be adjustable for vertical movement, the normal crest shall be El. 30.0, the maximum and minimum elevations, 36.1 and 26.8 respectively. Piping to overflow tank shall be as shown on the drawings.

14-09. Chemical Feed Equipment:

Chemical feed equipment has been removed under Spec. 802, Advance Spec. "C", Excluding Addendum No. 1, in which the lime mixing tanks have been changed from bowl shaped to flat bottoms.

Low speed agitators will be used in lieu of high speed agitators originally specified.

The upper level tanks will be equipped with vight-fitting covers, charging doors and dust evacuators. The low level tanks will not be so equipped. The assembly will include a chemical feed pump of the displacement type complete with electric motors and drive mechanism.

14-10. Lime Mixing and Feed Tanks:

Two tanks shall be placed on the lower floor level with their tops at Elev. 30.0. These tanks shall be furnished with 4 or at legs each for mounting directly on the concrete floor.

14-10. (Cont'd)

Two tanks shall be installed directly above with their tops at Elev. 39.5. This pair of tanks shall have 4 structural leg. each which shall straddle the two tanks set at the lower level.

Lime slurry will be mixed and fed from the high level tanks to the low level tanks and will be pumped therefrom to the softeners.

14-11. Lime Tank Piping -Cold Water:

The high level tanks shall take cold water, for mixing lime, through a 2-inch black steel line to terminate at a 1-1/2 inch standard disc meter. From the meter, separate 1-1/2 inch branch lines of black steel pipe shall be run to serve each tank. Branch lines shall be equipped with 1-1/2 inch threaded iron body, bronze mounted, solid wedge gate valves suitable for 150 lbs. working pressure.

The low level tanks shall be equipped exactly as above specified.

The two high level tanks shall be equipped with tight fitting covers, charging doors, and hydraulically operated dust evacuators. A 3/4-inch black steel pipe with gate valve control shall be installed to serve the evacuators.

14-12. Meters:

The meters for measuring water supply to lime tanks shall be 1-1/2 inch disc type, capable of measuring 100 gallons per minute, safe working capacity, constructed of non-corrosive materials in accordance with A.W.W.A. specification. Meters shall have split cases and straight reading registers, in U.S. gallons, with dial graduations which will permit accurate reading

14-10. (Cont'd.)

Two tanks shall be installed directly above with their tops at May. 850'. This pair of tanks shall have 4 structural legs, each which shall straddle the two tanks set at the lower level.

Lime slurry will be mixed and fed from the High Level tanks to the low level tanks and will be pumped therefrom to the softeners.

14-11. Lime Tank Piping - Cold Water.

The high level tanks shall take cold water, for slaking lime, through a 1-inch flanr steel line to terminate at a 1-1/2 inch standard disc meter. From the meter, separate 1-1/2 inch bronze lines of black steel pipe shall be run to serve each tank. Branch lines shall be equipped with 1-1/2 inch chromed iron body, bronze mounted, solid wedge gate valves suitable for 150 lbs. working pressure.

The low level tanks shall be equipped exactly as above specified.

The two-high level tanks shall be equipped with tight fitting covers, clapping doors, and hydraulically operated dust evacuators. A 3/4-inch blank steel pipe with gate valve control shall be installed to serve the evacuators.

14-12. Meters:

The meters for measuring water supply to lime tanks shall be 1-1/2 inch disc [illegible] capable of measuring 100-gallons per minute, with working capacity, as [illegible] of non-corrosive material to be used with A.W.W.A. specifications. Meters shall have by-pass and strainer reading registers in U.S. [illegible] with dial graduations which will permit accurate reading

14-12. (Cont'd)

to 10 gallons. Meters shall be equipped with American Standard flanged ends and shall be installed as shown on the plans.

No water shall pass through the meters except that used for charging the four tanks.

14-13. Lime Tanks - Drainage Piping:

Drain lines from evacuators shall be 2-inch black steel, discharging into a 6-inch waste stack as shown on the drawings. Drainage piping shall be equipped with unions and cleanout plugs for easy maintenance.

14-14. Lime Tanks- Chemical Piping:

Each high level tank shall be equipped with 2-1/2 inch black steel transfer pipes extending vertically from their bottoms to convey lime slurry to the two low level tanks. Each transfer pipe shall be equipped with a gate valve and unions for quick dissembly. The transfer pipes shall discharge into the low level tanks through ball float valves set in low tanks and adjusted to maintain constant liquid level and to prevent overflowing.

Lime slurry from the low level tanks shall be conveyed to the chemical feed pumps through the valved manifold system of 2-inch black steel pipe, so valved as to permit each of three pumps to serve a given softening unit independently of the others. The fourth chemical pump will be held in reserve.

From the pipe manifold each pump suction shall be served by a length of 1-1/2 inch rubber covered, smooth bore suction hose, equipped at each end with a 1-1/2 inch female pipe thread connection.

14-13. (Cont'd)

to 10 gallons. Meters shall be equipped with American Standard flanged ends and shall be installed as shown on the plans.

No water shall pass through the meters except that used for charging the lime tanks.

14-13. Lime Tanks - Drainage Piping

Drain lines from evaporators shall be 2-inch black steel, discharging into 6-inch waste stack as shown on the drawings. Drainage piping shall be equipped with unions and cleanout plugs for easy maintenance.

14-14. Lime Tanks - Chemical Piping:

Each high level tank shall be equipped with 2-1/2 inch black steel transfer pipes extending vertically from their bottoms to convey lime slurry to the two low level tanks. Each transfer pipe shall be equipped with a gate valve and unions for quick disassembly. The transfer pipes shall discharge into the low level tanks through ball float valves set in low tanks and adjusted to maintain constant liquid level and to prevent overflowing.

Lime slurry from the low level tanks shall be conveyed to the chemical feed pumps through the valved manifold system of 2-inch black steel pipe, so valved as to permit each of three pumps to serve a given softening unit independently of the others. The fourth chemical pump will be held in reserve.

From the pipe manifold each pump suction shall be served by a length of 1-1/2 inch rubber covered, smooth bore suction hose, equipped at each end with a 1-1/2 inch female pipe thread connection.

14-14. (Cont'd)

Hose connections shall be of malleable iron securely held in place by hose clamps.

Discharge from each of three pumps shall be carried to individual softening units through 1-1/2 inch 3 braid smooth bore water hose, coupled each end, as above described.

The fourth or reserve chemical pump shall be equipped with suction and discharge hoses, as above described, the length of suction hose to be sufficient to reach from any manifold outlet to any pump and the discharge hose to reach from any pump to any of the softening units.

14-15. Lime Feed Pumps:

The four lime feed pumps shall be located as shown on the drawings.

The concrete foundation provided for these pumps shall be level and shall be finished to a true, smooth surface. The pumps shall be bolted in position without straining or warping the assembly.

Electrical connections and details shall be as specified in Section 30. Each pump motor shall have an automatic cutout actuated by low liquid level in the lime mixing tanks as called for in Specification 502, Advance Spec. "C".

14-16. Chemical Storage Hoist:

The Contractor shall procure and install an electric hoist to operate on a monorail, complete with canvas sling for hoisting chemicals to the storage space provided in the chemical feed and storage building. The hoist shall have a capacity of 2000 lbs. with a lifting speed of 20 feet per minute and a total lift of 20 feet.

Sheet 8 of 8

14-16. (Cont'd)

The hoist shall be of the low head type supported on four wheel trolleys. The hoisting machine shall be totally enclosed to protect the working parts from the action of chemical dust. The drive from motor to hoist shall be a noiseless, endless chain, or gears which shall be fully enclosed in drip-proof housing.

The electric motor shall be wound for 220 volts, 3 phase, 60 cycles and shall be equipped with push button control to be located on the rear wall of the building adjacent to the opening in the floor.

The electrical control shall include overload and undervoltage protection and upper and lower limit switches to stop the hoist when the cable has reached the end of its travel.

Sufficient control cable shall be provided to permit the hoist to move along the monorail for a distance of 8 feet from the center of the opening in the storage room floor.

The monorail track shall be 8 feet long with suitable stops at either end and shall be of the type which will allow maximum head room.

The monorail track will be fastened to a concrete beam in the ceiling of the storage room.

The assembly shall be suitable for operation under the following conditions:

Chemicals will be raised from the lower floor at elevation 27.5 to the upper floor at elevation 37.0 through a 4 x 4 foot opening. The monorail track will be fastened to the under side of a concrete beam at elevation 46.20. The ceiling elevation is 47.37.

Article. (Cont'd)

The hoist shall be of the low head type supported on four wheel trolleys. The hoisting machine shall be totally enclosed to prevent the working parts from the action of chemical dust. The drive from motor to hoist shall be a molesious, endless chain, or gears which shall be fully enclosed in drip-proof housing.

The electric motor shall be wound for 220 volts, 3 phase, 60 cycles and shall be equipped with push button control to be located on the rear wall of the building adjacent to the opening in the floor.

The electrical control shall include overload and undervoltage protection and upper and lower limit switches to stop the hoist when cable has reached the end of its travel.

Sufficient control cable shall be provided to permit the hoist to move along the monorail for a distance of 8 feet from the center of the opening in the storage room floor.

The monorail track shall be 8 feet long with suitable stops at either end and shall be of the type which will allow maximum head room.

The monorail track will be fastened to a concrete beam in the ceiling of the storage room.

The assembly shall be suitable for operation under the following conditions:

Materials will be raised from the lower floor at elevation 87.5 to the upper floor at elevation 97.0 through a 4 x 8 floor opening. The monorail track will be fastened to the under side of a concrete beam at elevation of 90. The ceiling elevation is 47.67.

14-16. (Cont'd)

A heavy canvas sling 3 feet wide by 9 feet long equipped with a metal spreader at each end shall be furnished for hoisting bags of chemicals. Each spreader shall be equipped with means for fastening to the hoist hood so that the load will be uniformly distributed within the sling.

14-17. Painting:

Influent and effluent piping shall be coated with coal tar base enamel.

Metal pipe supports shall be painted the same color and with the same material as the pipes which they support.

Gate and check valves shall be painted the same color and with the same material as the connecting pipes.

The overflow tank and connecting pipes shall be coated with coal tar base enamel. Lime tank piping shall be painted light gray including all chemical and drainage piping. Brass valves and fittings shall not be painted.

Lime feed pumps shall be painted the same color as the original coating.

The three steel softening units shall be painted medium gray.

The four lime feed and mixing tanks including supports, etc. shall be painted light gray. All painting shall be done in accordance with Section 42.

Page 8 of 8

SECTION 15

RECARBONATION

15-01. Scope of the Work:

It is the intent to procure and install equipment and apparatus complete in every detail with which to recarbonate the treated water immediately after softening and before filtering.

The chemical and physical characteristics of the softened water are shown in Para. 5, Specification 502, Advance Spec. "C".

The equipment shall have ample capacity for recarbonating 3 M.G.D. and shall be complete in every detail and ready to operate. The equipment shall be capable of cooling, scrubbing, drying, compressing, and applying not less than 1000 lbs. of carbon dioxide per 24 hours, from flue gas generated by oil burner and containing about 10% of carbon dioxide gas.

15-02. Recarbonation Tank:

The recarbonation tank shall be constructed to the dimensions and elevations as shown on the drawings and shall be equipped with 24-inch inlet and outlet pipes, wood baffles and gas manifold and grid system.

15-03. Foundation Under Tank:

The tank will be constructed on refilled material extending from Elevation 12.70 to Elevation 25.00.

Fill shall consist of pure sand free from clay, loam or other foreign matter, deposited in layers and flooded with water so that each layer will thoroughly compact upon the material previously placed. Fill shall be made as far in advance of pouring concrete as possible. No concrete shall be poured until all evidence of settling has ceased. If

SECTION 15

MECHANICAL EQUIPMENT

15-01. Scope of the Work.

It is the intent to provide and install equipment and appurtenances complete in every detail which is required by the specifications and as shown on the drawings. The equipment shall be complete in every detail and ready to operate. The equipment shall be capable of cooling, scrubbing, drying, compressing, and supplying not less than 1000 lbs. of carbon dioxide per 24 hours, from flue gas conveyed by oil burner and containing about 10% of carbon dioxide gas.

15-02. Recarbonation Tanks.

The recarbonation tank shall be constructed to the dimensions and elevations as shown on the drawings and shall be equipped with 24-inch inlet and outlet pipes, wood baffles and gas manifold and grid system.

15-03. Tank Underdrain Under Tanks.

The tank will be constructed on refilled material excluding from Elevation 19.93 to Elevation 20.93.

Fill shall consist of pure sand free from clay, loam or other foreign and or, deposited in layers and flooded with water so that each layer will thoroughly compact upon the a before previously placed. Fill shall be made as far in advance of pouring concrete as possible. No concrete shall be poured until all evidence of settling has ceased. If

15-03. (Cont'd)

called for by the Government's representative, a load test shall be placed upon the filled material. Safe loading shall be 1500 lbs. per square foot without settlement.

15-04. Concrete:

Concrete shall be Class E-1 with smooth troweled finish.

Where this tank adjoins the existing clear water storage tank, chemical feed building, and spiractor pit wall, asphalt impregnated felt 1/2-inch thick shall be so placed as to form a continuous filler between the two walls. This for the purpose of preventing excessive load on the existing structure should the recarbonation tank tend to settle or shift on the filled material.

ALTERNATE

15-05. Gas Piping and Distribution:

Piping from the compressor to the tank and all gas piping within the tank shall be Class "B" cast iron with cast iron fittings. The main gas header shall be of 6-inch Class "B" cast iron pipe installed on the bottom of the tank. The header shall be drilled and tapped with standard pipe threads to take 1-1/4 inch cast iron laterals spaced on 12-inch centers with 3/32-inch holes spaced on 4-inch centers.

Laterals shall be capped on their outer ends, with a 3/32-inch hole drilled in the center of each cap, the overall length to be such that the ends of the laterals will clear the sidewalls of the tank by 2-1/2 inches, the tank being 8' 6" inside width.

15-02. (Cont'd)

called for by the Government Representative. Load test shall be placed upon the filled material. Safe loading shall be 1500 lbs. per square foot without deflection.

15-04. Concrete:

Concrete shall be Class "B-1 with smooth troweled finish.

Before this tank and/or the existing clear water storage tank, chemical feed building, and splitter pit wall, asphalt impregnated felt 1/2-inch thick shall be so placed as to form a continuous filler between the two units. This for the purpose of preventing excessive load on the existing structure should the reservoir tank tend to buckle or shift on the filled material.

PLUMBING

15-05. Gas Piping and Distribution:

Piping from the compressor to the tank and all gas piping within the tank shall be Class "A" cast iron with cast iron fittings. The main gas header shall be of 6-inch Class "B" cast iron pipe installed on the bottom of the tank. The header shall be drilled and tapped with standard pipe threads to take 1-1/4 inch cast iron laterals spaced on 13-inch centers with 3/32-inch holes spaced on 4-inch centers.

Lateral shall be capped on their outer ends, with a 3/32-inch hole drilled in the center of each cap, the overall length to be such that the ends of the laterals will clear the sidewalls of the tank by 4-1/2 inches, the tank being 8' 6" inside width.

15-05. (Cont'd)

The 6-inch header shall be laid on the longitudinal center line of the tank and shall be plugged at each end.

Laterals shall be installed at right angles to the header with orifice holes pointing down.

The entire assembly shall be made up tight and shall be blocked up neatly so that it will remain in correct position. Care shall be taken to keep orifice holes clear of obstruction.

15-06. Alternate - Gas Piping and Distribution:

In lieu of the cast iron pipe specified in Para. 15-05, cement-asbestos pipe will be favorably considered for gas distribution inside the recarbonation tank and elsewhere provided that comparable results will be secured.

Capacity, drilling and general arrangement of the assembly shall be as specified in Para. 15-05.

15-07. Gas Generating Equipment- Intent:

Flue gas shall be generated from light fuel oil by means of an oil burner to be used in connection with a standard hot water boiler.

15-08. Boiler:

The boiler shall be of the cast iron sectional type, fitted with front plate and trim for oil burning operation. The boiler shall be approximately 26-3/4 inches wide by 32-5/16 inches long over the sections, and shall be furnished complete with 9-inch smoke pipe connection, gauge for registering temperature and head pressure, front plate, 10-inch high base,

15-05. (Continued)

The 6-inch header shall be laid on the longitudinal center line of the tank and shall be plugged at each end.

A tubercle shall be installed at right angle to the header with orifice facing upward.

The entire assembly shall be made up tight and shall be blocked up neatly so that it will remain in correct position. Care shall be taken to keep orifice holes clear of obstruction.

15-06. Alternate - Pipe Piping and Distribution:

In lieu of the cast iron pipe specified in Para. 15-05, concrete-bonded fir will be favorably considered for gas distribution inside the tank and elsewhere provided that comparable results will be secured.

Quantity, drilling and general arrangement of the assembly shall be as specified in Para. 15-05.

15-07. Gas Generating Equipment:

Fire gas shall be generated from light fuel oil by means of an burner to be used in connection with a standard hot water boiler.

15-08. Boiler:

The boiler shall be of the cast iron sectional type, fitted with front plate and trim for oil burning operation. The boiler shall be approximately 26-1/4 inches wide by 32-5/16 inches long over the sections, and shall be furnished complete with 9-inch smoke pipe connection, jacket for registering temperature and head pressure, front plate, 10-inch high base,

15-08. (Cont'd)

flue doors, fire door, push nipples, draw bolts, etc. Boiler shall carry a manufacturers' rating of not less than 640 sq. ft. of hot water radiation based on a heat emission of 150 b.t.u. per square foot. Boiler shall be warranted for a water working pressure of not less than 30 p.s.i.

15-09. Water Induction Valve:

Water induction valve shall be 1/2-inch Sylphon, or approved equal, bellows type valve, thermostatically controlled from the boiler water temperature by a thermal bulb and a capillary tube. Valve and control shall be adjustable over a range of 100° to 150° F. The valve shall be installed on the inlet side of the boiler, the outlet to be free to discharge as shown on the plans.

15-10. Oil Burner:

The oil burner shall be of the atomizing gun type for flange mounting in the above described boiler. It shall be designed to burn # 3 oil in varying amounts up to 2 gallons per hour and shall be equipped with a nozzle capable of passing 1.75 gallons of oil per hour at 100 lbs. pressure per square inch.

Positive means shall be provided for the electric ignition of the fuel together with complete automatic electrical control which shall embody all safety features required by the National Board of Underwriters and ordinarily used with this type of equipment.

The blower shall be of the squirrel cage type having a capacity of not less than 2800 C.F.M. at 1/4 inch S.P., driven by V-belt to a speed of 300 to 470 R.P.M.

15-08. (cont'd)

two doors, fire door, push nipples, draw bolts, etc. Boiler shall carry a manufacturer's rating of not less than 640 sq. ft. of hot water radiation based on a heat emission of 150 B.t.u. per square foot. Boiler shall be warranted for a water working pressure of not less than 80 p.s.i.

15-09. Water Indication Valve:

Water indication valve shall be 1\2-inch Syphon, or approved equal, bellows type valve, thermostatically controlled from the boiler water temperature by a thermal bulb and a capillary tube. Valve and control shall be adjustable over a range of 100° to 130° F. The valve shall be installed on the inlet side of the boiler, the outlet to be free to discharge as shown on the plans.

15-10. Oil Burner:

The oil burner shall be of the atomizing gun type for flange mounting in the above described boiler. It shall be designed to burn # 2 oil in varying amounts up to 2 gallons per hour and shall be equipped with a nozzle capable of passing 1.75 gallons of oil per hour at 100 lbs. pressure per square inch.

Protective means shall be provided for the electric ignition of the fuel together with complete automatic electrical control which shall embody all safety features required by the National Board of Underwriters and ordinarily used with this type of equipment.

The blower shall be of the squirrel cage type having a capacity of not less than 2800 C.F.M. at 1\4 inch S., driven by V-belts to a speed of 300 to 370 R.P.M.

15-10. (Cont'd)

The driving motor shall be not less than 1/2 H.P. wound for 120 volts, 60 cycles, single phase 1140 R.P.M.

The motor shall be Class "A"type, conforming to Yards and Docks Specification 9 Ye.

A suitable magnetic starting switch shall be furnished to operate the motor through interlocking circuits controlling the automatic operation of the equipment. Overload and undervoltage protection shall be provided.

15-11. Fuel Tank:

Fuel oil will be drawn from an underground storage tank of 420 gallons capacity fitted with fill line, vent, supply with check or foot valve, as required, and return line.

The tank shall be installed at the location and to the elevation as shown on the plans.

15-12. Cooler-Scrubber Unit:

The scrubber shall consist of a vertical cast iron cylinder of not less than 36" diameter with 3-1/2" flue gas inlet near the bottom and 3" gas outlet at the top, a manhole shall be provided in the top of the scrubber and a handhole near the bottom.

There shall be furnished sufficient limestone to make a bed 48" depth, within the scrubber, the limestone bed to be supported on a cast iron grate above the gas inlet. The limestone shall be sized and graded to assure adequate diffusion of the gases and cooling water.

15-12. (Cont'd)

Above the limestone bed shall be provided a water spray system by means of which cooling water will be applied uniformly over the surface of the limestone bed. The connection to the spray system shall be of 3/4" galvanized steel pipe and shall be equipped with a regulating valve, strainer, and shut-off valve. Pipe and connections to the source of pressure water shall be as shown on the plans. For removal of the waste cooling water, a drain connection, not less than 1-1/4" diameter, shall be provided at the bottom of the scrubber. The drain connection shall be equipped with a thermometer to indicate the temperature of the waste water. A drain trap and sump shall be provided as shown on the drawings.

15-13. Compressors:

The compressor shall be of the centrifugal type with a capacity of not less than 54 cu. ft. of free gas at 100° F. per minute discharged at a maximum pressure of 10 lbs. The compressor shall be driven by a 5 H.P. squirrel cage motor wound for 208 volts, 3 phase, 60 cycles.

A magnetic starter with push button control shall be furnished to operate this motor.

A dilution valve, open to the atmosphere shall be provided in the 3-inch inlet to the compressor.

15-14. Dryer:

On the discharge side of the compressor shall be furnished a line type dryer, of adequate size, by means of which moisture shall be removed from the gases and returned through an automatic trap to the waste pump.

15-12. (Cont'd)

Above the limestone bed shall be provided a water spray system by means of which cooling water will be applied uniformly over the surface of the limestone bed. The connection to the spray system shall be of 3/4" galvanized steel pipe and shall be equipped with a regulating valve, strainer, and shut-off valve. Pipe and connections to the source of pressure water shall be as shown on the plans. For removal of the waste cooling water, a drain connection, not less than 1-1/2" diameter, shall be provided at the bottom of the scrubber. The drain connection shall be equipped with a thermometer to indicate the temperature of the waste water. A drain trap and sump shall be provided as shown on the drawings.

15-13. Compressor:

The compressor shall be of the centrifugal type with a capacity of not less than 84 cu. ft. of free air at 100° F. per minute discharged at a maximum pressure of 10 lbs. The compressor shall be driven by a 5 H.P. squirrel cage motor wound for 208 volts, 3 phase, 60 cycles.

A magnetic starter with push button control shall be furnished to operate the motor.

A filtration valve, open to the atmosphere, shall be provided in the suction inlet to the compressor.

15-14. Dryer:

On the discharge side of the compressor shall be furnished a line type dryer of adequate size, by means of which moisture shall be removed from the gases and returned thereto; an absorbtive type dehydrating

15-14. (Cont'd)

The drye housing shall be of cast iron with 2-inch pipe connections and shall have removable sides. The drying elements shall be of corrosion resistant materials and shall be arranged for convenient re moval for inspection and cleaning.

15-15. Rate-of-flow Meter:

A rate-of-flow meter shall be provided to indicate the volume of gas passing through the equipment. For this purpose, a 2-inch venturi tube shall be installed together with a direct reading manometer of the direct reading type with the rate of flow indicated by the height of liquid column in one leg of the U tube. The manometer shall be provided with a polished metal backing plate graduated to show the rate of flow by direct reading. The manometer shall be arranged for wall mounting and shall be furnished with the necessary 1/2-inch copper pipe for connection to the venturi tube.

15-16. Carbon Dioxide Indicator:

There shall be furnished an Orsat, or equal, carbon dioxide percent indicator complete with reagents, printed directions for use and metal cabinet for wall mounting.

15-17. Thermometer:

Two thermometers shall be installed, one to measure the temperature of the cooling water at the point where it leaves the scrubber. This thermometer shall be installed in the 1-1/2 inch drain as shown on the plans.

The other thermometer shall be installed in the 3-inch gas line after passing through the venturi meter.

15-18. Pressure Gauge:

A 4-inch pressure gauge graduated in pounds per square inch with graduations from 0 to 20 lbs. shall be installed in the 3-inch gas line as shown on the plans.

15-19. Water Pipe and Fittings:

All pipe lines carrying water under pressure shall be standard weight galvanized steel. Fittings shall be galvanized malleable iron. Valves smaller than 2 inch shall be bronze.

15-20. Drain and Drip Lines:

Drain and drip lines above the floor shall be standard weight galvanized steel with galvanized fittings.

Drain lines below the floor shall be extra heavy cast iron soil pipe and fittings.

15-21. Qualifications of Manufacturer and Equipment:

All of the equipment under Section 15 shall be furnished by one manufacturer who is regularly engaged in the design and manufacture of equipment of this character, and who will furnish skilled engineering help to check over the installation and advise the Government's representative in the proper operation and maintenance of the same.

15-22. Guarantee:

The Manufacturer to whom the award is made shall guarantee the equipment as to materials, workmanship and operation for a period of one year from the date it is put into service.

15-23. Painting:

All gas piping shall be painted dark green. Gas piping below water level in the recarbonation tank shall be coated with coal-tar base enamel.

15-18. Pressure Gauge.

A 4-inch pressure gauge, graduated in pounds per square inch with graduations from 0 to 60 lbs. shall be installed in the 3-inch gas line as shown on the plans.

15-19. Water Pipe and Fittings.

All pipe lines carrying water under pressure shall be standard weight galvanized steel. Fittings shall be galvanized malleable iron. Valves smaller than 2 inch shall be bronze.

15-20. Drain and Drip Lines.

Drain and drip lines above the floor shall be standard weight galvanized steel with galvanized fittings.

Drain lines below the floor shall be extra heavy cast iron soil pipe and fittings.

15-21. Qualifications of Manufacturer and Equipment.

All of the equipment under Section 15 shall be furnished by one manufacturer who is regularly engaged in the design and manufacture of equipment of this character, and who will furnish skilled engineering help to oversee the installation and advise the Government's representative in the proper operation and maintenance of the same.

15-22. Guarantee.

The manufacturer to whom the award is made shall guarantee the equipment to be satisfactory, workmanship and operation for a period of one year from the date it is put into service.

15-23. Painting.

All pipe-piping shall be painted dark green. The piping below water level in the regeneration tank shall be coated with coal-tar base enamel.

Page 8 of 9

15-23. (Cont'd)

The hot water boiler jacket shall not be painted except as required to touch up defects in the original finish.

Hot and cold water piping shall be painted light gray.

Fuel piping to and from the oil burner, where exposed, shall be painted dark red.

The cooler-scrubber unit shall be painted medium gray.

Water piping to and from the scrubber shall be painted light gray.

The compressor unit shall be painted medium gray.

The dryer shall be painted medium gray.

All painting shall be done in accordance with Section 42.

15-23. (Cont'd)

The rotor motor brush jacket shall not be painted except as required to touch up defects in the original finish:

Hot and cold water piping shall be painted light gray;

Fuel piping to and from the oil burner, where exposed, shall be painted dark red.

The cooler-scrubber unit shall be painted medium gray.

Water piping to and from the scrubber shall be painted light gray.

The compressor unit shall be painted medium gray.

The layer shall be painted medium gray.

All painting shall be done in accordance with Section 23.

SECTION 16

FILTERS AND OPERATING FLOOR

16-01. Scope of the Work:

The work under this heading includes the installation of filter equipment, operating tables, gauges, and appurtenances procured under Spec. 502, Advance Spec. "F".

It also includes all concrete work, hand-rail, and miscellaneous items necessary to complete and make this part of the work ready for operation.

16-02. Concrete:

Floor and curb shall be Class D-1 with monolithic topping finish.

Filter floors, sidewalls and gullet walls shall be Class E-1 concrete with smooth trowelled surface.

Particular care shall be taken to place and join all metal water stops so that construction joins will be perfectly tight.

16-03. Transition Piece and Underdrainage System:

The cast iron transition pieces shall be set in the wall forms at the exact location and elevation, as shown on the plans, prior to pouring concrete, provided the same are available. If the walls are poured prior to delivery of the transition pieces, openings shall be left as shown on the plans including the metal water stops. The transition pieces shall then be set in the openings provided and the same shall be completely filled with concrete through suitable pouring gates, so arranged as to complete the filling under a 6-inch head.

SECTION 10

STRUCTURES AND OPERATING FLOOR

10-01. Scope of the Work:

The work under this heading includes the installation of filter equipment, operating tables, gauges, and appurtenances procured under Spec. EOS, Invance Spec. #5.

It also includes all concrete work, hand-rail, and miscellaneous items necessary to complete and make this part of the work ready for operation.

10-02. Concrete:

Pier and curb shall be Class D-1 with monolithic topping finish.

Fill on floor, sidewalls and gullet walls shall be class B-1 concrete with smooth troweled surface.

Pan under core shall be taken to place and join all metal water stops so that construction joins will be perfectly tight.

10-03. Trench Plate and Underdrain Piping System:

The cast iron trench plates shall be set in the wall forms at the exact location and elevation, as shown on the plans, prior to pouring concrete, provided the same are available. If the walls are poured prior to delivery of the trench plates, openings shall be left as shown on the plans including the usual water stops. The trench plates shall then be set in the openings provided and the same shall be completely filled with concrete through suitable pouring gates, so arranged as to complete the filling under the B-inch head.

16-03. (Cont'd)

The underdrainage system shall be installed by joining the cast iron manifold sections and the transition pieces as shown on the plans. Joints shall be made with 1/16-inch rubber gaskets placed between flanges and bolted tightly together.

Manifolds shall be laid in the centers of the filters to exact alignment and elevation. They shall be grouted in place with 1 part Portland cement and 2 parts clean sharp sand. The back ends of manifolds shall be securely blocked against filter walls.

The lateral pieces consisting of 2-inch cast iron pipe shall be centered in the bells of the central manifold and joined with yard and lead as specified in Para. 8 -06. Each lateral shall be kept in its correct ppsition, at right angles to the center line of the filter, and shall be blocked up to correct elevations. Special care shall be taken to set each lateral so that the holes drilled therein shall point downward and 22-1/2 degrees on either side of the vertical. Blocking under the laterals shall be kept between the drilled holes and shall not obstruct them. The end of each lateral shall be solidly blocked against the adjacent side wall with concrete.

The greatest possible care shall be taken to clean all pipes used in the filter underdrainage systems and to keep them free from foreign matter which would clog the drilled holes and greatly impair the correct operation of the plant. The same precaution must be exercised throughout the entire work including all pipe lines inside and outside of the building.

16-04. Placing Filter Media:

After the underdrainage system has been completed the filter floors shall be thoroughly cleaned of trash and dirt and the filtering media shall be placed in layers as shown on the plans.

The bottom layer shall consist of 2 to 1½ inch gravel which shall be placed on the filter floor and around the manifold system to a depth of 6 inches. This material shall be dumped in small batches and worked into place by hand to avoid obstructing the drilled holes in the lateral pipes.

The second layer of 1½ to 3/4 inch gravel shall be placed to an even thickness of 4 inches.

The third layer of 3/4 to ½ inch gravel shall be placed to an even thickness of 2½ inches.

The fourth layer of ½ to ¼ inch gravel shall be placed to an even thickness of 2½ inches.

The fifth layer of ¼ to 1/8 inch gravel shall be placed to an even thickness of 3 inches.

The material above specified shall be placed perfectly uniform layers and shall be kept free from dirt, and all foreign matter.

After the last layer of gravel has been placed, 27 inches of filter sand shall be added in a uniform layer. If it becomes necessary for workmen to enter the bed, the same shall be completely covered over with boards, tar paper, or other material in order that it be maintained in a sanitary condition.

16-04. Placing Filter Media.

After the underdrainage system has been completed the filter floors shall be thoroughly cleaned of trash and dirt and the filtering media shall be placed in layers as shown on the plans.

The bottom layer shall consist of 2 to 3½ inch gravel which shall be placed on the filter floor and around the manifold system to a depth of 6 inches. This material shall be dumped in small batches and worked into place by hand to avoid obstructing the drilled holes in the lateral pipes.

The second layer of 1½ to 3/4 inch gravel shall be placed to an even thickness of 4 inches.

The third layer of 3/4 to ½ inch gravel shall be placed to an even thickness of 3 inches.

The fourth layer of ½ to ¼ inch gravel shall be placed to an even thickness of 3 inches.

The fifth layer of ¼ to 1/8 inch gravel shall be placed to an even thickness of 3 inches.

The material above specified shall be placed perfectly uniform layers and shall be kept free from dirt, and all foreign matter.

After the last layer of gravel has been placed, 27 inches of filter sand as specified in the plans shall be added in uniform layers. If it becomes necessary to enter the tank, the sand shall be completely covered over with boards, but particular care must be taken that it be maintained in a sanitary condition.

16-05. Wash Water Troughs:

Wash water troughs shall be installed as shown on the plans, with their tops at elevation 32.5. Troughs shall be absolutely level throughout their entire lengths. The Contractor is particularly cautioned that this part of the work must be carried out with absolute accuracy.

16-06. Pipe Railing:

Pipe railing of 1-1/2 inch black steel, with either screw or welded joints shall be installed as indicated on the plans. The base of all railings shall be securely anchored to the concrete structure.

16-07. Operating Tables:

One operating table procured under Spec. 502, Advance Spec. "E", shall be installed to control each filter as shown on the plans.

Table shall be set level and shall be securely fastened to the floor.

A 1-inch pressure supply shall be run to each table. Each hydraulic valve for a given filter shall be connected with its respective control valve in the operating table by means of 3/4-inch line, one at the top of a given cylinder and one at the bottom.

A 1-inch waste water line shall be run from each operating table to terminate 4 inches above the gutter which extends through the pipe gallery. Flexible cable shall be run from the tail rod of each hydraulic valve to its indicator and control plate on the operating table. Cables shall change direction by means of sheaves which shall be securely fastened to adjacent pipes or structures, so placed as to give the shortest and most direct route from tail rod to indicator. Cables and sheaves shall be uniformly installed so that all three filters will be alike. Sheaves and cables are included with the equipment furnished under Specification 502, Advance Spec. "E".

16-06. Drain Water Troughs:

Drain water troughs shall be installed as shown on the plans, with their tops at elevation 32.5'. Troughs shall be adjustably level throughout their entire length. The Contractor is particularly cautioned that this part of the work must be carried out with absolute accuracy.

16-08. Pipe & Fittings:

Pipe railing of 1-1/2 inch black steel, with either screw or welded joints shall be installed as indicated on the plans. The base of all railings shall be securely anchored to the concrete structure.

16-09. Operating Tables:

The operating table pursuant under Spec. 302, Advance Spec. "B", shall be installed to control each filter as shown on the plans.

Table #1 to one level and shall be securely fastened to the floor.

A 1-inch pressure supply shall be run to each table. Each hydraulic valve from - plate filter shall be connected with its respective control valve in the operating table by means of 3/4-inch line, one at the top of a given cylinder and one at the bottom.

A 3-inch galvanized water line shall be run from each operating table to terminate 6 inches above the gutter which extends through the pipe gallery. Flexible cables shall be run from the trailered 3" each hydraulic valve to its indicator and control plate on the operating table. Cables shall change direction by means of sheaves which shall be securely fastened to adjacent pipes or structure, as placed as to give the shortest and most direct route from trail rod to indicator. Cables and sheaves shall be uniformly installed so that all chains & filters will be visible. Sheaves and cables are included with the equipment furnished under Specification 302, Advance Spec. "B".

16-07. (Cont'd)

The equipment furnished with the operating table includes Rate-of-Flow and Loss-of-Head indicating gauges. These and other parts of the equipment shall be installed and connected as specified in Sect. 17.

16-08. Painting:

Transition pieces and underdrainage system shall not be painted.

Wash water troughs shall be painted a light gray, the various coats to be of materials especially designed to prevent corrosion.

Operating tables shall not be painted except as required to touch up the original coating in case the same has been chipped or marred.

Piping to the operating tables shall be painted light gray.

All painting shall be done in accordance with Section 42.

16-07. (Cont'd)

The equipment furnished with the operating table includes
Table-to-Floor and Base-to-Head Indicating Gauges. Items and other parts
of the equipment shall be installed and connected as specified in Sect. IV.

16-08. Painting:

Irradiation places and underwriters system shall not be painted.
Wash water troughs shall be painted a light grey, the surface
coats to be of materials especially designed to prevent corrosion.
Operating tables shall not be painted except as required to touch
up the original coating in case the same has been chipped or marred.
Piping to the operating tables shall be painted light grey.
All painting shall be done in accordance with Section 62.

SECTION 17

PIPE GALLERY

17-01. Scope of the Work:

The work under this heading shall include the concrete structure, all pipe, valves and fittings, filter control equipment procured under Spec. 502, Advance Spec. "F", water service piping, chlorine conduit, drain lines, pipe railing and miscellaneous items.

17-02. Influent Piping:

Influent piping shall consist of 20-inch header leading from the recarbonation basin which shall be suspended from the ceiling as shown on the plans.

From the main header a 12-inch influent line shall be run to each filter. Each line shall be supported by a 4-inch steel pipe column from the floor to a pipe saddle placed under each 12-inch 45° bend.

A 16-inch vertical cross connection shall be installed from the 20-inch header to the 20-inch effluent line.

Bell and spigot pipe shall be Class B, A.W.W.A. or Class 100.

Flanged pipe shall be Class "B" with 125 lb. American Standard Flanges, faced, and drilled. Fittings shall be suitable for 100 lbs. working pressure.

Gate valves shall be iron body, bronze mounted, non-rising stems or outside screw and yoke, as noted on the plans, equipped with hand wheels.

All valves shall be suitable for 50 lbs. working pressure.

Pipe, valves and fittings shall be laid and joined as specified under Section 8. Hydraulic valves shall be in accordance with Paras. 11-04 and 11-05.

SECTION 17

PIPE WORKING

17-01. Scope of the Work.

The work under this heading shall include the contractor's structure, all pipe, valves and fittings, water control equipment procured under Spec. 302, Advance Spec. "B", water service pipins, chlorine conduit, drain lines, pipe railing and miscellaneous items.

17-02. Basement Piping.

Each basement piping shall consist of 20-inch header leading from the room normal to the bench which shall be suspended from the ceiling as shown on the plans.

From the main header a 12-inch inclusive line shall be run to each filter. Each line shall be supported by a 6-inch steel pipe column from the floor to a pipe saddle placed under each 12-inch ell bend.

A 8-inch vertical cross connection shall be installed from the 20-inch header to the 20-inch effluent line.

Bell and spigot pipe shall be Class B, A.W.W.A. or Class 100.

Flanged pipe shall be Class "B" with 150 lb. American Standard flanges, faced, and drilled. Fittings shall be suitable for 100 lbs. working pressure.

Gate valves shall be iron body, bronze mounted, non-rising stems or extended stem and yoke, as noted on the plans, equipped with hand wheels.

All valves shall be suitable for 80 lbs. working pressure.

Pipe, valves and fittings shall be laid and jointed as specified under Section 15. Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

17-03. Effluent Piping:

Effluent piping shall consist of a 20-inch header supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter shown on the plans. Pipe shall be bell and spigot, Class "B", A.W.W.A. or Class 100.

Flanged piping shall be Class "B" with 125 lb. American Standard Flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

Fittings shall be bell and spigot or flanged suitable for 100 lbs. working pressure.

Gate valves shall be as specified under Paragraph 17-02.

Pipe, valves and fittings shall be laid and joined as specified under Section 8.

17-04. Wash Water Piping:

Wash water piping shall consist of a main header 16 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter shown on the plans.

Pipe shall be bell and spigot Class B, A.W.W.A. or Class 150.

Flanged piping shall be Class "B" with 125 lb. American Standard Flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

Pipe valves and fittings shall be laid and joined as specified under Section 8. Each 16-inch hydraulic valve shall be supported by a 4-inch steel pipe column from the floor to a saddle placed under the valve.

17-03. Fuel Vault Piping:

Fuel vault piping shall consist of a 20-inch header supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter shown on the plans. Pipe shall be bell and spigot, Class "B", A.W.W.A. or Class 100.

Flanged piping shall be Class "B" with 125 lb. American Standard flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

Fittings shall be bell and spigot or flanged suitable for 100 lbs. working pressure.

Each valve shall be as specified under Paragraph 17-05.

Pipe, valves and fittings shall be laid and joined as specified under Section C.

17-04. Wash Water Piping:

Wash water piping shall consist of a main header 16 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter shown on the plans.

Pipe shall be bell and spigot Class B, A.W.W.A. or Class 150.

Flanged piping shall be Class "B" with 125 lb. American Standard flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

Pipe, valves and fittings shall be laid and joined as specified under Section C. Each 16-inch hydraulic valve shall be supported by a 6-inch steel pipe column from the floor to a saddle placed under the valve.

17-05. Sewer Piping (Waste Wash Water):

The sewer shall consist of a main header 20 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter as shown on the plans.

Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100.

Flanged piping shall be Class B, 125 lb. American Standard Flanged, faced and drilled.

Hydraulic valves shall be in accordance with Para. 11-04 and 11-05.

Pipe, valves and fittings shall be laid and joined as specified under Section 8.

17-06. Re-Wash Piping:

Re-wash lines shall consist of 4-inch pipe connecting from the 16-inch filter effluent line to the 20-inch sewer. Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100. Flanged pipe shall be Class B, with 125 lb. American Standard flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paras. 11-04 and 11-05.

Pipe, valves and fittings shall be joined as specified under Section 8

17-07. Rate-of-Flow Controllers:

Rate-of-flow controllers procured under Spec. 502, Advance Spec. "F", shall be installed, one on the effluent line of each filter as shown on the drawings. Each rate-of-flow controller shall be connected with the mercury filled actuator as specified in Para. 17-08 and with the gradual shut-off float control as specified in Par. 17-09.

17-02. Sewer Piping (Waste Wash Water):

The sewer shall consist of a main header 20 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter as shown on the plans.

Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100.

Flanged piping shall be Class B, 125 lb. American Standard Flanged, faced and drilled.

Hydraulic valves shall be in accordance with Para. 11-04 and 11-05.

Pipe, valves and fittings shall be laid and joined as specified under Section 9.

17-04. Re-Wash Piping:

Re-wash lines shall consist of 4-inch pipe connecting from the 16-inch filter effluent line to the 20-inch sewer. Pipe shall be B.11 and spigot, Class B, A.W.W.A. or Class 150. Flanged pipe shall be Class B, with 125 lb. American Standard flanges, faced and drilled.

Hydraulic valves shall be in accordance with Para. 11-04 and 11-05.

Pipe, valves and fittings shall be joined as specified under Section 9.

17-05. Rate-of-Flow Controllers:

Rate-of-flow controllers proposed under Spec. 602, Advance Spec. "F", shall be installed, one on the effluent line of each filter as shown on the drawings. The rate-of-flow controller shall be connected with the mercury filled actuator as specified in Para. 17-02 and with the gradual shut-off float control as specified in Par. 17-03.

17-08. Rate-of-Flow and Loss-of-Head Gauges:

The rate-of-flow and loss-of-head actuators shall be installed in pipe gallery on 3-inch pre-cast concrete slab placed over the gutters. The rate-of-flow actuator shall be connected with the rate of flow venturi by means of 3/8 inch pipes.

The loss-of-head actuator shall have a 3/8-inch connection extending up to connect with a 3/4-inch pipe extending through the filter wall with its center at Elevation 32.25. The end of the 3/4-inch pipe within the filter shall be equipped with bronze strainer. The other connection to the loss-of-head actuator shall be carried by 3/8-inch pipe to the inlet side of the venturi rate-of-flow controller.

Both the rate-of-flow and loss-of-head actuators shall have 1-inch black steel pipe cable guards extending from their tops upward to inclose the actuating cables which operate the respective gauges mounted on the operating table. Change of direction in the cable shall be made by means of sheaves as specified in Para. 16-07.

Cables, sheaves and miscellaneous parts are furnished with the equipment procured under Specification 502, Advance Spec. "E".

17-09. Gradual Shut-Off Control:

Each filter shall be equipped with a gradual shut-off control which shall be actuated by a float and cable from the water level within the filters to the rate of flow controller. The float shall be inclosed in a 2-1/2 inch steel tube with top elevation 36.25 and bottom in elevation 31.0.

The equipment shall be adjusted to shut off the filter effluent when the water level in the filter has fallen to elevation 32.0.

17-05. Rate-of-Flow and Loss-of-Head Gauges.

The rate-of-flow and loss-of-head equipment shall be installed in the gallery on 8-inch pre-cast concrete slab placed over the subbase. The rate-of-flow actuator shall be connected with the rate of flow venturi by means of 1/2 inch pipes.

The loss-of-head actuator shall have a 3/8-inch connection extending up to connect with a 3/4-inch pipe extending through the filter wall at the center at Elevation 82.25. The end of the 3/8-inch pipe within the filter shall be equipped with bronze strainer. The other connection to the loss-of-head actuator shall be carried by 5/8-inch pipe to the inlet side of the venturi rate-of-flow controller.

Both the rate-of-flow and loss-of-head actuators shall have 1-inch black steel pipe cable guards extending from their tops upward to inclose the actuating cables which operate the negative bronze mounted on the operating bridge. Change of direction in the cable shall be made by means of sheaves as specified in Para. 16-07.

Cables, sheaves and miscellaneous parts are furnished with the equipment performed under Specification 502, Advance Specs. "B".

17-06. Gravel Wash-Off Control.

Each filter shall be equipped with a gradual shut-off control which shall be actuated by a float and a pin from the water level within the filters to the rate of flow controller. The float shall be inclosed in a 2-1/2 inch steel tube with top elevation 86.5' and bottom in elevation 81.0.

The equipment shall be adjusted to shut off the filter effluent when the water level in the filter has fallen to elevation 83.0.

17-09. (Cont'd)

Change in direction in the cable shall be made by means of sheaves as specified in Para. 16-07. That part of the cable which is above the filter operating floor shall be inclosed in 1-inch black steel pipe.

17-10. Pipe, Valves, and Fittings:

Connecting pipes as above specified shall be of standard weight galvanized steel with galvanized malleable iron fittings.

Valves shall be of bronze suitable for 125 lbs. working pressure.

Pipes shall be securely fastened to the adjacent structure and the installation for the three filter units shall be identical.

17-11. Floor Drain:

A 6-inch cast iron drain shall be installed as shown on the plans to terminate near the end of the pipe gallery adjacent to the wash water pump room. A 12" x 12" cast iron grating shall be placed over the drain outlet.

17-12. Cat-walk and Stairs:

The catwalk within the pipe gallery shall be of Class D-1 concrete with wood-float finish.

17-13. Pipe Railing:

Pipe railing of 1-1/2 inch black steel with either screwed or welded joints shall be installed as indicated on the plans. Base of the railing shall be securely anchored to the concrete structure.

17-14. Painting:

All large cast iron pipe, valves and fittings shall be coated with coal-tar base enamel. Metal pipe supports shall be coated with the same material.

17-09. (Cont'd)

...change in direction in the cable shall be made by means of sheaves as specified in Para. 16-07. That part of the cable which is above the filter operating floor shall be inclosed in 3-inch black steel pipe.

17-10. Pipe, Valves, and Fittings:

Circulating pipes as above specified shall be of standard weight galvanized with galvanized malleable iron fittings.

Valves shall be of bronze suitable for 150 lbs. working pressure.

Pipe shall be securely fastened to the adjacent structure and the installation for this three filter units shall be identical.

17-11. Floor Drain:

A 6" cast iron drain shall be installed as shown on the plans to terminate near the end of the pipe gallery adjacent to the wash water pump room. A 18" x 12" cast iron grating shall be placed over the drain outlet.

17-12. Curb-Angle and Bolts:

The curb angle within the pipe gallery shall be of Class B-1 concrete with an 8-foot finish.

17-13. Pipe Railing:

Pipe railing of 1-1/2 inch black steel with either screwed or welded joints shall be furnished and installed on the plans. Ends of the railing shall be securely anchored to the concrete structure.

17-14. Painting:

All [illegible] pipe, valves and fittings shall be coated with a coal-tar base [illegible] metal pipe supports shall be coated with the same material.

17-14. (Cont'd)

Loss-of-head and rate-of-flow actuators shall be coated with rust inhibiting paint of similar color to the original paint.

Small connecting pipe and fittings shall be painted light gray.

Brass valves and fittings shall not be painted.

All painting shall be in accordance with Section 42.

SECTION 18

WASH WATER PUMP

18-01. Wash Water Pump:

The wash water pump procured under Spec. 502, Advance Spec. "F" shall be installed as shown on the drawings. The pumping unit shall be set and pipe connections shall be made in accordance with Paragraph 22-01.

18-02. Pipe Connections:

Suction shall be taken directly from the storage basin through an 18-inch header which shall terminate with an 18 x 16" tee. The 18-inch tee opening shall be plugged and backed with concrete for future extension. A 16-inch suction line shall be extended from the 18 x 16" tee to the pump. The discharge shall run through the pipe gallery as specified in Para. 17-04. All pipe and fittings shall be in accordance with Para. 22-02.

18-03. Pressure Recording Gauge:

The pressure recording gauge furnished with the pump shall be installed on the wall of the filter operating floor as shown on the plans.

Pipe connections shall be of 1/4-inch standard weight galvanized steel with galvanized malleable iron fittings.

18-04. Motor Starter:

The motor starter furnished with the pump shall be installed as shown on the plans with a push button control station on the filter operating floor.

18-05. Electrical Work:

All electrical work shall be in accordance with Section 32.

18-06. Painting:

Painting shall be as specified in Paragraph 22-16.

SECTION 19

WASTE WASH WATER TANK

19-01. Scope:

A waste wash water tank shall be constructed at the location and to the elevations and dimensions as shown on the drawings together with inlet and outlet pipes, overflow weir, manholes and incidental equipment.

19-02. Concrete:

The tank shall be constructed of Class E-1 concrete with 6 x 6" No. 6 wire mesh reinforcing.

Additional steel reinforcing shall be used in the concrete side slopes where the same span pipe trenches and additional concrete shall be poured around all entering pipes as indicated on the drawings.

19-03. Main Sewer:

The main wash water sewer from Manhole No. 88-F shall be of 24-inch vitrified clay pipe or concrete pipe laid and joined in accordance with Section 10. The sewer from M.H. 88-F to the filter plant shall be 20-inch Class 100 cast iron pipe.

19-04. Blow-off From Well Transmission Main:

The 6-inch blow-off line from the 18-inch well transmission main shall be of Class 100 cast iron bell and spigot pipe, in accordance with Section 8.

19-05. Outlet Pipes:

One 8-inch outlet pipe shall be installed from the tank to Manhole No. 88-B. A second 8-inch pipe shall be installed for future use and shall be plugged inside of the tank. Both lines shall be Class 100 C.I. pipe laid in accordance with Section 8.

SECTION 19

WASTE WATER TANK

19-01. Scope.

A waste water tank shall be constructed at the location and to the levels and dimensions as shown on the drawings together with inlet and outlet pipes, overflow weir, manhole and mechanical equipment.

19-02. Concrete.

The tank shall be constructed of Class B-2 concrete with 6 x 6# No. 6 wire mesh reinforcing.

Additional steel reinforcing shall be used in the concrete side slopes where the mine run pipe trenches and additional concrete shall be poured around all bursting pipes as indicated on the drawings.

19-03. Main Sewer.

The waste water sewer from Manhole No. 88-P shall be of 24-inch vitrified clay pipe or concrete pipe laid and joined in accordance with Section 10. The sewer from M.H. 88-P to the filter plant shall be 20-inch Class 100 cast iron pipe.

19-04. Blow-off From Wall Penetration Main.

The 6-inch blow-off line from the 12-inch wall penetration main shall be of Class 100 cast iron bell and spigot pipe, in accordance with Section 8.

19-05. Outlet Pipes.

One 8-inch outlet pipe shall be installed from the tank to Manhole No. 88-P. A second 8-inch pipe shall be installed for future use and shall be plugged inside of the tank. Both lines shall be Class 100 C.I. pipe laid in accordance with Section 8.

SECTION 20

CHLORINATION

20-01. Scope of the Work:

Two chlorinating units with automatic control equipment and accessories have been procured under Spec. 502, Advance Spec. "B". This equipment shall be installed as shown on the drawings with all pipe work, conduits, manholes and incidental work.

The entire assembly shall be checked for correct installation and shall be properly adjusted and put into operation by the Manufacturer's representative. The automatic features shall be carefully checked, over the normal, maximum and minimum rates of pumpage and shall be adjusted to maintain correct dosage of chlorine throughout the entire range.

20-02. Differential Tubes from Venturi Meters:

One pair of differential tubes shall be run from the service water Venturi No. 1 to Differential Converter No. 1 as specified in Para. 23-02.

A second pair of tubes shall be run from the well water Venturi No. 2 as specified in Para. 13-03. The tubes shall be connected into the chlorine differential converters by the valved manifold arrangement as shown on the plans whereby either or both chlorinators may be controlled by either or both venturi tubes.

All of the piping above specified shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves shall be bronze, suitable for 125 lbs. working pressure.

All pipe work shall be securely fastened to adjacent concrete or masonry.

SECTION 20

CHLORINATION

20-01. Scope of the Work:

Two chlorinating units with automatic control equipment and accessories have been procured under Spec. 802, Adding Spec. "A". The equipment shall be installed as shown on the drawings with all pipe work, conduits, manholes and incidental work.

The entire assembly shall be checked for correct installation and shall be properly adjusted and put into operation by the Manufacturer's representative. The automatic features shall be carefully checked, over the normal, maximum and minimum rates of pumping and shall be adjusted to maintain correct dosage of chlorine throughout the entire range.

20-02. Differential Tubes from Venturi Meters:

One pair of differential tubes shall be run from the service water Venturi No. 1 to Differential Converter No. 1 as specified in Sec. 20-03. A second pair of tubes shall be run from the well water Venturi No. 2 as specified in Spec. 20-03. The tubes shall be connected into the chlorine differential converters by the valved manifold arrangement as shown on the plans whereby either or both chlorinators may be controlled by either or both venturi tubes.

All of the piping above specified shall be standard weight galvanized with galvanized malleable iron fittings. Valves shall be bronze, suitable for 125 lbs. working pressure.

All pipe work shall be securely fastened to adjacent concrete or masonry.

20-03. Water Service to Chlorinators:

Water service to the two chlorinators shall consist of a 1½-inch supply connecting into the manifold system as shown on the plans. The manifold shall have two sections each with a solenoid valve.

One solenoid valve shall be connected into the well pump circuit and shall control the starting and stopping of Chlorinator No. 2.

The other solenoid valve shall be connected into the circuits of service pumps Nos. 1, 2, and 3, with a relay in each circuit, so arranged as to start Chlorinator No. 1 when any one service pump or combination of service pumps is in operation. The solenoid valve shall close and stop the chlorinator when all of the service pumps are shut down. Pipe shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves shall be bronze suitable for 125 lbs. working pressure.

20-04. Chlorine Storage Room:

The chlorine storage room shall be equipped with the platform scale procured under Spec. 502, Advance Spec. "B".

A chlorine line of 3/4 inch extra heavy black wrought iron pipe shall be securely fastened to the northeast wall about 4 ft. above the floor.

The four tank manifold, furnished with the equipment, shall be securely set about 4 ft. above the scale platform and securely joined to the chlorine line. The 1-inch extra heavy chlorine feed line shall be run over the door opening thence down and through the partition wall into the pump room to serve the two chlorinators. One 3/4-inch tee shall be provided to serve each chlorinator as shown on the drawings. Joints shall be made up with litharge and glycerine for 200 lbs. chlorine gas working pressure.

30-03. Water Service to Chlorinators:

Water service to the two chlorinators shall consist of 1½-inch supply connecting into the manifold system as shown on the plans. The manifold shall have two sections each with a solenoid valve.

One solenoid valve shall be connected into the well pump circuit and shall control the starting and stopping of Chlorinator No. 2.

The other solenoid valve shall be connected into the circuits of service pumps Nos. 1, 2, and 3, with a relay in each circuit, so arranged as to start Chlorinator No. 1 when any one service pump or combination of service pumps is in operation. The solenoid valve shall close and stop the chlorinators when all of the service pumps are shut down. Pipe shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves shall be bronze suitable for 125 lbs. working pressure.

30-04. Chlorine Storage Room:

The chlorine storage room shall be equipped with the platform scale procured under Spec. 502, Advance Spec. "B".

A chlorine line of 5/8 inch extra heavy block wrought iron pipe shall be securely fastened to the northeast wall about 4 ft. above the floor.

The four tank manifold, furnished with the equipment, shall be securely set above 4 Ft. above the scale platform and securely joined to the chlorine line. The 1-inch extra heavy chlorine feed line shall be run over the door opening through and through the partition wall into the pump room to serve the two chlorinators. One 3/4-inch tee shall be provided to serve each chlorinator as shown on the drawings. Joints shall be made up with litharge and glycerine for 300 lbs. chlorine gas working pressure.

20-05. Chlorine Solution Discharge Lines:

All lines carrying chlorine solution from the chlorinators, to the indicated points of application, shall be of 1-inch hose furnished with the equipment.

The hose shall in all cases be run through 2-1/2 inch black steel pipe conduit. Conduit shall have long sweep bends at each change in direction and shall be securely fastened to the adjacent concrete or masonry structure. Under no conditions shall solution hose be joined within the conduit.

20-06. Chlorine Overflow Lines:

Drainage lines from make-up trays shall consist of hose, furnished with the equipment, installed in a 2-1/2 inch steel conduit as specified in Para. 20-05. The conduits shall terminate just above the steel plate cover over the discharge pit and the hose shall be extended well down into the outlet trap past the water seal so that gas cannot back up into the pump room.

20-07. Vacuum Relief Lines:

A relief line shall be run from each chlorinator to the outside atmosphere as shown on the plans. Suitable lengths of hose for this purpose will be furnished with the equipment.

The hose shall be run in 1½-inch steel conduit with continuous down gradient and shall be turned down at its outer end.

20-08. Chlorine Distribution Manifold:

A chlorine distribution manifold, fabricated from hard rubber, pro - cured under Specification 502, Advance Spec. "B", shall be installed to take chlorine solution from either or both chlorinators and discharge the

Sheet 3 of 4

20-08. (Cont'd)

solution to any one or all of the injection points, A, B, and C, as shown on the plans.

The manifold shall be securely fastened to the wall of the building and particular care shall be exercised during construction to avoid damage to this equipment.

20-09. Painting:

Differential tubes and water service piping shall be painted light gray.

The water service manifold shall be painted light gray.

Solenoid valves shall be painted to match the original coating.

Chlorine gas piping shall be painted a bright red.

Conduits carrying chlorine hose shall be painted light gray.

All painting shall be in accordance with Section 42.

Sheet 4 of 4

SECTION 22

PUMP ROOM AND CONTROL BALCONY

22-01. Service Pumps:

Three 1500 G.P.M. service pumps procured under Spec. 502, Advance Spec. "A", and Addendum No. 1, shall be installed as shown on the drawings. One pump is equipped with electric drive only and two pumps are equipped with electric drive on one end and gasoline engine drive on the other end. The three pumps shall be installed complete with suction and discharge piping, gasoline fuel and cooling pipe systems, drains and appurtenances, as shown on the drawings. Each pump shall be set in proper position and shall be leveled both ways from end to end so that shaft and couplings are in exact alignment. Thin steel wedge shims shall be used under the base, where necessary, to obtain proper alignment and the entire assembly shall then be grouted in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position.

Pump foundation shall be constructed to the dimensions and elevations shown on the plans. Anchor bolts shall be set in exact accordance with the Manufacturers' drawings. Class D-1 concrete shall be used with smooth finish above the floor line. The foundation for future pump No. 4 shall be constructed to the floor line and shall have the same finish as the floor.

SECTION 82

PUMP ROOM AND CONTROL GALLERY

82-01. Service Pumps:

Two 1500 G.P.M. service pumps procured under Spec. 102, Advance Spec. "A", and Addendum No. 1, shall be installed as shown on the drawings. One pump is equipped with electric drive only and two pumps are equipped with electric drive on one end gasoline engine drive on the other end. The above pumps shall be installed complete with suction and discharge piping, gasoline fuel & cooling pipe systems, drains and appurtenances, as shown on the drawings. Each pump shall be set in proper position and shall be leveled both ways from end to end so that shaft and couplings are in exact alignment. Thin steel wedge shims shall be used under the base, where necessary. To obtain proper alignment and the entire assembly shall then be grouted in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position.

Pump foundation shall be constructed to the dimensions and elevations shown on the plans. Anchor bolt shall be set in exact accordance with the manufacturers' drawings. Class D-1 concrete shall be used with smooth finish above the floor line. The foundation for future pump No. 4 shall be constructed to the floor line and shall have the same finish as the floor.

22-02. Pipe Connections:

Pump suction and discharge piping shall be made up as shown on the drawings. The connecting pipes shall not be bolted to the pump flanges until they have been accurately aligned and permanently supported to make an exact fit without imposing any strain on the pump assembly.

Flanged pipe shall be Class "B" with 125 lb. American Standard Flanges, faced and drilled. Bell and spigot pipe shall be Class "B", A.W.W.A, or Class 150. Pipe shall be laid and joined in accordance with Section 8. All fittings shall be good for 150 lbs. working pressure.

All pipe lines shall be kept clean and free from dirt, grit, or other foreign matter which may lodge in pump impellers or other equipment and cause damage. Pipe lines shall in every case be thoroughly flushed with clean water before connecting with equipment.

22-03. Suction and Discharge Valves:

Gate valves on pump suction and discharge lines shall be A.W.W.A. standard iron body bronze mounted outside screw and yoke, flanged or bell ends as shown on the drawings, for 150 lb. working pressure.

Check valves shall be iron body bronze mounted, non-slam type with positive lubrication of moving parts from outside.

22-04. Pipe Vaults:

A concrete trench shall be constructed as shown on the plans, to carry the 16-inch suction header along the rear wall of the building. The trench shall have walls and floor constructed of Class D-1 concrete with 3-inch precast removable slab cover, of Class D-1 concrete, with two 1/2" round iron handles recessed in each section. The trench over valves shall

22-02. Pipe Connections:

Pump suction and discharge piping shall be made up as shown on the drawings. The connecting pipes shall not be bolted to the pump flanges until they have been accurately aligned and permanently supported to make joint with without imposing any strain on the pump assembly.

Flanged pipe shall be Class "B" with ISS lb. American Standard Cast Iron Flanged and Drilled Bell and Spigot pipe shall be Class "B" A.W.W.A. or Class 150. Pipe shall be laid and joined in accordance with Section D. All fittings shall be good for 150 lbs. working pressure.

All pipe lines shall be kept clean and free from dirt, grit, or other foreign matter which may lodge in pump impellers or other equipment and cause damage. Pipe lines shall in every case be thoroughly flushed with clean water before connecting with equipment.

22-03. Suction and Discharge Valves:

Gate valves on pump suction and discharge lines shall be A.W.W.A. standard iron body bronze mounted outside screw and yoke, flanged or bell made as shown on the drawings, for 150 lb. working pressure.

Check valves shall be iron body bronze mounted, non-slam type with positive indication of moving parts from outside.

22-04. Pipe Vaults:

A concrete trench shall be constructed as shown on the plans, to carry the 24-inch suction header along the rear wall of the building. The trench shall have walls and floor constructed of Class D-1 concrete with 3-inch precast removable slab cover, of Class D-1 concrete, with two 1\2" round iron handles recessed in each section. The trench over valves shall

22-04. (Cont'd)

be covered with 1/4-inch non-slip steel plates, as shown on the drawings, each plate to have a recessed drop steel handle. Plates shall be thoroughly coated with an approved coal tar base enamel. Trenches shall be equipped with 4-inch trapped cast iron floor drains with perforated or grating type covers. Floors shall be pitched to drains.

22-05. Water Level Controls - High Pressure:

Two water level control units have been procured under Spec. 502, Advance Spec. "A" as fully described therein. One controller shall be connected with the electric motor driven pump No. 3 and the other controller with dual drive pump No. 1. Dual unit No. 2 shall be held in reserve for gasoline engine operation in case of electric power failure. This pump shall not have automatic control but space shall be provided on the panel board for a future controller.

22-06. Pump Controls - Low Water:

One low water level control with four circuits shall be provided to stop the three service pumps when the water level in the storage basin falls to elevation 16.0. The fourth circuit is provided for a future service pump. The controller shall be supported by a pedestal to be bolted to floor. The actuating mechanism shall consist of a float installed in the 8-inch pipe extending vertically into the clear water basin, the water level being transmitted to the electrical contactors by means of a shaft extending through the wall of the building with a sheave at its outer end the same to be rotated by a tape connected with the float.

The shaft shall extend directly from the controller without intermediate sheaves. The shaft assembly shall include a $1\frac{1}{2}$ inch wall sleeve

22-06. (Cont'd)

shaft bearings, held in place by split tapered bushings secured by lock nuts. The contacts shall be of the mercury filled type, actuated by cams on a rotating shaft. The cams shall have a wide range of adjustment so that the contacts may be set to stop any one of the pumps at a given water level. The controller shall be furnished with float, tape, counterweight and all other parts needed to make a complete assembly ready for operation. The maximum range of water levels will be El. 26.75 with full tank and El. 15.00 with empty tank.

All parts coming in contact with water shall be of non-corrosive material. The equipment shall be fully guaranteed against defects in material and workmanship for a period of one year.

22-07. Well Pump Controls:

Wells delivering raw water to the plant shall have push button start and stop switches mounted on the main control panel, as specified under Section 30. The well pumps shall be grouped as follows, with individual push button start and stop control for each group.

Group No. 1 - Wells 3, 2, and 10.

Group No. 2 - Wells 8, 5, and 9.

Group No. 3 - Wells 1, 6, and 7.

Group No. 4 - Well 4 (alone).

22-08. Water Service Piping:

Water services shall be taken from two 1½-inch taps in the discharge header as shown on the plans. The 1½-inch taps shall be increased at the goose-necks to 2-inch and branch services of the size shown shall be

Sheet 4 of 9

22-08. (Cont'd)

carried to the points indicated; namely, chlorinating equipment, pressure gauge, automatic pump controllers, gasoline engine cooling systems, lavatory and hose bibs. All service piping shall be of standard weight galvanized steel with galvanized malleable iron fittings. Valve 2-inch and larger shall be cast iron, bronze mounted for 150 lbs. working pressure. Valves smaller than 2-inch shall have bronze body and working parts suitable for 150 lbs. pressure.

22-09. Ventilator:

A motor driven exhaust ventilator of 930 cu. ft. per minute capacity shall be installed as shown on the drawings, to exhaust air through a 9-1/2 inch galvanized sheet metal duct from the pump room to discharge through a louvered opening to the outside. The ventilator assembly shall be supported by a concrete base as shown. Motor characteristics shall be 1/8 H.P. - 110/220 volts, single phase, 1140 R.P.M.

Electrical work shall be done in accordance with Section 30.

22-10. Gasoline Engine Auxiliary Drive:

Gasoline engines for dual driven pumping units, together with fuel tanks and incidental equipment, have been procured under Spec. 502, Advance Spec. "A" and Addendum No. 1. Engines will be mounted on a steel base as an integral part of the pump assembly.

22-11. Fuel Tanks & Piping:

Two 280 gallon fuel tanks shall be buried at the location shown on the plans. Tanks shall slope 2 inches toward the fill pipe end and the top elevation of both tanks shall be 17.60 at the high end.

Sheet 8 of 9

22-11. (Cont'd)

Each tank shall be piped and valved as shown on the drawings. Pipe shall be standard weight galvanized steel with gasoline tight joints. All pipe lines carrying gasoline shall be pressure tested to 50 p.s.i. before being covered over. Leaks shall be repaired and the line retested until it is perfectly tight.

Extreme care shall be used to keep the storage tank and pipe lines absolutely lean and free from earth and other foreign matter. Before final connections are made, each pipe line shall be thoroughly blown out with air.

Each vent shall be equipped with a fine mesh insect screen at its top and an approved flame arrester just above the tank.

22-12. Hand Priming Pumps:

Manually operated hand priming pumps have been procured with the equipment. These pumps with one-gallon reserve tanks shall be installed as shown on the drawings to supply fuel directly to the engine carburetors. The assembly shall be securely fastened to the pump room wall with expansion bolts. Pipe work shall be in accordance with Para. 22-10.

22-13. Engine Cooling System:

The cooling system for gasoline engines shall consist of cold water supply admitted to the engine jacket through a temperature regulating valve which is controlled by the temperature of hot water passing upward and around the actuating bulb. In order to secure circulation, a $\frac{1}{2}$-inch cold water by-pass line shall be installed around the temperature control valve.

22-13. (Cont'd)

The by-pass shall contain a solenoid valve to be energized from the 6 volt storage battery to open when the engine ignition is turned on. The by-pass line shall be fitted with a union and orifice plate with opening to admit one gallon of cold water per minute to the engine jacket. The control valve shall maintain an average temperature of 160° F.

A standard angle thermometer for hot water shall be installed in the waste pipe above the engine. Graduations shall be in degrees "F" from 50 to 212. The hot water waste line shall drain into an increaser above the floor so that the discharge will be visible.

All piping shall be standard weight galvanized steel, with galvanized malleable iron fittings; bronze valves and hose bib.

22-14. Exhaust System:

The exhaust system from gasoline engines shall be installed as shown on the plans. Piping shall be standard weight black steel with black iron fittings except where flexible steel sections are shown. Joints shall be made gas tight.

A 3-inch stack shall be provided at each engine, at the location indicated, the lower 2 feet to be imbedded in concrete. The connection from the engine to the stack shall be made with a length of flexible steel tubing.

Mufflers procured with the equipment shall be installed under the balcony, as shown, and shall be securely fastened thereto by means of pipe hangers. From the mufflers, connections shall be run to the 4-inch main

22-14. (Cont'd)

exhaust stack which in turn shall extend through the roof of the pumping plant and upward along the wall of the filter plant to terminate with a long sweep bend.

The 4-inch stack shall be flashed and counterflashed where it extends through the roof and shall be securely fastened with iron straps to the wall of the filter plant above the pump room roof.

The 4-inch vertical run between the balcony floor and roof shall be covered with 2 inches of high temperature insulation with 7½ oz. canvas cover.

The 4-inch stack shall be equipped with a flange to carry its weight on the floor of the balcony. The exhaust assembly shall be constructed throughout with proper provision for expansion and contraction.

Drip legs with bleed cocks shall be installed to rid the exhaust piping of condensate. Half-inch drips shall be provided in both 3-inch stacks just above the pump room floor and in both 3-inch exhaust pipes.

22-15. Instrument Panel:

A board shall be provided as shown on the drawings for mounting one recording pressure gauge and two automatic pump controllers procured under Spec. 502, Advance Spec. "A". Space shall be left on the board for future instruments as shown on the plans. The board shall be of cement-asbestos or other hard durable composition which will retain its shape and not be affected by water. A hydraulic snubber shall be assembled and connected as shown to damp out pressure surges.

Pipe work shall be in accordance with Para. 22-07.

28-05. (Cont'd)

duct which, in turn, shall extend through the roof of the pumping plant and upward along the wall of the filter plant to terminate with a lamp hood.

The 4-inch stack shall be flashed and counterflashed where it extends through the roof and shall be securely fastened with iron straps to the wall of the filter plant above the pump room roof.

The 4-inch vertical run between the balcony floor and roof shall be covered with 2 inches of high temperature insulation with Fg no. canvas cover.

The 4-inch stack shall be equipped with a flange to carry its weight on the floor of the balcony. The exhaust assembly shall be constructed throughout with proper provision for expansion and contraction.

Drip traps with blood cocks shall be installed to rid the exhaust piping of condensate. Pail-hook drips shall be provided in both 3-inch stacks just above the pump room floor and in both 3-inch exhaust pipes.

28-06. Impeller Panels

A bench shall be provided as shown on the drawings for mounting the rotating impeller pumps and the automatic pump controllers mounted under Item 7.06, Alcove Space, "A". Space shall be left on the board for future installation as shown on the plans. The board shall be of pegboard, masonite or other hard durable composition which will retain its shape and not be affected by water. A hydraulic snubber shall be assembled and connected on the line on the pump suction gauges.

Pipe covers shall be in accordance with Spec. 28-07.

22-15. (Cont'd)

The entire assembly shall be supported by metal brackets fastened securely to the wall. All pipe work shall be concealed insofar as is possible, at the rear of the board.

Electrical work shall be in accordance with Section 30.

22-16. Painting:

Pumps, motors, and gasoline engines, light gray.

Suction and discharge piping and valves, above ground, light gray.

Hand-wheels on valves, bituminous, black.

Metal pipe vault covers, gray.

Water service piping above ground, light gray.

Ventilator and air duct, light gray.

Fuel tanks, and piping above ground, dark red or maroon.

Hand priming pump and piping, above ground, dark red or maroon.

Instrument panel, all exposed pipe and fittings, light gray.

Painting shall be in accordance with Section 42.

Sheet 9 of 9

SECTION 23

DISCHARGE MAIN

23-01. Discharge Main:

The discharge lines from the various service pumps shall be Class " B", A.W.W.A. cast iron pipe either bell and spigot or with 125 lb. American Standard flanges faced and drilled. In lieu of Class "B" bell and spigot, Class 150 centrifugally-made pipe may be used. Pipe shall be laid in accordance with Section 8.

Discharge piping shall be located in accordance with the dimensions and elevations shown on the plans and shall be bell and spigot or flanged as indicated.

23-02. Discharge Main Venturi Meter:

A venturi meter procured under Spec. 502, Advance Spec. "D" shall be installed in a concrete vault on the main 16-inch discharge line as shown on the plans. The meter tube shall be set and supported as specified in Section 13, Para. 13-02. Four 1-inch galvanized steel differential tubes together with main valves, sediment legs, blow-off valves and other appurtenances shall be installed exactly as specified in Section 13, Para. 13-03, one pair to connect with the register-indicator-recorder; the other pair to connect with the chlorinating equipment.

23-03. Register-Indicator-Recorder:

A register-indicator-recorder instrument procured under Spec. 502, Advance Spec. "D" shall be installed as shown on the drawings and connected with the differential tubes exactly as specified in Section 13, Para. 13-04.

SECTION 23

DISCHARGE MAIN

23-01. Discharge Mains.

The discharge lines from the various service pumps shall be Class "B", A.W.W.A. cast iron pipe either bell and spigot or with 125 lb. American Standard Flanges faced and drilled. Fittes of Class "B" bell and spigot, Class 150 cast-iron flanged-ends pipe may be used. Pipe shall be laid in accordance with Section 6.

Discharge piping shall be located in accordance with the dimensions and elevations shown on the plans and shall be bell and spigot or flanged as indicated.

23-02. Discharge Main Venturi Meter.

A Venturi meter proposed under Spec. 502, Advance Spec. "D" shall be installed in a concrete vault on the main 18-inch discharge line as shown on the plans. The meter tube shall be set and supported as specified in Section 6, Par. 18-02. Four 1-inch galvanized steel differential tubes together with main valves, sediment legs, blow-off valves and other appurtenances shall be installed exactly as specified in Section 12, Para. 12-03. One pair to be used with the register-indicator-recorder; the other pair to connect with the chlorinating equipment.

23-03. Register-Indicator-Recorder.

A recorder-indicator-recorder instrument proposed under Spec. 502, Advance Spec. "D" shall be installed as shown on the drawings and connected with the differential tubes exactly as specified in Section 12, Para. 12-04.

MARINE BARRACKS,

NEW RIVER, N. C.

PROJECT P-108-4

SPECIFICATION NO. 502

SPECIFICATIONS FOR

WATER STORAGE, TREATMENT, AND PUMPING PLANT

DIVISION TRAINING AREA

SECTIONS 13, 14, 15, 16, 17, 18,

19, 20, 22, 23, 24, 26, and 27

CARR & J. E. GREINER CO.

ARCHITECT-ENGINEERS

June 25, 1942

TABLE OF CONTENTS

SECTION

Spec. No. 592

TABLE OF CONTENTS

Spec. No. 502

SPECIFICATIONS FOR WATER STORAGE, TREATMENT AND PUMPING PLANT

SCOPE:

It is the intent of this specifications to secure a complete water storage treatment and pumping plant to be located in the Division Training Area, and including the following features:

(a) Control of raw water inflow

(b) Softening

(c) Recarbonation

(d) Filtering

(e) Pre- and Post-Chlorination

(f) Clear Water Storage

(g) High Lift Pumping

All necessary labor, materials, and equipment shall be furnished by the Contractor to provide a plant ready to operate in an efficient and satisfactory manner.

ADVANCE SPECIFICATIONS have been issued for the procurement of equipment as follows:

Advance Specification "A", and Addendum No. 1, dated July 17, 1941, High Lift Pumping Equipment, including electric motor, gasoline engine, motor starters, water level controls, and pressure recording gauge.

Advance Specification "B", dated January 6, 1942 and Addendum No. 1, dated February 6, 1942, "Chlorinating Equipment".

Advance Specification "C", dated January 30, 1942, "Water Softening Equipment".

Advance Specification "D", dated January 16, 1942, one raw water venturi meter and one treated water venturi meter, together with the necessary instruments.

Advance Specification "E", dated January 16, 1942, "Filter Plant Equipment," including underdrains, filter gravel and sand, operating tables, loss of head and rate of flow gauges, wash troughs, and rate of flow controllers.

Advance Specification "F", dated February 10, 1942, "Wash Water Pump," including motor, motor starter and pressure recording gauge.

ALTERNATIVES:

Consideration will be given to any and all quotations on any similar comparable item manufactured other than that specified hereinafter.

All manufacturers' quotations on alternatives together with specifications, samples of materials shall be submitted to the Resident Officer-in-Charge for approval.

The Government reserves the right to accept or reject any single item or any and all quotations submitted.

The work, in general, will embrace the furnishing of all labor and materials and performing all work for the construction of a water treatment and pumping station, complete with all accessories required to construct the work in accordance with the Contract, the drawings, these specifications and the intent thereof at the Marine Barracks, New River, North Carolina.

DRAWINGS ACCOMPANYING SPECIFICATIONS:

The following drawings accompany these specifications and will form a part of the work. Wherever "as shown", "as indicated", "as detailed", or words of similar import are used, it shall be understood that reference to these drawings is made unless stated otherwise. Drawings are the property

of the Government and shall not be used for any purpose other than that contemplated by the specifications.

PARTIAL LIST OF DRAWINGS, WATER STORAGE AND TREATMENT PLANT

M. B. Nos.	Y & D. Nos.	Title
541	162221	Foundation Plan - Reinforcing Details & Schedules
542	162222	Plans Showing Origin of Reinforcing Sections - Stairs & Details
543	162223	Reinforcing Steel Sections - Filter & Wash Water Pump Room
544	162224	Reinforcing Steel Sections - Filters, Reception Hall & Filter Beams
545	162225	Reinforcing Steel Sections - Front Filter Walls, Sections & Details
546	162226	Reinforcing Steel Sections - Filters, Rear Pipe Gallery Wall & Details
547	162227	Reinforcing Steel Plans - Floor Elevation 27.5 - End Filter Foundation; Walls & Details
548	162228	Reinforcing Steel Plans - Floor Elevation 37.0 - Steel in Top Slabs & Catwalks
549	162229	Reinforcing Steel Plans - Floor Elevation 37.0 - Steel in Bottom of Slabs & Water Proofing
550	162230	Miscellaneous Details
551	162231	Miscellaneous Details
552	162232	Bill of Materials - Reinforcing Steel
553	162233	Pipe Gallery & Wash Water Pump - Underdrainage System
554	162234	Filters & Pipe Gallery - Section thru Pipe Gallery
555	162235	Plan Filter Operating Floor - Section Filter & Pipe Gallery
556	162236	Pumps, Piping & Control Equipment, 2 longitudinal Sections
557	162237	

of the Government and shall not be used for any purpose other than that contemplated by the specifications.

PARTIAL LIST OF DRAWINGS, WATER STORAGE & TREATMENT PLANT (CONT'D)

M. B. Nos.	Y & D Nos.	Title
557	162237	Transition piece, Manifold pipe
558	162238	Pipe Railing, Trench-Covers, Steel-Floor-Cover
559	162239	Miscellaneous Details
560	162240	Miscellaneous Details
2867		First Floor Plan, Door and Window Schedule Sections
2868		Second Floor Plan, Sections, Details, Roof Drainage Plan
2869		Elevations, Sections and Typical Window Details
2870		Cross Sections, Section Details, Slab and Beam Schedules
3639		Plumbing Layout
3640		Heating Layout
1736		Electrical Layout
2700		Distribution Transformer

SECTION 1

GENERAL CONDITIONS

1-01. Description:

The general conditions stated herein shall apply to any and all parts of the work to be performed under this contract.

1-02. Intent of Drawings and Specifications:

Unless otherwise specifically set forth, the Contractors shall furnish all material, plant supplies, equipment, labor, etc., necessary to complete the work according to the true intent and meaning of the drawings and specifications of which intent and meaning the Resident Officer-in-Charge shall be the interpreter.

1-03. Protection of Material and Work:

The Contractors shall, at all times, carefully and properly protect all materials of any description, both before and after being used on the work, and all work performed, and provide all enclosure or special protection from weather deemed necessary.

1-04. Samples, etc: The Contractor shall furnish samples of materials proposed for use on the work, when required under the several headings of the specification, and when samples are approved no substitution shall be made without the consent of the Resident Officer-in-Charge.

Where any particular brand of manufactured article is specified, it is used simply for convenience to indicate the character or quality of the article desired. Another make or brand, equally good in the opinion of the Resident Officer-in-Charge will be acceptable.

In no case shall materials be delivered to the work until the required approval has been given.

Spec. No. 802

SECTION I

GENERAL CONDITIONS

1-01. Description:

The General Conditions stated herein shall apply to any and all parts of the work to be performed under this contract.

1-02. Interpretation and Specifications:

Unless otherwise specifically set forth, the Contractor shall furnish all material, plant supplies, equipment, labor, etc., necessary to complete the work according to the true intent and meaning of the drawings and specifications of which attent and according the specifications shall be the interpretation.

1-03. Inspection of Work:

The Inspector shall, at all times, carefully and properly inspect all work performed, both before and after being incorporated in the work. and all work performed, and provide for observance of special precautions from weather during necessary.

1-04. Samples, etc.: The Contractor shall furnish samples of materials proposed for use in the work, when required under the several headings of the specifications. No substitutions or made without the consent of and Assistant Director-in-Charge.

Where any portion of any standard article is specified, it is used simply for a standard of quality and character or quality of the article desired. In any case or doubt, equally good in the opinion of the Architect-in-Charge will be accepted.

If any work shall be started prior to approval of plans, it shall be done at the Contractor's risk.

1-05. NAVY DEPARTMENT, BUREAU OF YARDS AND DOCKS, AND FEDERAL SPECIFICATIONS, hereinafter referred to, including latest revisions and amendments, may be seen at the office of the Resident Officer-in-Charge or at the offices of the Bureau of Yards and Docks, Washington, D. C. Copies of these documents may be obtained by applying at the Government Printing Office, Washington, D. C., Superintendent of Documents; the specification desired should be indicated by number and date.

Where detailed requirements are omitted as a whole or in part, the standard specifications given in the following list shall govern except where modified by this specification and/or its accompanying drawings.

NAVAL SPECIFICATIONS

No.	Date	Title
No. 4 Yd	October 1939	Construction of Portland Cement Concrete Pavements
No. 7Yg	January 2, 1934	Roofing, Siding, and Sheet Metal Work; Damp-proofing and Membrane Waterproofing
Addendum No. 1	October 1935	
No. 9 Ye	Bureau of Yards and Docks	Electric Motors
No. 11 Yc	October 1939	Marble and Tile Work
No. 12 Yb	September 1934	Standards of Design for Structural Steel
No. 13 Yc	October 1935	Concrete Construction
No. 17 Yb	July 1938	Metal Weatherstripping for Wood Doors, Windows & Transoms
No. 21 Yc		Installation of Equipment
No. 22 Yb	May 1939	Structural Steel Welding
No. 26 Ya	April 1, 1930	Earthwork
No. 27 Yb	May 1939	Screens
No. 33 RId		Gaskets, rubber
No. 39 P14a	November 1, 1940	Wood piles

NAVAL SPECIFICATIONS (CONT'D)

No.	Date	Title
42 P12f	September 1, 1939	Padlocks
42 C12h	April 1, 1940	Cloth, Wire Screens
43 B11c	September 1, 1936	Bolts, Nuts, Studs and Tap Rivets
44 P10i	May 2, 1938	Pipe, Steel; Seamless and Welded, Black and galvanized.
44 T2c		Standard Threads
45 F5d	September 3, 1940	Fittings, Pipe, Iron (Malleable) Threaded, 150 lb.
45 G11	November 15, 1939	Gauges
46 I6c	July 1, 1940	Gray iron castings
46 S14a	March 1, 1933	Solder, Tin-Lead
47 C2f	March 1, 1933	Copper: Bars, Plates, Rods, Shapes, Sheets, Strips,
47 L1b	August 1, 1933	Lead, Sheet
47 S10d	February 1, 1935	Steel, Sheet, Black and Zinc-Coated (Galvanized)
48S8c	August 1, 1934	Steelwork, Structural, Fabricated (Shore Use)
52 C5b	March 1, 1941	Cement, Linoleum
52 P17a	March 1, 1941	Primer and Enamel, Bituminous
52 V10	April 2, 1934	Varnish, Asphalt
52 V13d	May 1, 1941	Varnish, Insulating (Electrical)
66P1a		Power plant, heating & ventilating piping.

FEDERAL SPECIFICATIONS

No.	Date	Title
DD-G-451	April 28, 1931	Glass; Flat for Glazing Purposes
FF-H-106	June 6, 1933	Hardware; Locks, and Trim
FF-H-111	September 5, 1933	Hardware; Shelf and Miscellaneous
FF-H-116a	February 10, 1937	Hardware; Hinges

MARIE STRATIFICATIONS (CONT'D)

No.	Date	Title
[illegible]	September 1, 1980	Proclivate
[illegible]	April 1, 1810	Cliff, Fire Gorgons
[illegible]	September 3, 1932	Delta, Mute, Study and Top Virgin
[illegible]	May 2, 1932	Trip, Steal; Surplus and Helical Blade and Pulverized,
[illegible]	September 5, 1920	[illegible]
[illegible]	November 15, 1939	Pen-S
[illegible]	July 1, 1910	Grey Iron Reading
[illegible]	April 1, 1933	Solder, Tin-Lead
[illegible]	March 1, 1932	Copper Bar, Plate, Rod, Gauge, Sheet
[illegible]	August 1, 1930	Lead, Sheet
[illegible]	February 1, 1934	Steel, Sheet, Mild and Alloy-Coated (Galvanized)
[illegible]	August 1, 1934	Stainless, Structural, Polished (Above 18")
[illegible]	March 1, 1941	Copper, Plate, Bar
[illegible]	March 1, 1942	Primer and Undercoat, Metallic
[illegible]	April-2, 1934	Varnish, Wash-15
[illegible]	May 1, 1901	Varnish, Insulating (Miscellaneous)
[illegible]		Paper Plate, Packing & Varnishing

PAINTS, STAINS

No.	Date	Title
[illegible]	[illegible]	Paper Coating Aluminum
[illegible]	[illegible]	Black; Flat for Glazing Purposes
[illegible]	June 6, 1938	Red Lead, Powder and Mixed
[illegible]	September 6, 1952	Primers, Mill and Miscellaneous
[illegible]	February 19, 1937	Synthetic Type

FEDERAL SPECIFICATIONS (CONT'D)

No.	Date	Title
FF-H-136	October 29, 1936	Hardware; Lavatory
FF-H-121a	April 12, 1937	Hardware; Door Closers
FF-N-101	May 3, 1932	Nails, Spikes, Staples, Tacks
LLL-L-321a	May 21, 1935	Fiber-Board; Insulating
LLL-L-351a	May 2, 1939	Linoleum; Battleship
QQ-B-71a	January 12, 1938	Bars; reinforcement, concrete
QQ-L-156	June 5, 1934	Lead, Calking
QQ-M-151a	November 27, 1937	Metals, General Spec. for inspection of
QQ-S-711a	August 27, 1937	Steel; Structural (for bridges)
QQ-S-721A	August 27, 1937	Steel, Structural (for buildings)
QQ-T-191	August 1, 1933	Terne-Plate (Long Ternes)
RR-T-661	January 20, 1936	Treads; Safety, Metallic
SS-B-656	June 28, 1932	Brick, Building, (Common) clay
SS-B-691		Brick, Sewer, Clay
SS-C-161	February 7, 1933	Cement, Keenes
SS-C-191A	September 30, 1936	Cement, Portland
SS-C-201	September 30, 1936	Cement, Portland, High-Early-Strength
SS-G-901	October 14, 1930	Gypsum, Calcined
SS-P-401	March 3, 1931	Plaster; Gypsum
SS-P-431a	April 1935	Plaster-Board; Gypsum
SS-P-351	August 28, 1940	Pipe: Cement - Asbestos
SS-P-361	June 1935	Pipe: Clay, Sewer
SS-P-371	February 19, 1937	Pipe, Concrete, Non-pressure, non-reinforced and reinforced

FEDERAL SPECIFICAYIONS (CONT'D)

No.	Date	Title
SS-S-721	November 10, 1931	Stone, Architectural, Cast
SS-T-341	July 3, 1934	Tile: Structural, Clay Load Bearing, Wall
SS-W-51a	April 2, 1935	Wall Board - Gypsum
TT-D-651	March 31, 1931	Drier; Paint-Liquid
TT-P-23a	March 22, 1940	Paint: Cold Water
TT-P-36a	July 23, 1938	Paints: Lead-Zinc-Base
TT-P-56	October 5, 1935	Paint: (for) Priming Plaster Surfaces
TT-P-61	March 31, 1931	Paint: Ready-mixed, and Semi-paste, Black
TT-R-191a	July 5, 1938	Red Lead, Dry and Paste-in-oil
TT-P-781	December 28, 1939	Putty and Elastic-Compound (for) Metal Sash-Glazing
TT-P-791a	June 25, 1938	Putty: Pure-Linseed-Oil for Wood Glazing
TT-S-176	October 29, 1938	Sealer; Floor, Wood
TT-T-271	March 31, 1931	Thinner; Paint
TT-V-71a	September 9, 1939	Varnish: Interior
TT-V-91a	February 26, 1940	Varnish: Shellac
TT-V-121a	May 7, 1935	Varnish: Spar, Water Resisting
TT-W-251a	November 6, 1934	White Lead
UU-V-101a	July 3, 1935	Wallboard, Composition
WW-P-356		Cast iron, threaded
WW-P-401	June 17, 1935	Soil Pipe and Fittings
WW-P-421	July 21, 1931	Pipe, Water, Cast Iron (Bell and Spigot)
WW-P-491		Pipe fittings, cast iron drainage.

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

FEDERAL SPECIFICATIONS (CONT'D)

No.	Date	Title
WW-P-501	January 9, 1934	Pipe Fittings, Cast Iron (Threaded)
WW-P-541a		Plumbing Fixtures: (for) Shore Purpose
WW-T-799	October 18, 1932	Tubing, Copper
WW-V-51		Valves, brass or bronze, angle & globe
WW-V-76b	November 25, 1938	Valves, Gate: 125 Pound Threaded and Flanged (For Land Use)

1-06. DRAWINGS AND SPECIFICATIONS COOPERATIVE:

The drawings and specifications shall be considered as cooperative and work and materials called for by one and not shown or mentioned in the other shall be done or furnished in as faithful and thorough a manner as though fully covered by both.

1-07. COMPLETE WORK REQUIRED:

It is intended that the drawings and these specifications include everything requisiste and necessary to finish the entire work properly notwithstanding every item necessarily involved is not particularly mentioned.

All work when finished shall be delivered in a complete and undamaged state.

1-08. PLANS AND WORKING DRAWINGS:

Plans, showing such details as are necessary to give a comprehensive idea of the construction contemplated will be furnished.

The Contractors shall submit for approval, eight (8) copies of all shop drawings called for under the various headings.

These drawings shall be complete, giving all the required information. If approved, each copy will be identified as having received such approval by being stamped or marked thus:

MARINE BARRACKS

NEW RIVER NORTH CAROLINA

Office of Resident Officer-in-Charge

- - - - - - - - - - - - - - - - - - - -

Spec'n No._____ Project No._____
Approved subject to Contract
Requirements and Corrections
noted in red.

_____
Resident Officer-in-Charge
By direction

After being stamped and marked for correction with the necessary changes having been indicated thereon, the drawings will be returned to the Contractors for the necessary corrections. After the corrections have been made, the Contractors shall submit four (4) copies of corrected drawings for final approval.

The approval shall not be construed as a complete check, but will only indicate that the general method of construction and detail is satisfactory. Approval of drawings will not relieve the Contractors of the responsibility for any error which may exist, as the Contractors shall be responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work.

If the drawings are not approved each copy will be so identified by being stamped or marked thus: "THIS SHOP DRAWING IS NOT APPROVED" and

dated and returned to the Contractor for resubmission.

1-09. SUBSTITUTION OF MATERIALS:

Where it is found that materials called for are not obtainable, other materials may be used, but the approval of the Resident Officer-in-Charge must first be obtained.

1-10. REMOVING RUBBISH:

The Contractors shall at all times keep the buildings and premises reasonably free of dirt and rubbish resulting from their operations. When delivered the premises and buildings shall be in a clean and satisfactory condition.

1-11 COORDINATE DATUM:

Coordinates are based on the North Carolina State System of Plane Coordinates.

1-12. ELEVATION DATUM: All elevations given refer to Mean Sea Level.

1-13. EMERGENCY ALTERNATIVE SPECIFICATIONS:

From time to time certain emergency alternative specifications may be issued for the purpose of conserving strategic materials. The alternative specifications will supersede these specifications in the case of materials not already procured.

SECTION 2

CLEARING OF SITE

2-01. Preliminary Clearing:

(a) The contractor shall remove, by cutting at the ground level, all brush, dead trees, and small trees not exceeding 5" in diameter, at breast height (4' from ground). The area to be cleared will be outlined by the Government's Representative. Specimen dogwoods and young pines over 3" in diameter shall not be removed without the consent of the Government's Representative. This material shall be pilled in nearby open areas and burned. Proper care shall be exercised in burning to avoid damage to remaining trees and to prevent fires escaping. All fires shall be extinguished at the end of the day by covering the embers with sand or soil. All top soil removed from the sites of buildings and other structures shall be piled at nearby locations as directed by the Government's Representative, for use in landscaping.

2-02. Secondary Clearing:

After buildings and other structures have been staked out, all trees falling within the lines of the structures shall be removed; trees outside the lines of buildings or other structures shall be removed only by permission of the Government's Representative. Where necessary, hand excavation and refilling methods shall be used to avoid cutting or damaging the trunks, limbs or root systems of valuable trees.

2-03. Salvage of Timber:

The contractor shall save for use elsewhere on the project all trees suitable for piles, poles or saw timber. Saw logs shall be cut into 16' lengths; piles and poles shall be cleared of branches and tops, etc. Salvaged timber shall be disposed of as prescribed by the Government's Representative.

SECTION 3

EXCAVATION, FILLING AND GRADING

3-01. Description:

The work under this heading consists of furnishing material and equipment and performing necessary labor to do all the dewatering, bracing, excavation, filling and rough grading required in connection with the construction of the buildings, pipe lines and other structures shown on the drawings or specified herein.

3-02. Location of Structures:

The position of structures will be established by marking (a) definite lines of the exterior; (b) an elevation from which all foundations, floors and other grades may be measured.

3-03. Trench Excavation:

Trenches for sewers shall be excavated to the depth indicated by the construction drawings and to a width which will permit 6" of clearance between the barrel of the pipe and sides of the trench, in sizes up to and including 18"; and 8" in sizes over 18". Trenches for cast iron pipe shall be as narrow as possible, consistent with good pipe jointing. Where sheeting is used, trenches shall be cut to such additional width as may be required to obtain the clearance as specified above. Excavation shall be carried out in such a manner as not to interfere with existing ditches and other drainage features.

3-04. Length of Open Trench:

Trenches shall be opened in advance of pipe laying to such extent as may be consistent with the type of soil encountered. Where excavations will stand without caving, trenching operations may proceed well in advance of the pipe line. Where trenches are carried through unstable material, they

shall be excavated in advance of pipe laying only to such extent as may prove consistent with the conditions encountered.

3-05. Trench Excavation Below Sub-grade;

Whenever the character of the material at the bottom of an excavation is unsuitable for pipe laying, the trench shall be excavated to additional depth as required to place therein suitable foundation material. In no case shall trench excavation be carried to a depth below actual sub-grade where the pipe is to be laid on natural soil. Excavation shall be carried to a point slightly above grade and trimmed by hand to finished grade so that blocking or refilling under the pipe will not be necessary.

3-06. Special Foundations:

Where required the contractor shall remove unsuitable material from the bottom of the trench and he shall provide proper foundation for the pipe either by filling in with a layer of gravel or crushed stone, or where conditions warrant such action, he shall construct a foundation of timber or concrete in accordance with the details and dimensions indicated on the construction drawings, or as directed.

3-07. Dewatering Trenches:

Trenches shall be dewatered to such extent as is necessary to make dry joints in the pipe lines. Dewatering may be done by trench pumps, under drains, or well points. It is the intent, to use whichever method will apply best to a given condition, from the standpoint of expediting the work with the greatest economy. Trench drainage shall be disposed of, insofar as possible, so that other construction operations will not be interfered with. Where required, shallow ditches shall be excavated to carry the drainage to the nearest point of disposal.

3-08. Trench Bracing or Sheeting:

Excavations shall be spot-braced or sheeted, as conditions may require to safeguard men working therein, and or adjacent structures or proposed structures. Timbering shall be put in place by skilled workmen and shall be arranged so that it may be withdrawn as refilling proceeds. It is the intent to salvage sheeting and bracing wherever possible and the same will be left in trenches only where necessary to safeguard the pipe line under construction or adjacent structures or proposed structures. Sheeting extending below the springing line of the pipe shall not be withdrawn, but may be cut off above the lowest waler if practicable.

3-09. Trench Refilling:

The refilling of all excavations shall be carried out as rapidly as practicable after the completion of the structural work therein, or after the excavations have served their purpose. No refill shall be made, however, until all necessary measurements and elevations have been secured on the completed structure. Authorization to refill excavations will be given at the proper time by the Government's Representative.

In refilling trenches, in which vitrified or concrete pipe is laid, earth shall be thrown in by hand and solidly compacted under, around, and over the pipe to a depth of at least one foot above the top of the pipe. Such compacting shall be done in a thorough manner with rammers made for the purpose and due care shall be exercised not to disturb freshly made joints or the alignment of the pipe. From the above point to the top of the trench, refilling may be completed by hand or mechanically, with excess earth rounded over the top of the trench.

Excavations across roadways, or in other locations where settlement must be avoided, shall be thoroughly consolidated by ramming the refill in

6" layers or by puddling with water. In such cases, excess material shall be removed and disposed of as directed by the Government's Representative.

3-10. Excavation and Refill Around Treatment Plant and Other Structures:

The Contractor shall excavate to the dimensions and depths indicated or required. Excavations carried below the depths indicated shall be refilled to the proper grade with Class B-1 concrete. Excavation shall be shored and braced by members of suitable sizes and arrangement, where necessary, to prevent danger to persons or structures, injurious caving, or erosion. Shoring and bracing shall be installed so as not to interfere with the proper placing and compacting of backfilling, and so as not to require cross braces piercing the walls of any structures. Where required to be left inplace by the Government's Representative, shoring, bracing and/or sheeting shall be cut off at least 12" below the finished grade.

The contractor shall not allow ground water to rise within the limits of the excavations until the same have been refilled completely. Only clean sandy soil shall be used in refilling which shall be compacted thoroughly by hand or mechanical methods.

3-11. Dewatering Excavations for Structures:

The contractor shall provide adequate pumping equipment, under drains, well points and other equipment necessary to remove water from the excavations and keep them free from water while construction is in progress. It is the intent to use whichever method

will expedite the work with the greatest economy.

3-12. Precaution Against Floatation:

The contractor is warned that the structures herein specified are subject to floatation if water is allowed to rise around them before the backfilling is placed and compacted and the superstructures are completed. He shall have in place, at all times, duplicate pumping equipment and as an additional precaution shall leave pipe connections and other openings free in order that the structures may fill with water if the excavation accidentally should be flooded.

3-13. Disposal of Excess Material:

Surplus earth shall be distributed as directed by the Government's Representative.

SECTION 4

CONCRETE WORK

4-01. Description:

Work under this heading consists of furnishing all materials and equipment and performing necessary labor to do all concrete work shown on drawings or specified.

4-02. General:

The various trades shall be given opportunity to install all hangers, anchor bolts, inserts, sleeves, pipes, frames, water stops, or other items to be built into the concrete as required by the drawings and specifications, or as is necessary for the proper execution of the work. All the aforementioned items shall be installed exactly in the location and at the elevation shown on the drawings; shall be fastened securely to prevent displacement during pouring, and shall be checked and approved by the Government's Representative before concrete is poured.

4-03. Concrete:

Concrete shall be of the material required by, and shall be proportioned, mixed, placed, cured, and finished as required by Bureau of Yards and Docks Specification No. 13Yc.

4-04. Forms and Form Work shall conform in every respect to requirements of Bureau of Yards and Docks Specification 13Yc.

4-05. Reinforcement:

All reinforcement bars shall be intermediate grade, new billet steel and shall conform to and be placed in the manner specified by Bureau of Yards and Docks Specification 13Yc. Metal

Spec. No. 502

Section 4

CONCRETE CONSTRUCTION

4-01. Description:

Work under this heading consists of furnishing all materials and equipment and performing necessary labor to do all concrete work shown on drawings or specified.

4-02. General:

The various trades shall be given opportunity to install all hangers, anchor bolts, inserts, sleeves, pipes, frames, water stops, or other items to be built into the concrete as required by the drawings and specifications, or as necessary for the proper execution of the work. All the aforementioned items shall be installed exactly in the location and at the elevation shown on the drawings; shall be securely to prevent displacement during pouring, and shall be checked and approved by the Government's Representative before concrete is poured.

4-03. Concrete:

Concrete shall be of two thousand pounds, and shall be proportioned, mixed, placed, cured, and finished as required by Bureau of Yards and Docks Specification No. 19Yd.

4-04. Forms and Workmanship: shall conform in every respect to requirements of Bureau of Yards and Docks Specification 19Yd.

4-05. Reinforcement:

All reinforcement work shall be fabricated from billet steel and shall conform to and be placed in the manner specified by Bureau of Yards and Docks Specification 19Yd. Total

bar supports, ties and spacers shall be of steel, of an approved design, and adequate to insure against displacement of the reinforcement during the work of construction. Shop drawings and bending details will be required.

4-06. Footings and Piers shall be of the size and shape indicated on the drawings, placed on undistrubed soil which has been leveled properly.

4-07. Expansion Joints of a bituminous joint material, conforming to Bureau of Yards and Docks Specification 13Yc, shall be provided where shown on the drawings.

4-08. Vibration:

Concrete shall be uniformly dense and hard, free from honey comb and other defects. Concrete shall be compacted by means of high frequency mechanical internal vibration in accordance with the Requirements of Bureau of Yards and Docks Specification 13Yc.

4-09. Concrete Finishes shall be as shown on the drawings or required elsewhere in these specifications.

4-10. Beveling:

All exposed angles in concrete work shall be beveled 1".

4-11. Roof Slabs:

The tops of the structural slabs over which roofing is indicated shall be floated and troweled to true and smooth surfaces.

4-12. Reference to Yards and Docks Specifications:

Wherever in these specifications references occur to certain classes of concrete and concrete finishes, it shall be understood to refer to the classes and finishes described in Bureau of Yards and Docks Specifications No. 13Yc.

SECTION 5

MANHOLES

5-01. Description:

Manholes of brick masonry shall be built at such locations as shown on the drawings. Channels shall be formed in the bottom of manholes and shall be extended to the inside top of the sewer or drain. Manhole on sewers 24" in diameter and larger shall be 5' feet inside diameter. Wider or deeper foundations than those shown on the drawings shall be used wherever soil conditions are encountered which may make this necessary.

When constructing brick manholes, special care shall be exercised to fill completely joints with cement mortar so that the finished work will be watertight. Special attention shall be given to dewatering manhole excavations so that the work may be performed in the dry, dewatering to continue until the mortar used in joints and in plastering the outside has hardened sufficiently to make a watertight structure.

Shove joints shall be used throughout and joints on the inside of the manhole shall be neatly struck and pointed. The use of bats will be permitted to a reasonable extent above the ground-water level only. The outside walls of all brick manholes shall be plastered with cement mortar 1/2" thick.

Blank connections shall be built in the manholes as indicated on the drawings. Manhole steps shall be securely set in the brick work as indicated on the construction drawings.

Manhole frames and covers shall be set on top of the finished brick work in a bed of mortar. Particular care shall be exercised to set covers to exact grade where the same are located in roads or sidewalks. In open

Spec. No. 606

SECTION 6

MANHOLES

6-01. Description:

Manholes of brick masonry shall be built at such locations as shown on the drawings. Channels shall be formed in the bottom of manholes and shall be extended to the inside top of the sewer or drain. Manhole cover opening 24" in diameter and larger shall be 5' feet inside diameter. Wider or deeper foundations than those shown on the drawings shall be used wherever soil conditions are encountered which may make this necessary.

When constructing brick manholes, special care shall be exercised to fill completely joints with cement mortar so that the finished work will be watertight. Special attention shall be given to diameter measurements so that the work may be performed in the dry, diameters to continue until the mortar used in joints and in plastering the outside has hardened sufficiently to make a watertight structure.

Shove joints shall be used [illegible]

the manhole shall be neatly struck and pointed. The use of putz will be permitted in a reasonable amount above the ground-water level only. The outside walls of all brick manholes shall be plastered with cement mortar 1/2" thick.

Block connections shall be built in the manholes as indicated on the drawings. Manhole steps shall be securely set in the brick work as indicated on the construction drawings.

Manhole frames and covers shall be set on top of the finished brick work in a bed of mortar. Particular care shall be exercised to set covers to exact grade where the same are located in roads or sidewalks. In open

areas, covers shall be set 3 inches above the adjacent grade in order to exclude surface water and grit.

After completion of manholes earth will be graded around the top of the frame to form a gradual slope meeting the adjacent grade.

5-02. Manhole Brick:

Brick used for manhole construction shall be new and whole, of uniform standard size, hard-burned throughout. They shall be free from cracks, true in shape, and shall not absorb more than 10% moisture when perfectly dry and then immersed in water for 24 hours. They shall otherwise conform to Federal Specification SS-B-656. (Class "H").

5-03. Manhole Frames, Covers, & Steps:

Castings shall be close grained gray iron of good quality and of such character that the castings will be strong and of even grain. The castings shall conform, so far as applicable, with Navy Department Specification 46I6c, July 1, 1940. No admixture of inferior metal will be permitted. The finished castings shall be true to pattern, smooth, free from scales, lumps, blisters, sand holes, or other defects which will make them unfit for use. Plugging or filling will not be permitted. The frames and covers shall be interchangeable throughout. The seating surface between frame and covers shall be machined as required to obtain a true surface, so that covers will fit into frames in any position without rocking. Castings shall be made to the exact size and dimensions as shown on the construction drawings. Frames and covers shall be thoroughly coated, before delivery, with a good grade of asphaltum. Steps shall be delivered uncoated.

5-04. Cement Mortar shall be composed of Portland cement one part and clean sharp sand three parts. Portland cement shall conform to Federal

Specification SS-C-191a, September 30, 1936. Sand shall consist of sharp silicious grains, free from clay, loam, dirt, mica or other organic matter or impurities.

Spec. No. 502

Specification 38-D-1916, September 30, 1936. Sand small content of sharp
silicious grains, free from clay, loam, dirt, mica or other organic
matter or impurities.

SECTION 6

STEEL AND IRON WORK

6-01. Description:

Work under this heading includes all miscellaneous steel and iron work indicated, specified or necessary to complete the work.

6-02. Structural Steel:

All structural steel shall be in accordance with Federal Specifications QQ-S-721a and Navy Department Specification 48S8c. Welding shall be in accordance with Bureau of Yards and Docks Specification 22 Yb.

6-03. Castings:

Castings, unless otherwise specified, shall be close grained gray iron of good quality, sound and conform, insofar as is applicable with Navy Department Specification 46I6c, July 1, 1940. No admixture of inferior metal will be permitted. The finished castings shall be true to an approved pattern, smooth, free from scales, lumps, blisters, sand-holes, or other defects which will make them unfit for use. Plugging or filling will not be permitted. Castings shall be delivered uncoated.

6-04. Pipe Railings:

1-1/2" black steel pipe railings shall be installed as shown on the drawings. Railings shall be bolted securely in position by means of anchor or expansion bolts. Fittings may be of the screw threaded type, or welded slip joint type. Pipe shall conform to the requirements of Navy Department Specification 44P10i. Posts and railings abutting masonry shall engage flanges which shall be secured by suitable anchor, expansion or toggle bolts as the case requires. Railings in connection with stairs shall consist of a top rail which shall be about 3 feet above the stair treads, an intermediate rail about half-way between the top rail and the stair treads, and uprights which

Spec. No. 802

SECTION C

STEEL AND WORKMANSHIP

C-01. Description:

Work under this heading includes all miscellaneous steel and iron work installed, specified or necessary to complete the work.

C-02. Structural Steel:

All structural steel shall be in accordance with Federal Specifications QQ-S-781a and Navy Department Specification 46B3a. Rolling mill tolerances shall be in accordance with Manual of Steel Construction AISC.

C-03. Castings:

Castings, unless otherwise specified, shall be close grained gray iron of good quality, sound and smooth. Number 30 application with Navy Department Specification 46B3a, July 1, 1950. No unbroken or imperfect castings will be permitted. The finished castings shall be true to the approved pattern, though free from scales, flaws, blisters, misruns, or other defects which will make them unfit for use. Plug or filling will not be permitted.

C-04. Pipe Rails:

1-1/2" black steel pipe railings shall be shown at the drawings. Railings shall be bolted securely in position by means of another or expansion bolts. Fittings may be of the screw threaded type, or welded butt joint type. Pipe shall conform to the requirements of Navy Department Specification 46B3a. Posts and railings subject to impact loads shall be reinforced by substantial gussets, escutcheon or flange plates. Railing in connection with stairs shall extend at top rail which shall be about 3 inches above the stair treads, or likewise the rail about 42-inches between the top rail and the stair treads, and uprights which

shall be located at the top and bottom of each run, and intermediate uprights so that no span will exceed 7 ft. Removable sections shall be arranged so that they may be removed readily but shall provide positive protection when in place.

6-05. Thresholds:

Steel thresholds or cast iron thresholds into which an approved antislip, granular or lead surface has been incorporated, shall be provided for exterior doors. They shall have beveled edges and a channeled or checkered top surface, fitted neatly to the door jambs, and secured in place by countersunk-head expansion bolts staggered and spaced not more than 13 inches apart.

6-06. Manhole Steps:

Manhole steps shall be in accordance with Paragraph 5-03.

6-07. Trench Plates:

Checkered steel trench and pit plates shall be installed as shown on the drawings. Steel shall be in accordance with Navy Department Specification 48S8c. Welding shall be done in accordance with Bureau of Yards and Docks Specification 22Yb. Shop drawings shall be submitted.

6-08. Gratings: The Contractor shall install steel gratings where shown on the drawings. Steel shall be in accordance with Navy Department Specifications 48S8c. Welding shall be done in accordance with Bureau of Yards and Docks Specification 22Yb. Shop drawings shall be submitted.

SECTION 7

PERMANENT UNDERDRAINS

7-01. Description:

The Contractor shall construct permanent underdrains as shown or as required and directed by the Government's Representative. Underdrains shall be constructed of not less than 4" inch terra cotta or cast iron pipe, as shown, laid with open joints. A small piece of wood shall be placed in the bell of each length to center the next length and provide a smooth flow line. The outside of each joint shall be wrapped with two thicknesses of burlap and the pipe shall be completely surrounded with minimum thickness of 6" inches of gravel. Gravel shall be graded from 1/8" to 3/8" with the largest size nearest the pipe. The entire installation shall be made upon undisturbed earth, and, if necessary, heavy plank shall be used to bridge trenches.

SECTION 8

CAST IRON PIPE AND FITTINGS

8-01. Description:

Under this heading are included all filters, influent, effluent, wash water and sewer mains, raw water transmission, pump suction and discharge, and service or other cast iron lines required for the completion of the work. Cast iron soil pipe lines are not included under this heading. Furnishing and placing of pumping and other equipment connecting to pipe lines is described elsewhere herein. Pipe lines shall be constructed complete, including all fittings, valves, floor stands, wall castings, pipe supports, etc. All materials required for installing the pipe lines, such as lead, hemp, gaskets, bolts, nuts, etc., and all labor, tools and appliances shall be furnished by the Contractor.

8-02. Excavation and Refill:

The Contractor shall excavate such trenches below or outside the limits of the excavation for the building as may be necessary for the installation of pipe lines. Excavation generally shall be in accordance with Section 3 herein. Trenches shall be only of such depth and width, as shall be required to enable joints to be made properly. Pipe line trenches shall be refilled, with earth, gravel and concrete, as shown on the drawings or as directed by the Government's Representative.

8-03. Lines and Elevations:

All pipes, fittings, wall castings, etc., shall be placed accurately in the positions and at the elevation shown on the drawings and shall be so maintained. The Contractor shall cut pipe neatly to measurement, wherever necessary, to bring pipe, fittings or valves into proper position. Suitable supports shall be placed under fittings and valves and elsewhere as necessary or as directed.

8-04. Connections to Existing Pipe:

The Contractor shall make such connections to existing pipe as may be shown on the drawings, or as may become necessary.

8-05. Laying Pipe:

Proper and suitable tools and appliances shall be used for the safe and convenient handling and laying of pipes and fittings. Great care shall be taken to prevent damage to the pipe coating, particularly on the inside of the pipes and fittings. All pipes shall be examined carefully for defects, and no pipe shall be laid which is known to be defective. No pipe shall be encased in concrete or covered until properly tested. If any defective piece is discovered after having been laid it shall be removed and replaced with a sound one in a satisfactory manner. All pipes and fittings shall be thoroughly cleaned before they are laid, shall be kept clean until they care accepted in the completed work, and when laid shall conform accurately to the lines and grades shown on the drawings. The cleaning of these pipes is of extreme importance.

Pipe shall be unloaded mechanically or by hand in such manner as will avoid breakage. Derricks, skids or other approved methods shall be used. Under no conditions shall cast iron pipe be dropped, dragged or otherwise roughly handled to such extent as will cause damage to the pipe or the material with which it is coated.

Before any joint is poured the last length of pipe shall be adjusted to horizontal and vertical alignment. No kinks will be permitted.

8-06. Lead Joints:

In jointing the bell-and-spigot pipes and fittings the spigot of each pipe shall be properly seated in the bell of the next adjacent piece and adjusted so as to give a uniform space for the joint which shall be made with twisted or braided hemp packing and soft pig lead. Before entering

the spigot into the bell both bell and spigot shall be free from moisture and cleaned of earth, sand, grease, or lumps of tar coating. The packing shall be thoroughly driven into the bell so that the lead, after having been calked, shall have a depth of not less than 2 inches for pipe less than 6 inches in diameter and not less than 2½ inches for larger pipe. The melting pot shall be kept near the joint to be poured, and each joint shall be made in one pouring. Dross shall not be allowed to accumulate in the melting pot. The joints shall be thoroughly calked by competent pipe joiners, and in such manner as shall secure a tight joint without overstraining the iron of the bells.

In general, calking tools of three sizes shall be used on each joint, beginning with the smallest and finishing with the largest. The tool used last shall be slightly smaller than the width of the finished joint. Calking shall be done with a hammer weighing not less than 3½ lbs.

8-07. Flanged Joints:

Flanged joints shall be made up with 1/16" thick, ring type, cold water gaskets of approved material. Flanges shall be drawn-up evenly and snugly with square head machine bolts and hexagonal nuts. In making up flanged lines care shall be taken not to produce stresses in the piping and pipe and fittings shall be completely assembled and adequately supported, in final position, by suitable hangers or piers before any flange is bolted to a pump or other piece of equipment.

8-08. Cast Iron Pipe:

Cast iron bell and spigot pipe shall be Class B, A.W.W.A. Standard. Flanged pipe shall be 125 lb. American Standard flanges on Class B cast iron pipe.

8-09. Calking Lead:

Pig lead for jointing pipe and fittings shall be in accordance with Federal Specification No. QQ-L-156.

8-10. Bell and Spigot Fittings:

Cast iron bell and spigot fittings shall be Class D, A.W.W.A. Standard for sizes up to and including 12"; fittings over 12" shall be Class B. Dead end castings, plugs, and bends exceeding $22\frac{1}{2}^{o}$ shall be securely anchored in position by concrete backing placed against solid earth or by steel tie rods. Steel tie rods shall be installed when and as directed by the Government's Representative.

8-11. Flanged Fittings:

Unless otherwise indicated flanged fittings shall be 125 lb. American Standard for steam. Eccentric reducing fittings shall be used where shown.

8-12. Wall Castings:

Necessary wall castings shall be furnished and set for pipe passing through the walls. Castings shall be of the type indicated and shall be provided with suitable water stops. Castings shall be set in walls at time of pouring concrete, special care being taken to insure that they will remain in true line and grade.

8-13. Valve Boxes:

Valve boxes shall be of cast iron, adjustable as to length, and enlarged at the lower end to fit the valve bonnet snugly. The shaft shall be not less than $5\frac{1}{2}$" in diameter and the total weight of the box shall be not less than 70 lbs. The lid shall have the word "WATER" cast on top.

8-14. Floor Stands:

Floor stands shall be of cast iron with bronze lifting nuts and cast iron hand wheel. Lifting nut threads and hand wheels shall be

S-10. Bell and Spigot Fittings:

Cast iron bell and spigot fittings shall be Class B, A.W.W.A. Standard for sizes up to and including 12"; fittings over 12" shall be Class B. Bead end coatings, plugs, and bends exceeding 22½° shall be securely anchored in position by concrete backing placed against solid earth or by steel tie rods. Steel tie rods shall be installed when and as directed by the Government's Representative.

S-11. Flanged Fittings:

Unless otherwise indicated flanged fittings shall be ISB lb. American Standard for steam. Eccentric reducing fittings shall be used where shown.

S-12. Wall Castings:

Necessary wall castings shall be furnished and set for pipe passing through the walls. Castings shall be of the type indicated and shall be provided with suitable water stops. Castings shall be set in walls at time of pouring concrete, special care being taken to insure that they will remain in true line and grade.

S-13. Valve Boxes:

Valve boxes shall be of cast iron. Adjustable as to length, and enlarged at the lower end to fit the valve bonnet as ~~shown~~. The shaft shall be not less than 5¼" in diameter and the total weight of the box shall be not less than 70 lbs. The lid shall have the word "WATER" cast on top.

S-14. Floor Stands:

Floor stands shall be of cast iron with bronze lifting nuts and cast iron hand wheel. Lifting nut threads and head wheels shall be

suitable for the valve to be operated. Floor stands shall be bolted securely at the base.

8-15. Pipe Supports:

Pipe entering and leaving buildings shall be supported so as to protect the pipe against settlement. Pipe within buildings shall be supported by members capable of taking the weight and shall be provided with necessary hangers, saddles, rollers, brackets, piers, or other supports as may be shown on the drawings, or as necessary for proper support.

8-16. Testing:

All cast iron pressure pipe lines shall be tight when completed. The Contractor shall test all low pressure lines including, influent, effluent, sewer raw water and suction pipes, wash water, pump discharges, service lines and all other piping connected with the outside water system shall be tested with 150 pounds water pressure for a period of one hour. All pipe lines to be tested shall be allowed to remain open to view until after the test has shown them to be absolutely tight. No pipe shall be concreted around, or filled or floored over, until the Government's Representative is satisfied that the line in question is tight and has ordered it covered. Should the test on any line show that the same is not tight, the contractor shall take such additional steps as may be necessary to render them absolutely tight.

8-17. Sterilizing Pipe:

During the laying of water pipes chlorinated lime, containing not less than 50% of available chlorine shall be placed in the pipes as they are laid. The exact quantity and spacing of doses will be indicated by the Government's Representative. In order to mix and circulate the

sterilizing agent throughout the pipe lines water shall be turned in from such points and in such sequence as will produce the most effective results. It is desired that a strong chlorine residual, not less than 20 parts per million, be retained in the pipe for a period of 24 hours. In lieu of the above method a portable chlorinator and liquid chlorine may be employed to sterilize the pipes. After sterilization the system shall be thoroughly flushed using water from the service mains. The sterilization shall be conducted in such a manner that all pumps and other equipment in the treatment plant coming in contact with water will be thoroughly disinfected.

Spec. No. 808 *

sterilizing agent throughout the pipe lines water shall be turned in from such points and in such sequence as will produce the most effective results. It is desired that a strong chlorine residual, not less than 50 parts per million, be retained in the pipe for a period of 24 hours. In lieu of the above method portable chlorinator and liquid chlorine may be employed to sterilize the pipes. After sterilization the system shall be thoroughly flushed using water from the service mains. The sterilization shall be accomplished in such a manner that all pumps and other equipment in the treatment plant coming in contact with water will be thoroughly disinfected.

SECTION 9

MISCELLANEOUS PIPING

9-01. Description:

Work under this heading consists of the construction of piping to convey water, chlorine solution, air, etc., between the various units of the treatment plant.

9-02. Excavation and Refill:

Shall be performed in accordance with provisions of Section 3 herein.

9-03. Steel Pipe:

Steel pipe shall be standard weight black, Navy Department Specification 44P10i, May 2, 1938, threaded and coupled. Before making up pipe, the male thread shall be coated with an approved pipe thread compound.

9-04. Soil Pipe:

Soil pipe (except in acid waste lines) shall be extra heavy cast iron soil pipe of best quality, meeting the requirements of Federal Specification WW-P-401, June 17, 1935, with caulked lead joints. All changes in pipe sizes shall be made with proper increasing fittings. Changes of direction shall be made by using proper fittings such as wyes, one-half, one-sixth, and one-eight bends, except that sanitary tees may be used at the base of vertical stacks. Clean-outs shall be installed so as to permit clearing of any lines without tearing the same down.

9-05. Acid Drain Pipe, Fittings and Connections:

Sewer pipe receiving acid drainage from the laboratory shall be laid in accordance with the following provisions; The joints shall be

SECTION D

MISCELLANEOUS PIPING

D-01. Description:

Work under this heading consists of the construction of piping to convey water, chlorine solution, air, etc., between the various units of the treatment plant.

D-02. Excavation and Refill:

Shall be performed in accordance with provisions of Section B hereof.

D-03. Brass Pipe:

Brass pipe shall be standard weight Class, Navy Department Specification WW-P-351, May 8, 1950, threaded and coupled. Screw fitting up pipe, the male thread shall be covered with an approved pipe thread compound.

D-04. Soil Pipe:

Soil pipe (except in acid waste lines) shall be cast iron soil pipe, Federal Specification WW-P-401, June 17, 1932, with caulked lead joints, and shall be pipe-marked with name of manufacturer. Each length of pipe shall be free by using proper fittings such as wyes, one-half one-sixth, and one-eighth bends, except that extra heavy hubs may be used at the base of vertical risers. Clean-outs shall be installed so as to permit cleaning of any line without taking the pipe down.

D-05. Acid Drain Pipe, Fittings and Joints:

Every plant handling acid shall have an adequate drainage system. Type and capacity shall be laid in accordance with the following provisions: The joints shall be

carefully made by packing one-half of the hub with specially treated pure asbestos packing well rammed. The remainder of the hub shall be carefully and thoroughly filled with an acid resisting coal tar compound.

Cast iron pipe lines receiving acid drainage shall be in accordance with the following requirements: Pipe and fittings shall be uncoated, extra heavy, bell and spigot acid resisting cast iron pipe containing from 12% to 14% silicon. All traps and waste connections shall be extended through the roof with bell and spigot cast iron pipe as specified for sanitary drainage lines. Inside of vent pipes shall be hot coated with acid resisting coal tar compound.

9-06. Copper Tubing:

Copper tubing shall be seamless type "L" with soldered or flanged fittings in accordance with Federal Specification WW-T-799, October 18, 1932, including Errata No. 2.

9-07. Chlorine Solution Piping:

Chlorine solution shall be conveyed in rubber chemical solution hose run inside of conduit consisting of terra cotta pipe with cement joints laid accurately to line and grade and in accordance with the applicable provisions of Sections 3 and 11. Hose and appurtenances shall be of material selected for resistance to the corrosive effect of chlorine. Conduit inside of buildings shall be of black steel pipe, standard weight, suspended or supported as shown on the plans.

9-08. Threaded Fittings:

Threaded fittings shall be black, malleable iron in accordance with Navy Department Specification 45F5c, July 1934.

9-09. Pipe Supports: All pipe lines shall be laid to the line and grade shown on the drawings and shall be accurately supported with suitable hangers, piers, brackets or other supports that may be necessary or as required by the Government's Representative.

carefully made by breaking one-half of the hub with specially treated pure asbestos packing will remain. The remainder of the hub shall be carefully and thoroughly filled with an acid resisting coal tar compound.

Cast iron pipe lines receiving acid drainage shall be in accordance with the following requirements. Pipe and fittings shall be uncoated, extra heavy, bell and spigot acid resisting cast iron pipe containing from 13½ to 14½ silicon. All traps and waste connections shall be extended through the roof with bell and spigot cast iron pipe as specified for sanitary drainage lines. Inside of vent pipes shall be not coated with acid resisting coal tar compound.

D-06. Copper Tubing:

Copper tubing shall be seamless type "L" with soldered or flanged fittings in accordance with Federal Specification WW-T-795, October 19, 1932, including Errata No. 2.

D-07. Chlorine Solution Piping:

Chlorine solution shall be conveyed in rubber chemical solution hose run inside of conduit or existing 2" or 4" cast iron pipe with flanged joints. All hose shall be suitable for the pressure used in the system. Provisions of Sections 5 and 11. Hose and appurtenances shall be of material selected for resistance to the corrosive effect of wet rinse. Gaskets inside of buildings shall be of black sheet fiber, extended weight, suspended or supported as shown on the Plans.

D-08. Threaded Fittings:

Threaded fittings shall be black, malleable iron in accordance with Navy Department Specification dated July 1934.

D-09. Pipe Supports: All pipe lines shall be supported on the line and brace shown on the drawings and shall be adequately supported with suitable hangers, piers, brackets or other supports which may be necessary or as required by the Government's Representative.

SECTION 10

SEWERS AND DRAINS

10-01. Description:

Work under this heading includes the construction of sewers and drains in and around the water treatment plant.

10-02. Excavation and Refill: Shall be performed in accordance with the provisions of Section 3 herein.

10-03. Pipe Laying:

Pipe for sewers and drains shall be of vitrified clay unless otherwise shown. In laying pipe the bell shall always point up-grade and special care shall be exercised to insure that each length shall abut solidly against the length already laid.

Before joints are made, each pipe shall be well bedded on solid foundation after the preceding length has been thoroughly embedded and secured in place. Cement joints shall be made by entering the spigot end of the pipe into the bell and calking the annular space with tightly twisted hemp or jute, particular care being taken to center the pipe exactly so that no shoulder or uneveness shall occur along the inside of the pipe barrell. The hemp or jute gasket shall be of one continuous piece for each joint and of such diameter as to fit the annular space snugly. The gasket shall be well calked with a hardwood or iron tool until it is solidly against the back of the bell.

Before any joint is made, pipe shall be set exactly to grade by means of a suitable grade rod which shall be so equipped that exact measurement may be carried from the grade line overhead to the invert of the pipe line. In general, grade rods shall be made of durable wood with

SECTION 10

EXCAVATION AND BACKFILL

10-01. Description:

Work under this heading includes the construction of sewers and drainage in and adjacent to water area work.

10-02. Excavation and Backfill: Shall be performed in accordance with the provisions of Section 2 hereof.

10-03. Pipe Laying:

Pipe for sewers and drains shall be of vitrified clay unless otherwise shown. In laying pipe the bell shall always point upgrade and special work shall be executed to insure that a bell length shall not solidly support the length of pipe.

Before jointing are made, each pipe shall be well bedded in solid foundation after the preceding length has been thoroughly embedded and secured in place. Cement joints shall be made by covering the spigot end of the pipe into the bell and filling the annular space with slightly tapering ring of jute. Portland cement mortar to center the pipe in the bell. The top or pipe crown shall be compacted for a width of 6" on each side of the pipe. For each joint excavation shall be made so that the annular space shall be filled and caulked the bottom of the bell uniformly.

Pipe shall be laid on a firm foundation and to the lines and grades indicated on the plans. Before any joint is made, pipe shall be set exactly to grade. Pipe joints shall be watertight. Portland cement mortar shall be used for this purpose. Mortar shall be mixed in the proportion of one part cement to two parts sand. Mortar shall be used within thirty minutes after mixing. Pipe shall be laid with bell ends facing upgrade. Bell holes shall be excavated to such depth that the barrel of the pipe will have a uniform bearing throughout its length. Pipe shall be laid to the lines and grades indicated on the plans or as directed by the Engineer. Pipe shall be laid with close joints and true alignment. Before any joint is made, the pipe shall be clean and dry. Mortar shall be used within thirty minutes after mixing. Pipe shall be laid with bell ends facing upgrade. Bell holes shall be excavated to such depth that the barrel of the pipe will have a uniform bearing throughout its length. Pipe shall be laid to the lines and grades indicated on the plans or as directed by the Engineer. Pipe shall be laid with close joints and true alignment.

a right angle bracket at the bottom, which will extend at least 8" into the pipe barrel. After each length of pipe has been set to grade, it shall be also set to alignment by plumbing down from the reference line to the true center of the pipe.

Cement joints shall be composed of Portland cement, one part, and clean sharp sand, two parts. The ingredients shall be thoroughly mixed and then thinned with water to make a stiff paste. The annular space shall be filled with cement mortar, the same to be thoroughly compacted in layers, by means of a wooden calking tool. Calking shall continue until the cement is flush with the bell, after which a ring of cement shall be placed around the pipe and beveled off at an angle of about 45 degrees to slope from the outside of the bell to the pipe barrel.

When laying pipe with cement joints, each length of pipe, as laid, shall be thoroughly swabbed out to remove cement or jute which protrudes into the barrel. After the joint is completed, pipe shall not be disturbed nor shall back-fill be made until the cement has hardened.

In making joints with bituminous material, the pipe shall be entered into the bell, set to exact grade and alignment, and calked with oakum or jute, exactly as specified for cement joints. A clay-covered joint runner shall then be clamped tightly around the pipe and against the bell after which a clay pouring gate shall be formed at the top of the runner, into which melted bituminous compound shall be poured to fill completely the annular space and the gate to a height of 2" above the top of the bell. If the annular space is not filled at the first pouring, a second pouring shall follow immediately.

At least 12 hours before any bituminous joint is made, the outside of the spigot and the inside of the bell of each length of pipe shall

be cleaned of foreign matter and thoroughly primed with a solution furnished by the manufacturer or prepared on the job by dissolving the joining material in gasoline or other suitable quick-drying solvent to such consistency as will produce a satisfactory coating of material when applied with a brush. The primer, when dry, shall have a smooth, hard finsih.

SECTION 11

VALVES

11-01. Gate Valves (1 to 3", inclusive, Bronze):

Valves under this heading shall be single wedge disc open left wheel handle and shall meet the requirements of Federal Specification WW-V-76b.

11-02. Gate Valves, Cast Iron Body:

Cast iron body gate valves shall be hub end screw end or flanged end as indicated on the drawings, zinc-free-bronze mounted, double disc, open left valves for 125 pounds working pressure and shall be outside screw and yoke with hand wheel or floor stand as indicated. Valves installed in locations requiring the use of valve key shall be non-rising stem, hub end iron body, zinc-free-bronze mounted, double disc, screw nut head, open left, 125 pounds working pressure, A.W.W.A. specification.

Wherever applicable, valves shall be in accordance with Federal Specification WW-V-76b, November 25, 1938.

11-03. Globe Valves:

Globe valves shall be installed where shown and shall meet the requirements of Federal Specification WW-V-51.

11-04. Hydraulic Valves, Wash Water Influent and Waste:

16" wash water influent valves	3 required
18" wash water waste valves	3 required

Valves shall be flanged end, A.W.W.A. Standard Iron body, fully bronze mounted, square end double disc gate valves, having guid surfaces, extending the full length of gate, especially designed for

long life under conditions wherein it will be partially closed, and shall be equipped with cylinders for hydraulic operation with water.

The valves shall be suitable for operation with zero to 25 lb. pressure against gates, and maximum of 60 lbs., minimum 40 lbs. pressure in cylinder. The cylinders may be either of cast iron lined with seamless bronze, or of seamless bronze alone, with cast iron heads, and steel tie rods. The pistons shall be double cup, best quality, oak chrome leathers, with cast iron backing plates, and bronze piston and tail rods. Valves shall be set in vertical position for operation.

11-05. Hydraulic Valves, General:

12" Filter Influent Valves,	3 required
10" Filter Effluent Valves	3 required
4" Filter to Waste Valves	3 required

If available valves shall conform with all requirements listed under Wash Water, Influent, and Wash Water Waste Valves. If, however, earlier deilvery can be obtained by so doing, valves can be furnished with Standard Circular Discs, in place of square end valves. In all other respects valves shall conform to specifications covering mountings, hydraulic cylinders, pistons and tail rods as specified under Wash Water Influent and Wash Water Waste Valves.

11-06. Check Valves:

Non-slam lubricated check valves, of an approved make, shall be installed where shown on the drawings. Check valves shall be iron body, zinc-free-bronze mounted, for a working pressure of 125 pounds.

SECTION 13

RAW WATER MAIN AND CONTROLS

13-01. Transmission Main:

Well water will be conveyed to a point near the eastmost corner of the clear water storage tank through an 18-inch asbestos-cement pipe line. From this point an 18-inch cast iron line shall be laid, together with valves and fittings to the venturi tube and softening plant as indicated on the drawings. Cast iron pipe shall be Class "B", A.W.W.A. or Class 150, laid in accordance with Section 8.

13-02. Raw Water Venturi Meter:

A venturi tube procured under Specification No. 502, Advance Spec. "D", shall be installed in the softening equipment pit as shown on the drawings. The tube shall be set in strict accordance with the manufacturers' instructions and shall be supported by concrete piers as indicated.

13-03. Differential Pipes:

Four 1-inch differential pipes of standard weight galvanized steel shall be carried from the venturi tube; one pair to operate the chlorinator differential converter and the remaining pair to operate the register-indicator-recorder instrument.

Each 1-inch pipe shall be valved immediately after leaving the venturi tube and a 12-inch long sediment leg with blow-off cock at its lower end shall then be installed. From this point the four pipes shall be graded up continuously to the chlorine equipment and meter registers so that no air pockets will be formed at any point in the entire run.

SECTION 15

RAW WATER MAIN AND CONTROLS

15-01. Transmission Main:

Well water will be conveyed to a point near the southeast corner of the clear water storage tank through an 18-inch reinforced-concrete pipe line. From this point an 18-inch cast iron line shall be laid, together with valves and fittings to the venturi tube and softening plant as indicated on the drawings. Cast iron pipe shall be Class "B" A.W.W.A. of Class 150, laid in accordance with Section 9.

15-02. Raw Water Venturi Meter:

A venturi tube procured under Specification No. 802, Venturi Meter, "D", shall be installed in the metering equipment pit as shown on the drawings. The tube shall be set in strict accordance with the manufacturer's instructions and shall be supported by concrete piers as indicated.

15-03. Differential Pipes:

Four 1-inch differential pipes of standard weight galvanized steel shall be carried from the venturi tube; one pair to operate the chlorinator differential converter and the remaining pair to operate the registering indicator-recorder instrument.

Each 1-inch pipe shall be valved immediately after leaving the venturi tube and a 12-inch lucite sediment leg with blow-off hook assembly lower end shall then be installed. From this point the four pipes shall be graded by continuously to the metering equipment and water regulators so that no air pockets will be formed at any point in the entire run.

13-04. Register-Indicator-Recorder:

The register-indicator-recorder instrument procured under Spec. 502, Advance Spec. "D", shall be installed on the pump room balcony at the location shown on the drawings and shall be connected with the differential pipes from the venturi meter after the same have been thoroughly flushed and are free from sediment and air. The instrument shall be set and adjusted in accordance with the manufacturers' drawings and instructions and shall receive final check and adjustment by the manufacturers' representative so that the registration is within the specified range of accuracy. Electrical connections shall be made to the recording instrument in accordance with Section 30.

13-05. Painting:

The venturi meter and connecting pipes outside of the building shall be thoroughly coated with an approved coal tar base enamel applied in accordance with Section 42.

18-04. Register-Indicator-Recorder:

The register-indicator-recorder instruments provided under Spec. 502, Advance Spec. "D", shall be installed on the pump room balcony at the location shown on the drawings and shall be connected with the differential pipes from the venturi meter after the same have been thoroughly flushed and are free from sediment and air. The instrument shall be set and adjusted in accordance with the manufacturers' drawings and instructions and shall reveal a final check and adjustment by the manufacturers' representative as that the registration is within the specified range of accuracy. Electrical connections shall be made to the recording instrument in accordance with Section 80.

18-05. Painting:

The venturi meter and connecting pipe outside of the building shall be thoroughly coated with an approved coal tar base enamel applied in accordance with Section 42.

SECTION 14

WATER SOFTENING

14-01. Scope of the Work:

Three 1-M.G.D. water softening units, of the catalytic process type, together with chemical feed apparatus and appurtenances have been procured under Specification 502, Advance Spec. "C". This equipment is to be erected complete with all appurtenances as shown on the drawings and is to be operated for a period of 60 days by the manufacturers' representative, during which period correct dosage of chemicals and operating routine will be established.

The three softener units shall be set up and all pipe connections shall be made in exact accordance with the dimensions and elevations as shown on the drawings. The manufacturers' representative shall check the entire installation and shall put the plant into operation after erection has been completed.

14-02. Influent and Effluent Piping:

Piping shall be bell and spigot or flanged cast iron as indicated on the plans. Bell and spigot pipe shall be Class "B" or Class 100. Bell and spigot fittings shall be Class "D" for 12-inch and smaller and Class "B" for larger sizes. Flanged pipe and fittings shall be Class "B" with 125 lb. American Standard flanges faced and drilled.

Pipe, fittings, and valves shall be made up and joined as specified under Section 8.

14-03. Pipe Supports:

Pipe supports shall be made of the material as indicated on the

SECTION M

MARINE SPRINKLING

M-01. Scope of the Work:

Turbo Lyn-O-Mat water softening units, of the exactly to proposed type, together with chemical feed apparatus and appurtenances may been procured under Specification 803, Advance Spec. "C". This equipment is to be erected complete with all applurtenances as shown on the drawings and is to be operated for a period of 30 days by the manufacturers' representative, during which period correct dosage of chemicals and operating routine will be established.

The three softener units shall be set up and all pipe connections shall be made in exact accordance with the dimensions and elevations as shown on the drawings. The manufacturers' representative shall check the entire installation and shall put the plant into operation after erection has been completed.

M-02. Lighting and Efficient Piping:

Piping shall be bell and spigot or flanged cast iron as indicated on the plans. Bell and spigot pipe shall be class "A" for 6-inch and smaller and class "B" for 8-inch and larger sizes. Flanged pipe and fittings shall be class "D" with 125 lb. American Standard Flanges fused and drilled.

Elbows, fittings, and valves shall be made up and jointed as specified under Section G.

M-03. Pipe Supports:

Pipe supports shall be made of the materials as indicated on the

14-03. (Cont'd)

drawings and shall be placed as shown, including piers, saddles, and brackets.

14-04. Gate and Check Valves:

Gate valves shall be iron body, bronze mounted, double disc, A.W.W.A. standard non-rising stem or outside screw and yoke equipped with hand wheels, as shown on the drawings. Valves shall be suitable for 50 lbs. working pressure and shall be flanged or bell end as indicated.

Check valves shall be standard iron body, bronze mounted, with flanged ends suitable for 50 lbs. working pressure.

14-05. Waste Piping and Valves:

Waste piping for draining spent material from the softeners shall be of standard weight black steel threaded pipe with malleable or cast iron fittings. Valves shall be iron body, bronze mounted, double disc or solid wedge with flanged ends suitable for 50 lbs. working pressure.

14-06. Rate-of-Flow Controllers:

Three rate-of-flow controllers have been procured under Specification 502, Advance Spec. "C". These controllers are self-contained units with flanged ends. They shall be set in accordance with the manufacturers' recommendations and shall be checked and adjusted by the manufacturers' representative.

Each controller shall be equipped with a manometer to indicate the rate of flow in gallons per minute.

14-07. Drainage:

A cast iron floor drain with perforated or grating type cover

15-03. (Cont'd)

drawings and shall be placed as shown, including yokes, saddles, and brackets.

15-04. Gate and Check Valves:

Gate valves shall be Iron body, bronze mounted, double disc, A.W.W.A. standard non-rising stem or outside screw and yoke equipped with hand wheels, as shown on the drawings. Valves shall be suitable for 80 lbs. working pressure and shall be flanged or bell end as indicated.

Check valves shall be standard iron body, bronze mounted, with flanged ends suitable for 80 lbs. working pressure.

15-05. Waste Piping and Valves:

Waste piping for draining sewage material from the scavengers shall be of standard weight black steel threaded pipe with malleable or cast iron fittings. Valves shall be iron body, bronze mounted, double disc or solid wedge with flanged ends suitable for 80 lbs. working pressure.

15-06. Return-of-Flow Controllers:

Three return-of-flow controllers have been procured under Specification 1052, Advance Sheet No. 3. These controllers are self-contained units with flanged ends. They shall be accompanied with the manufacturers' recommendations and shall be checked and adjusted by the manufacturers' representatives.

Each controller shall be equipped with a manometer to indicate the rate of flow in gallons per minute.

15-07. Drainage:

A heavy iron floor drain with perforated or grating type cover

14-07. (Cont'd)

shall be installed together with 4-inch cast iron drain line and cleanout as shown on the drawings.

14-08. Overflow Tank:

An overflow tank constructed of 3/16-inch welded steel plate with double weirs, an 18-inch flanged inlet, a 16-inch flanged future connection and one 12-inch flanged drain shall be installed as shown on the plans. The 16-inch flange shall be blanked off. The two overflow weirs shall be adjustable for vertical movement, the normal crest shall be El. 36.0, the maximum and minimum elevations, 36.1 and 35.8 respectively. Piping to overflow tank shall be as shown on the drawings.

14-09. Chemical Feed Equipment:

Chemical feed equipment has been procured under Spec. 502, Advance Spec. "C", including Addendum No. 1, in which the lime mixing tanks have been changed from bowl shaped to flat bottoms.

Low speed agitators will be used in lieu of high speed agitators originally specified.

The upper level tanks will be equipped with tight fitting covers, charging doors and dust evacuators. The low level tanks will not be so equipped. The assembly will include 4 chemical feed pumps of the displacement type complete with electric motors and drive mechanism.

14-10. Lime Mixing and Feed Tanks:

Two tanks shall be placed on the lower floor level with their tops at Elev. 30.0. These tanks shall be furnished with 4 short legs each for mounting directly on the concrete floor.

16-07. (Cont'd)

shall be installed together with 4-inch cast iron grate line and cleanout as shown on the drawings.

16-08. Overflow Tank:

An overflow tank constructed of 3/16-inch welded steel plate with double webs, an 18-inch flanged inlet, a 10-inch flanged future connection and one 12-inch flanged drain shall be installed as shown on the plans. The 16-inch flange shall be blanked off. The two overflow weirs shall be adjustable for vertical movement, the normal crest shall be El. 96.0, the maximum and minimum elevations, 96.1 and 95.8 respectively. Piping to overflow tank shall be as shown on the drawings.

16-09. Chemical Feed Equipment:

Chemical feed equipment has been procured under Spec. 502, Advance Spec. "O", including Addendum No. 1, in which the time mixing tanks have been changed from bowl shaped to flat bottoms.

Low speed agitators will be used in lieu of high speed agitators originally specified.

The upper level tanks will be equipped with tight fitting covers, charging doors and dust evacuators. The low level tanks will not be so equipped. The assembly will include 4 chemical feed pumps of the displacement type complete with electric motors and drive mechanism.

16-10. Pipe Fixing and Feed Tanks:

Two tanks shall be placed on the lower floor level with their tops at Elev. 95.0. These tanks shall be furnished with 4 short legs each for mounting directly on the concrete floor.

14-10. (Cont'd)

Two tanks shall be installed directly above with their tops at Elev. 39.5. This pair of tanks shall have 4 structural leg. each which shall straddle the two tanks set at the lower level.

Lime slurry will be mixed and fed from the high level tanks to the low level tanks and will be pumped therefrom to the softeners.

14-11. Lime Tank Piping -Cold Water:

The high level tanks shall take cold water, for mixing lime, through a 2-inch black steel line to terminate at a 1-1/2 inch standard disc meter. From the meter, separate 1-1/2 inch branch lines of black steel pipe shall be run to serve each tank. Branch lines shall be equipped with 1-1/2 inch threaded iron body, bronze mounted, solid wedge gate valves suitable for 150 lbs. working pressure.

The low level tanks shall be equipped exactly as above specified.

The two high level tanks shall be equipped with tight fitting covers, charging doors, and hydraulically operated dust evacuators. A 3/4-inch black steel pipe with gate valve control shall be installed to serve the evacuators.

14-12. Meters:

The meters for measuring water supply to lime tanks shall be 1-1/2 inch disc type, capable of measuring 100 gallons per minute, safe working capacity, constructed of non-corrosive materials in accordance with A.W.W.A. specification. Meters shall have split cases and straight reading registers, in U.S. gallons, with dial graduations which will permit accurate reading

14-10. (Cont'd.)

Two vents shall be installed directly above with their type as above. The pair of tanks shall have 4 compartments [illegible] each which shall straddle the two tanks next at the lower level.

Lime slurry will be mixed and fed from the high level tanks to the lower level tanks and will be piped therefrom to the softeners.

14-11. Lime Tank Piping -Cold Water.

The high level tanks shall take cold water, for rinsing lime, through a 2-inch black steel line to terminate at a 1-1/2 inch standard flow meter. From the meter, separate 1-1/2 inch branch lines of black steel pipe shall be run to serve each tank. Branch lines shall be equipped with 1-1/2 inch threaded iron body, bronze mounted, solid wedge gate valves suitable for 150 lbs. working pressure.

The low level tanks shall be supplied exactly as above specified.

The two high level tanks shall be supplied with eight fitting covers, charging doors, and hydraulically operated dust evacuators. A 4-inch black steel pipe with gate valve control shall be installed to serve the evacuators.

14-12. Meters.

The meters for measuring water supply to lime tanks shall be 1-1/2 inch disc [illegible], capable of measuring 100 gallons per minute, safe maximum capacity, constructed of non-corrosive materials in accordance with A.W.W.A. specifications. Meters shall have split cases and straight reading registers in U.S. gallons, with dial graduations [illegible] reading

14-12. (Cont'd)

to 10 gallons. Meters shall be equipped with American Standard flanged ends and shall be installed as shown on the plans.

No water shall pass through the meters except that used for charging the four tanks.

14-13. Lime Tanks - Drainage Piping:

Drain lines from evacuators shall be 2-inch black steel, discharging into a 6-inch waste stack as shown on the drawings. Drainage piping shall be equipped with unions and cleanout plugs for easy maintenance.

14-14. Lime Tanks- Chemical Piping:

Each high level tank shall be equipped with 2-1/2 inch black steel transfer pipes extending vertically from their bottoms to convey lime slurry to the two low level tanks. Each transfer pipe shall be equipped with a gate valve and unions for quick dissembly. The transfer pipes shall discharge into the low level tanks through ball float valves set in low tanks and adjusted to maintain constant liquid level and to prevent overflowing.

Lime slurry from the low level tanks shall be conveyed to the chemical feed pumps through the valved manifold system of 2-inch black steel pipe, so valved as to permit each of three pumps to serve a given softening unit independently of the others. The fourth chemical pump will be held in reserve.

From the pipe manifold each pump suction shall be served by a length of 1-1/2 inch rubber covered, smooth bore suction hose, equipped at each end with a 1-1/2 inch female pipe thread connection.

14-12. (Cont'd)

to 10 gallons. Hoses shall be equipped with American Standard flanged ends and shall be installed as shown on the plans.

No water shall pass through the meters except that used for cleaning the form tanks.

14-13. Lime Tanks - Drainage Piping:

Drain lines from evaporators shall be 8-inch black steel, discharging into a 6-inch waste stack as shown on the drawings. Drainage piping shall be equipped with unions and cleanout plugs for easy maintenance.

14-14. Lime Tanks-Chemical Piping:

Each high level tank shall be equipped with 2-1/2 inch black steel transfer pipes extending vertically from their bottom to convey lime slurry to the two low level tanks. Each transfer pipe shall be equipped with a gate valve and unions for quick disassembly. The transfer pipes shall discharge into the low level tanks through ball float valves set in low tanks and adjusted to maintain constant liquid level and to prevent overflowing.

Lime slurry from the low level tanks shall be conveyed to the chemical feed pumps through the valved manifold system of 2-inch black steel pipe, so valved as to permit each of three pumps to serve a given softening unit independently of the others. The fourth chemical pump will be held in reserve.

From the pipe manifold each pump suction shall be served by a length of 1-1/2 inch rubber covered, smooth bore suction hose, equipped at each end with a 1-1/2 inch female pipe thread connector.

14-14. (Cont'd)

Hose connections shall be of malleable iron securely held in place by hose clamps.

Discharge from each of three pumps shall be carried to individual softening units through 1-1/2 inch 3 braid smooth bore water hose, coupled each end, as above described.

The fourth or reserve chemical pump shall be equipped with suction and discharge hoses, as above described, the length of suction hose to be sufficient to reach from any manifold outlet to any pump and the discharge hose to reach from any pump to any of the softening units.

14-15. Lime Feed Pumps:

The four lime feed pumps shall be located as shown on the drawings.

The concrete foundation provided for these pumps shall be level and shall be finished to a true, smooth surface. The pumps shall be bolted in position without straining or warping the assembly.

Electrical connections and details shall be as specified in Section 30. Each pump motor shall have an automatic cutout actuated by low liquid level in the lime mixing tanks as called for in Specification 502, Advance Spec. "C".

14-16. Chemical Storage Hoist:

The Contractor shall procure and install an electric hoist to operate on a monorail, complete with canvas sling for hoisting chemicals to the storage space provided in the chemical feed and storage building. The hoist shall have a capacity of 2000 lbs. with a lifting speed of 20 feet per minute and a total lift of 20 feet.

14-14. (cont'd)

Hose connections shall be of malleable iron securely held in place by hose clamps.

Discharge from each of three pumps shall be carried to individual softening units through 3 inch 3 ply cotton bore water hose, coupled each end, as above described.

The fourth or reserve chemical pump shall be equipped with suction and discharge hose, as above described, the length of suction hose to be sufficient to reach from any manifold outlet to any pump and the discharge hose to reach from any pump to any of the softening units.

14-15. Lime Feed Pumps:

The four lime feed pumps shall be located as shown on the drawings.

The concrete foundation provided for these pumps shall be level and shall be finished to a true, smooth surface. The pumps shall be bolted in position without straining or warping the assembly.

Electrical connections and details shall be as specified in Section 80. Each pump motor shall have an automatic cutout actuated by low liquid level in the lime mixing tanks as called for in Specification 80S, Advance Spec. "C".

14-16. Chemical Storage House:

The Contractor shall procure and install an electric hoist to operate on a monorail, complete with control gear for raising chemicals to the storage space provided in the chemical feed and storage building. The hoist shall have a capacity of 5000 lbs. with a lifting speed of 20 feet per minute and a total lift of 20 feet.

14-16. (Cont'd)

The hoist shall be of the low head type supported on four wheel trolleys. The hoisting machine shall be totally enclosed to protect the working parts from the action of chemical dust. The drive from motor to hoist shall be a noiseless, endless chain, or gears which shall be fully enclosed in drip-proof housing.

The electric motor shall be wound for 220 volts, 3 phase, 60 cycles and shall be equipped with push button control to be located on the rear wall of the building adjacent to the opening in the floor.

The electrical control shall include overload and undervoltage protection and upper and lower limit switches to stop the hoist when the cable has reached the end of its travel.

Sufficient control cable shall be provided to permit the hoist to move along the monorail for a distance of 8 feet from the center of the opening in the storage room floor.

The monorail track shall be 8 feet long with suitable stops at either end and shall be of the type which will allow maximum head room.

The monorail track will be fastened to a concrete beam in the ceiling of the storage room.

The assembly shall be suitable for operation under the following conditions:

Chemicals will be raised from the lower floor at elevation 27.5 to the upper floor at elevation 37.0 through a 4 x 4 foot opening. The monorail track will be fastened to the under side of a concrete beam at elevation 46.20. The ceiling elevation is 47.37.

14-15. (Cont'd)

The hoist shall be of the low head type supported on four wheel trolleys. The hoisting machine shall be totally enclosed to protect the working parts from the action of chemical dust. The drive motor to hoist shall be a noiseless, endless chain, or gears which shall be fully enclosed in dirt-proof housing.

The electric motor shall be wound for 230 volts, 3 phase, 60 cycles and shall be equipped with push button control to be located on the rear wall of the building adjacent to the opening in the floor.

The electrical control shall include overload and undervoltage protection and upper and lower limit switches to stop the hoist when the cable has reached the end of its travel.

Sufficient control cable shall be provided to permit the hoist to move along the monorail for a distance of 8 feet from the center of the opening in the storage room floor.

The monorail track shall be 3 feet long with suitable stops at either end and shall be of the type which will allow maximum head room.

The monorail track will be fastened to a concrete beam in the ceiling of the storage room.

The assembly shall be suitable for operation under the following conditions:

Chemicals will be raised from the lower floor at elevation 27.3 to the upper floor at elevation 37.0 through a 4 x 4 foot opening. The monorail track will be fastened to the under side of a concrete beam at elevation 46.20. The ceiling elevation is 47.37.

14-16. (Cont'd)

A heavy canvas sling 3 feet wide by 9 feet long equipped with a metal spreader at each end shall be furnished for hoisting bags of chemicals. Each spreader shall be equipped with means for fastening to the hoist hood so that the load will be uniformly distributed within the sling.

14-17. Painting:

Influent and effluent piping shall be coated with coal tar base enamel.

Metal pipe supports shall be painted the same color and with the same material as the pipes which they support.

Gate and check valves shall be painted the same color and with the same material as the connecting pipes.

The overflow tank and connecting pipes shall be coated with coal tar base enamel. Lime tank piping shall be painted light gray including all chemical and drainage piping. Brass valves and fittings shall not be painted.

Lime feed pumps shall be painted the same color as the original coating.

The three steel softening units shall be painted medium gray.

The four lime feed and mixing tanks including supports, etc. shall be painted light gray. All painting shall be done in accordance with Section 42.

14-15. (Cont'd)

A heavy canvas sling 2 feet wide by 8 feet long equipped with a metal spreader at each end shall be furnished for hoisting pipe sections. Each spreader shall be equipped with means for fastening to the hoist hook so that the load will be uniformly distributed within the sling.

14-17. PAINTING.

Interior and exterior piping shall be coated with coal tar base enamel.

Metal pipe supports shall be painted the same color and with the same material as the pipes which they support.

Gate and check valves shall be painted the same color and with the same material as the connecting pipes.

The overflow tank and connecting pipes shall be coated with coal tar base enamel. Lime tank piping shall be painted light gray, including all chemical and drainage piping. Brass valves and fittings shall not be painted.

Lime feed pumps shall be painted the same color as the original coating.

The brine chest agitating motor shall be painted medium gray.

The four lime feed and mixing tanks insulating supports, when shall be painted light gray. All painting shall be done in accordance with Section 42.

SECTION 15

RECARBONATION

15-01. Scope of the Work:

It is the intent to procure and install equipment and apparatus complete in every detail with which to recarbonate the treated water immediately after softening and before filtering.

The chemical and physical characteristics of the softened water are shown in Para. 5, Specification 502, Advance Spec. "C".

The equipment shall have ample capacity for recarbonating 3 M.G.D. and shall be complete in every detail and ready to operate. The equipment shall be capable of cooling, scrubbing, drying, compressing, and applying not less than 1000 lbs. of carbon dioxide per 24 hours, from flue gas generated by oil burner and containing about 10% of carbon dioxide gas.

15-02. Recarbonation Tank:

The recarbonation tank shall be constructed to the dimensions and elevations as shown on the drawings and shall be equipped with 24-inch inlet and outlet pipes, wood baffles and gas manifold and grid system.

15-03. Foundation Under Tank:

The tank will be constructed on refilled material extending from Elevation 12.70 to Elevation 25.00.

Fill shall consist of pure sand free from clay, loam or other foreign matter, deposited in layers and flooded with water so that each layer will thoroughly compact upon the material previously placed. Fill shall be made as far in advance of pouring concrete as possible. No concrete shall be poured until all evidence of settling has ceased. If

SECTION 09

REHABILITATION

15-09. Scope of the Work:

It is the intent to procure and install equipment and apparatus complete in every detail with which to recarbonate the treated water immediately after softening and before filtering.

The chemical and physical characteristics of the softened water are shown in Para. 5, Specification 502, Advance Spec. "G".

The equipment shall have ample capacity for recarbonating 3 M.G.D. and shall be complete in every detail and ready to operate. The equipment shall be capable of cooling, scrubbing, drying, compressing, and applying not less than 1000 lbs. of carbon dioxide per 24 hours, from flue gas produced by oil burner and containing about 10% of carbon dioxide gas.

15-02. Recarbonation Tank:

The recarbonation tank shall be constructed to the dimensions and elevations as shown on the drawings and shall be equipped with 24-inch inlet and outlet pipes, wood baffles and gas manifold and grid system.

15-03. Foundation Under Tank:

The tank will be constructed on prepared material excavating from Elevation 17.70 to Elevation 25.00.

Fill shall consist of pure sand free from clay, loam or other foreign matter, deposited in layers and flooded with water so that each layer will thoroughly compact upon the material previously placed. Fill shall be made as for in manner of paving concrete as possible. No compact shall be packed until all evidence of settling has ceased. If

15-03. (Cont'd)

called for by the Government's representative, a load test shall be placed upon the filled material. Safe loading shall be 1500 lbs. per square foot without settlement.

15-04. Concrete:

Concrete shall be Class E-1 with smooth troweled finish.

Where this tank adjoins the existing clear water storage tank, chemical feed building, and spiractor pit wall, asphalt impregnated felt 1/2-inch thick shall be so placed as to form a continuous filler between the two walls. This for the purpose of preventing excessive load on the existing structure should the recarbonation tank tend to settle or shift on the filled material.

ALTERNATE

15-05. Gas Piping and Distribution:

Piping from the compressor to the tank and all gas piping within the tank shall be Class "B" cast iron with cast iron fittings. The main gas header shall be of 6-inch Class "B" cast iron pipe installed on the bottom of the tank. The header shall be drilled and tapped with standard pipe threads to take 1-1/4 inch cast iron laterals spaced on 12-inch centers with 3/32-inch holes spaced on 4-inch centers.

Laterals shall be capped on their outer ends, with a 3/32-inch hole drilled in the center of each cap, the overall length to be such that the ends of the laterals will clear the sidewalls of the tank by 2-1/2 inches, the tank being 8' 6" inside width.

15-03. (Cont'd)

called for by the Government's representative, a load test shall be placed upon the filled material. Site loading shall be 1500 lbs. per square foot without settlement.

15-04. Concrete:

Concrete shall be Class B-3 with smooth troweled finish.

Where this tank adjoins the existing clear water storage tank, chemical feed building, and aspirator pit wall, expansion impregnated felt 1/2-inch thick shall be so placed as to form a continuous filler between the two walls. This for the purpose of preventing excessive load on the existing structure should the precipitation tank tend to settle or shift on the filled material.

ALTERNATE

15-05. Gas Piping and Distribution:

Piping from the compressor to the tank and all gas piping within the tank shall be Class "B" cast iron with cast iron fittings. The main gas header shall be of 6-inch Class "B" cast iron pipe installed on the bottom of the tank. Gas header shall be drilled and tapped with standard pipe threads to take 1-1/4 inch cast iron laterals spaced on 12-inch centers with 3/32-inch holes spaced on 4-inch centers.

Laterals shall be capped on their outer ends, with a 3/32-inch hole drilled in the center of each cap, the overall length to be such that the ends of the laterals will clear the sidewalls of the tank by 3-1/2 inches, the tank being 3' 6" inside width.

15-05. (Cont'd)

The 6-inch header shall be laid on the longitudinal center line of the tank and shall be plugged at each end.

Laterals shall be installed at right angles to the header with orifice holes pointing down.

The entire assembly shall be made up tight and shall be blocked up neatly so that it will remain in correct position. Care shall be taken to keep orifice holes clear of obstruction.

15-06. Alternate - Gas Piping and Distribution:

In lieu of the cast iron pipe specified in Para. 15-05, cement-asbestos pipe will be favorably considered for gas distribution inside the recarbonation tank and elsewhere provided that comparable results will be secured.

Capacity, drilling and general arrangement of the assembly shall be as specified in Para. 15-05.

15-07. Gas Generating Equipment- Intent:

Flue gas shall be generated from light fuel oil by means of an oil burner to be used in connection with a standard hot water boiler.

15-08. Boiler:

The boiler shall be of the cast iron sectional type, fitted with front plate and trim for oil burning operation. The boiler shall be approximately 26-3/4 inches wide by 32-5/16 inches long over the sections, and shall be furnished complete with 9-inch smoke pipe connection, gauge for registering temperature and head pressure, front plate, 10-inch high base,

15-06. (Cont'd)

The 8-inch header shall be laid on the longitudinal center line of the tank and shall be plugged at each end.

Laterals shall be installed at right angles to the header with orifice holes pointing down.

The entire assembly shall be made up tight and shall be blocked up neatly so that it will remain in correct position. Care shall be taken to keep orifice holes clear of obstruction.

15-06. Alternate - Gas Piping and Distribution:

In lieu of the cast iron pipe specified in Para. 15-05, concentric suboxtoe pipe will be favorably considered for gas distribution inside the reabsorption tank and elsewhere provided that comparable results will be secured.

Capacity, drilling and general arrangement of the assembly shall be as specified in Para. 15-05.

15-07. Gas Generating Equipment:

Flue gas shall be generated from light fuel oil by means of an oil burner to be used in combination with a standard hot water boiler.

15-08. Boiler:

The boiler shall be of the cast iron sectional type, fitted with front plate and trim for oil burning operation. The boiler shall be approximately 28-3/4" inches wide by 22-6/16 inches long over the sections, and shall be furnished complete with 8-inch smoke pipe connection, grate for burning bituminous coal hood pressure, front plate, 10-inch high base,

15-08. (Cont'd)

flue doors, fire door, push nipples, draw bolts, etc. Boiler shall carry a manufacturers' rating of not less than 640 sq. ft. of hot water radiation based on a heat emission of 150 b.t.u. per square foot. Boiler shall be warranted for a water working pressure of not less than 30 p.s.i.

15-09. Water Induction Valve:

Water induction valve shall be 1/2-inch Sylphon, or approved equal, bellows type valve, thermostatically controlled from the boiler water temperature by a thermal bulb and a capillary tube. Valve and control shall be adjustable over a range of 100° to 150° F. The valve shall be installed on the inlet side of the boiler, the outlet to be free to discharge as shown on the plans.

15-10. Oil Burner:

The oil burner shall be of the atomizing gun type for flange mounting in the above described boiler. It shall be designed to burn # 3 oil in varying amounts up to 2 gallons per hour and shall be equipped with a nozzle capable of passing 1.75 gallons of oil per hour at 100 lbs. pressure per square inch.

Positive means shall be provided for the electric ignition of the fuel together with complete automatic electrical control which shall embody all safety features required by the National Board of Underwriters and ordinarily used with this type of equipment.

The blower shall be of the squirrel cage type having a capacity of not less than 2800 C.F.M. at 1/4 inch S.P., driven by V-belt to a speed of 300 to 470 R.P.M.

15-10. (Cont'd)

The driving motor shall be not less than 1/2 H.P. wound for 120 volts, 60 cycles, single phase 1140 R.P.M.

The motor shall be Class "A"type, conforming to Yards and Docks Specification 9 Ye.

A suitable magnetic starting switch shall be furnished to operate the motor through interlocking circuits controlling the automatic operation of the equipment. Overload and undervoltage protection shall be provided.

15-11. Fuel Tank:

Fuel oil will be drawn from an underground storage tank of 420 gallons capacity fitted with fill line, vent, supply with check or foot valve, as required, and return line.

The tank shall be installed at the location and to the elevation as shown on the plans.

15-12. Cooler-Scrubber Unit:

The scrubber shall consist of a vertical cast iron cylinder of not less than 36" diameter with 3-1/2" flue gas inlet near the bottom and 3" gas outlet at the top, a manhole shall be provided in the top of the scrubber and a handhole near the bottom.

There shall be furnished sufficient limestone to make a bed 48" depth, within the scrubber, the limestone bed to be supported on a cast iron grate above the gas inlet. The limestone shall be sized and graded to assure adequate diffusion of the gases and cooling water.

15-12. (Cont'd)

Above the limestone bed shall be provided a water spray system by means of which cooling water will be applied uniformly over the surface of the limestone bed. The connection to the spray system shall be of 3/4" galvanized steel pipe and shall be equipped with a regulating valve, strainer, and shut-off valve. Pipe and connections to the source of pressure water shall be as shown on the plans. For removal of the waste cooling water, a drain connection, not less than 1-1/4" diameter, shall be provided at the bottom of the scrubber. The drain connection shall be equipped with a thermometer to indicate the temperature of the waste water. A drain trap and sump shall be provided as shown on the drawings.

15-13. Compressors:

The compressor shall be of the centrifugal type with a capacity of not less than 54 cu. ft. of free gas at 100° F. per minute discharged at a maximum pressure of 10 lbs. The compressor shall be driven by a 5 H.P. squirrel cage motor wound for 208 volts, 3 phase, 60 cycles.

A magnetic starter with push button control shall be furnished to operate this motor.

A dilution valve, open to the atmosphere shall be provided in the 3-inch inlet to the compressor.

15-14. Dryer:

On the discharge side of the compressor shall be furnished a line type dryer, of adequate size, by means of which moisture shall be removed from the gases and returned through an automatic trap to the waste pump.

15-14. (Cont'd)

The drye housing shall be of cast iron with 2-inch pipe connections and shall have removable sides. The drying elements shall be of corrosion resistant materials and shall be arranged for convenient re moval for inspection and cleaning.

15-15. Rate-of-flow Meter:

A rate-of-flow meter shall be provided to indicate the volume of gas passing through the equipment. For this purpose, a 2-inch venturi tube shall be installed together with a direct reading manometer of the direct reading type with the rate of flow indicated by the height of liquid column in one leg of the U tube. The manometer shall be provided with a polished metal backing plate graduated to show the rate of flow by direct reading. The manometer shall be arranged for wall mounting and shall be furnished with the necessary 1/2-inch copper pipe for connection to the venturi tube.

15-16. Carbon Dioxide Indicator:

There shall be furnished an Orsat, or equal, carbon dioxide per-cent indicator complete with reagents, printed directions for use and metal cabinet for wall mounting.

15-17. Thermometer:

Two thermometers shall be installed, one to measure the temperature of the cooling water at the point where it leaves the scrubber. This thermometer shall be installed in the 1-1/2 inch drain as shown on the plans.

The other thermometer shall be installed in the 3-inch gas line after passing through the venturi meter.

15-16. (Cont'd)

The drip pan shall be of cast iron with 3-inch pipe connections and shall have removable sides. The drying elements shall be of corrosion resistant material and shall be arranged for convenient removal for inspection and cleaning.

15-17. Rate-of-Flow Meter.

A rate-of-flow meter shall be provided to indicate the volume of gas passing through the equipment. For this purpose, a 2-inch venturi tube shall be installed together with a direct reading manometer of the direct reading type with the rate of flow indicated by the height of liquid column in one leg of the U tube. The manometer shall be provided with a polished metal backing plate graduated to show the rate of flow by direct reading. The manometer shall be arranged for wall mounting and shall be furnished with the necessary 1/2-inch copper pipe for connection to the venturi tube.

15-18. Carbon Dioxide Indicator.

There shall be furnished an Orsat, or equal, carbon dioxide portable indicator complete with reagents, printed directions for use and metal carrying case for wall mounting.

15-19. Thermometers.

Two thermometers shall be installed, one to measure the temperature of the cooling water at the point where it leaves the scrubber. This thermometer shall be installed in the 1-1/2 inch drain as shown on the plans. The other thermometer shall be installed in the 3-inch gas line after passing through the venturi meter.

15-18. Pressure Gauge:

A 4-inch pressure gauge graduated in pounds per square inch with graduations from 0 to 20 lbs. shall be installed in the 3-inch gas line as shown on the plans.

15-19. Water Pipe and Fittings:

All pipe lines carrying water under pressure shall be standard weight galvanized steel. Fittings shall be galvanized malleable iron. Valves smaller than 2 inch shall be bronze.

15-20. Drain and Drip Lines:

Drain and drip lines above the floor shall be standard weight galvanized steel with galvanized fittings.

Drain lines below the floor shall be extra heavy cast iron soil pipe and fittings.

15-21. Qualifications of Manufacturer and Equipment:

All of the equipment under Section 15 shall be furnished by one manufacturer who is regularly engaged in the design and manufacture of equipment of this character, and who will furnish skilled engineering help to check over the installation and advise the Government's representative in the proper operation and maintenance of the same.

15-22. Guarantee:

The Manufacturer to whom the award is made shall guarantee the equipment as to materials, workmanship and operation for a period of one year from the date it is put into service.

15-23. Painting:

All gas piping shall be painted dark green. Gas piping below water level in the recarbonation tank shall be coated with coal-tar base enamel.

15-18. Pressure Gauge:

A 4-inch pressure gauge graduated in pounds per square inch with graduations from 0 to 80 lbs. shall be installed in the 3-inch cpa line as shown on the plans.

15-19. Water Pipe and Fittings:

All pipe lines carrying water under pressure shall be standard weight galvanized steel. Fittings shall be galvanized malleable iron. Valves smaller than 2 inch shall be bronze.

15-20. Drain and Drip Lines:

Drain and drip lines above the floor shall be standard weight galvanized steel with galvanized fittings.

Drain lines below the floor shall be extra heavy cast iron soil pipe and fittings.

15-21. Qualifications of Manufacturer and Equipment:

All of the equipment under Section 15 shall be furnished by one manufacturer who is regularly engaged in the design and manufacture of equipment of this character, and who will furnish skilled engineering help to obtain over the installation and advise the Government's representative in the proper operation and maintenance of the same.

15-22. Guarantee:

The Manufacturer to whom the award is made shall guarantee the equipment as to materials, workmanship and operation for a period of one year from the date it is put into service.

15-23. Painting:

All gas piping shall be painted dark green. One piping below water level in the recombination tank shall be coated with coal-tar base enamel.

15-23. (Cont'd)

The hot water boiler jacket shall not be painted except as required to touch up defects in the original finish.

Hot and cold water piping shall be painted light gray.

Fuel piping to and from the oil burner, where exposed, shall be painted dark red.

The cooler-scrubber unit shall be painted medium gray.

Water piping to and from the scrubber shall be painted light gray.

The compressor unit shall be painted medium gray.

The dryer shall be painted medium gray.

All painting shall be done in accordance with Section 42.

16-2X. (Cont'd)

The hot water boiler jacket shall not be painted except as required to touch up defects in the original finish.

Hot and cold water piping shall be painted light gray.

Fuel piping to and from the oil burner, where exposed, shall be painted dark red.

The cooler-scrubber unit shall be painted medium gray.

Water piping to and from the scrubber shall be painted light gray.

The compressor unit shall be painted medium gray.

The dryer shall be painted medium gray.

All painting shall be done in accordance with Section 4S.

SECTION 16

FILTERS AND OPERATING FLOOR

16-01. Scope of the Work:

The work under this heading includes the installation of filter equipment, operating tables, gauges, and appurtenances procured under Spec. 502, Advance Spec. "F".

It also includes all concrete work, hand-rail, and miscellaneous items necessary to complete and make this part of the work ready for operation.

16-02. Concrete:

Floor and curb shall be Class D-1 with monolithic topping finish.

Filter floors, sidewalls and gullet walls shall be Class E-1 concrete with smooth trowelled surface.

Particular care shall be taken to place and join all metal water stops so that construction joins will be perfectly tight.

16-03. Transition Piece and Underdrainage System:

The cast iron transition pieces shall be set in the wall forms at the exact location and elevation, as shown on the plans, prior to pouring concrete, provided the same are available. If the walls are poured prior to delivery of the transition pieces, openings shall be left as shown on the plans including the metal water stops. The transition pieces shall then be set in the openings provided and the same shall be completely filled with concrete through suitable pouring gates, so arranged as to complete the filling under a 6-inch head.

SECTION 16

PIERS AND OPERATING FLOOR

16-01. Scope of the Work.

This work under this heading includes the installation of fixed equipment, operating tables, fences, and appurtenances provided under Spec. 302, Advance Spec. "D".

It also includes all concrete work, hand-rail, and miscellaneous items necessary to complete and make this part of the work ready for operation.

16-02. Concrete:

Floor and curb shall be Class 3-1 with monolithic topping finish.

Pilton floors, sidewalls and gullet walls shall be Class 3-1 even-grade with smooth troweled surface.

Particular care shall be taken to place and join all metal water stops so that construction joints will be perfectly tight.

16-03. Transition Piece and Underdrainage System:

The cast iron transition piece shall be set in the wall forms at the exact location and elevation, as shown on the plans, prior to pouring concrete, provided the same are available. If the walls are poured prior to delivery of the transition piece, openings shall be left as shown on the plans including the model water stops. The transition piece shall then be set in the openings provided and the same shall be completely filled with concrete through suitable pouring pipes, so arranged as to complete the filling under a 3-inch head.

16-03. (Cont'd)

The underdrainage system shall be installed by joining the cast iron manifold sections and the transition pieces as shown on the plans. Joints shall be made with 1/16-inch rubber gaskets placed between flanges and bolted tightly together.

Manifolds shall be laid in the centers of the filters to exact alignment and elevation. They shall be grouted in place with 1 part Portland cement and 2 parts clean sharp sand. The back ends of manifolds shall be securely blocked against filter walls.

The lateral pieces consisting of 2-inch cast iron pipe shall be centered in the bells of the central manifold and joined with yard and lead as specified in Para. 8 -06. Each lateral shall be kept in its correct ppsition, at right angles to the center line of the filter, and shall be blocked up to correct elevations. Special care shall be taken to set each lateral so that the holes drilled therein shall point downward and 22-1/2 degrees on either side of the vertical. Blocking under the laterals shall be kept between the drilled holes and shall not obstruct them. The end of each lateral shall be solidly blocked against the adjacent side wall with concrete.

The greatest possible care shall be taken to clean all pipes used in the filter underdrainage systems and to keep them free from foreign matter which would clog the drilled holes and greatly impair the correct operation of the plant. The same precaution must be exercised throughout the entire work including all pipe lines inside and outside of the building.

16-04. Placing Filter Media:

After the underdrainage system has been completed the filter floors shall be thoroughly cleaned of trash and dirt and the filtering media shall be placed in layers as shown on the plans.

The bottom layer shall consist of 2 to 1½ inch gravel which shall be placed on the filter floor and around the manifold system to a depth of 6 inches. This material shall be dumped in small batches and worked into place by hand to avoid obstructing the drilled holes in the lateral pipes.

The second layer of 1½ to 3/4 inch gravel shall be placed to an even thickness of 4 inches.

The third layer of 3/4 to ½ inch gravel shall be placed to an even thickness of 2½ inches.

The fourth layer of ½ to ¼ inch gravel shall be placed to an even thickness of 2½ inches.

The fifth layer of ¼ to 1/8 inch gravel shall be placed to an even thickness of 3 inches.

The material above specified shall be placed perfectly uniform layers and shall be kept free from dirt, and all foreign matter.

After the last layer of gravel has been placed, 27 inches of filter sand shall be added in a uniform layer. If it becomes necessary for workmen to enter the bed, the same shall be completely covered over with boards, tar paper, or other material in order that it be maintained in a sanitary condition.

10-04. Placing Filter Media.

After the underdrainage system has been completed the filter floors shall be thoroughly cleaned of trash and dirt and the filtering media shall be placed in layers as shown on the plans.

The bottom layer shall consist of 2 to 1½ inch gravel which shall be placed on the filter floor and around the manifold system to a depth of 8 inches. This material shall be dumped in small batches and worked into place by hand to avoid obstructing the drilled holes in the lateral pipes.

The second layer of ½ to 3/4 inch gravel shall be placed to an even thickness of 4 inches.

The third layer of 3/4 to ½ inch gravel shall be placed to an even thickness of 3½ inches.

The fourth layer of ½ to ¼ inch gravel shall be placed to an even thickness of 3½ inches.

The fifth layer of ¼ to 1/8 inch gravel shall be placed to an even thickness of 3 inches.

The material above specified shall be placed perfectly uniform

After the last layer of gravel has been placed, 27 inches of filter sand shall be added in a uniform layer. If it become necessary for workmen to enter the bed, the sand shall be completely removed over with boards, ter proof, or other material in order that it be maintained in a sanitary condition.

16-05. Wash Water Troughs:

Wash water troughs shall be installed as shown on the plans, with their tops at elevation 32.5. Troughs shall be absolutely level throughout their entire lengths. The Contractor is particularly cautioned that this part of the work must be carried out with absolute accuracy.

16-06. Pipe Railing:

Pipe railing of 1-1/2 inch black steel, with either screw or welded joints shall be installed as indicated on the plans. The base of all railings shall be securely anchored to the concrete structure.

16-07. Operating Tables:

One operating table procured under Spec. 502, Advance Spec. "E", shall be installed to control each filter as shown on the plans.

Table shall be set level and shall be securely fastened to the floor.

A 1-inch pressure supply shall be run to each table. Each hydraulic valve for a given filter shall be connected with its respective control valve in the operating table by means of 3/4-inch line, one at the top of a given cylinder and one at the bottom.

A 1-inch waste water line shall be run from each operating table to terminate 4 inches above the gutter which extends through the pipe gallery. Flexible cable shall be run from the tail rod of each hydraulic valve to its indicator and control plate on the operating table. Cables shall change direction by means of sheaves which shall be securely fastened to adjacent pipes or structures, so placed as to give the shortest and most direct route from tail rod to indicator. Cables and sheaves shall be uniformly installed so that all three filters will be alike. Sheaves and cables are included with the equipment furnished under Specification 502, Advance Spec. "E".

16-06. Open Water Troughs:

Open water troughs shall be installed as shown on the plans, with their tops at elevation 92.5. Troughs shall be absolutely level throughout their entire length. The Contractor is particularly cautioned that this part of the work must be carried out with absolute accuracy.

16-06. Pipe Railing:

Pipe railing of 1-1/2 inch black steel, with either screw or welded joints shall be installed as indicated on the plans. The base of all railings shall be accurately anchored to the concrete structure.

16-07. Operating Tables:

One operating table pressured under Spec. 602, Alternate Spec. "Z", shall be installed to control each filter as shown on the plans.

Table shall be set level and shall be securely fastened to the floor.

A 1-inch pressure supply shall be run to each table. Each hydraulic valve for a given filter shall be connected with its respective control valve in the operating table by means of 3/4-inch line, one at the top of a given cylinder and one at the bottom.

[illegible] shall be run down each operating table to terminate 4 inches above the gutter water ontends through the pipe railing. Flexible cable shall be run from the tail rod of each hydraulic valve to its indicator and control plate on the operating table. Cables shall change direction by means of sheave wells shall be securely fastened to adjacent pipes or structures, so placed as to give the shortest and most direct route from tail rod to indicator. Cable and sheave shall be uniformly lubricated so that all three filters will be alike. Sheaves and cables are included with the equipment furnished under Specification 602, Alternate Spec. "Z",

16-07. (Cont'd)

The equipment furnished with the operating table includes Rate-of-Flow and Loss-of-Head indicating gauges. These and other parts of the equipment shall be installed and connected as specified in Sect. 17.

16-08. Painting:

Transition pieces and underdrainage system shall not be painted.

Wash water troughs shall be painted a light gray, the various coats to be of materials especially designed to prevent corrosion.

Operating tables shall not be painted except as required to touch up the original coating in case the same has been chipped or marred.

Piping to the operating tables shall be painted light gray.

All painting shall be done in accordance with Section 42.

15-07. (Cont'd)

The equipment furnished with the operating table includes Rate-of-Flow and Lung-at-Rest Indicating Gauges. These and other parts of the equipment shall be installed and connected as specified in Sect. 17.

16-02. Painting:

Translation pipes and underdrainage system shall not be painted.

Wash water troughs shall be painted a light grey, the various coats to be of materials especially designed to prevent corrosion.

Operating tables shall not be painted except as required to touch up the original coating in case it has been chipped or marred.

Piping to the operating tables shall be painted light grey.

All painting shall be done in accordance with Section 42.

SECTION 17

PIPE GALLERY

17-01. Scope of the Work:

The work under this heading shall include the concrete structure, all pipe, valves and fittings, filter control equipment procured under Spec. 502, Advance Spec. "F", water service piping, chlorine conduit, drain lines, pipe railing and miscellaneous items.

17-02. Influent Piping:

Influent piping shall consist of 20-inch header leading from the recarbonation basin which shall be suspended from the ceiling as shown on the plans.

From the main header a 12-inch influent line shall be run to each filter. Each line shall be supported by a 4-inch steel pipe column from the floor to a pipe saddle placed under each 12-inch 45° bend.

A 16-inch vertical cross connection shall be installed from the 20-inch header to the 20-inch effluent line.

Bell and spigot pipe shall be Class B, A.W.W.A. or Class 100.

Flanged pipe shall be Class "B" with 125 lb. American Standard Flanges, faced, and drilled. Fittings shall be suitable for 100 lbs. working pressure.

Gate valves shall be iron body, bronze mounted, non-rising stems or outside screw and yoke, as noted on the plans, equipped with hand wheels.

All valves shall be suitable for 50 lbs. working pressure.

Pipe, valves and fittings shall be laid and joined as specified under Section 8. Hydraulic valves shall be in accordance with Paras. 11-04 and 11-05.

SECTION 17

PIPE GALLERY

17-01. Scope of the Work.

The work under this heading shall include the concrete structure, all pipe, valves and fittings, filter control equipment procured under Spec. 302, Advance Spec. "P", water service piping, chlorine conduit, drain lines, pipe railing and miscellaneous items.

17-02. Influent Piping.

Influent piping shall consist of 20-inch header leading from the reconnection point which shall be extended from the ceiling as shown on the plans.

From the main header a 12-inch influent line shall be run to each filter. Each line shall be supported by a 4-inch steel pipe column from the floor to a pipe saddle placed under each 12-inch 45° bend.

A 16-inch vertical cross connection shall be installed from the 20-inch header to the 20-inch effluent line.

Bell and spigot pipe shall be Class B, A.W.W.A. or Class 150, Flanged pipe shall be Class "B" with 150 lb. American Standard flanges, faced, and drilled. Fittings shall be suitable for 100 lbs. working pressure.

Gate valves shall be iron body, bronze mounted, non-rising stem or outside screw and yoke, as noted on the plans, equipped with hand wheels. All valves shall be suitable for 50 lbs. working pressure.

Pipe, valves and fittings shall be laid and joined as specified under Section 3. Hydraulic valves shall be in accordance with Specs. 17-04 and 17-05.

17-03. Effluent Piping:

Effluent piping shall consist of a 20-inch header supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter shown on the plans. Pipe shall be bell and spigot, Class "B", A.W.W.A. or Class 100.

Flanged piping shall be Class "B" with 125 lb. American Standard Flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

Fittings shall be bell and spigot or flanged suitable for 100 lbs. working pressure.

Gate valves shall be as specified under Paragraph 17-02.

Pipe, valves and fittings shall be laid and joined as specified under Section 8.

17-04. Wash Water Piping:

Wash water piping shall consist of a main header 16 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter shown on the plans.

Pipe shall be bell and spigot Class B, A.W.W.A. or Class 150.

Flanged piping shall be Class "B" with 125 lb. American Standard Flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paragraphs 11-04 and 11-05.

Pipe valves and fittings shall be laid and joined as specified under Section 8. Each 16-inch hydraulic valve shall be supported by a 4-inch steel pipe column from the floor to a saddle placed under the valve.

17-05. Sewer Piping (Waste Wash Water):

The sewer shall consist of a main header 20 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter as shown on the plans.

Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100.

Flanged piping shall be Class B, 125 lb. American Standard Flanged, faced and drilled.

Hydraulic valves shall be in accordance with Para. 11-04 and 11-05.

Pipe, valves and fittings shall be laid and joined as specified under Section 8.

17-06. Re-Wash Piping:

Re-wash lines shall consist of 4-inch pipe connecting from the 16-inch filter effluent line to the 20-inch sewer. Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100. Flanged pipe shall be Class B, with 125 lb. American Standard flanges, faced and drilled.

Hydraulic valves shall be in accordance with Paras. 11-04 and 11-05.

Pipe, valves and fittings shall be joined as specified under Section 8

17-07. Rate-of-Flow Controllers:

Rate-of-flow controllers procured under Spec. 502, Advance Spec. "F", shall be installed, one on the effluent line of each filter as shown on the drawings. Each rate-of-flow controller shall be connected with the mercury filled actuator as specified in Para. 17-08 and with the gradual shut-off float control as specified in Par. 17-09.

17-05. Sewer Piping (Waste Water Mains):

The sewer shall consist of a main header 30 inches diameter supported by concrete piers on the floor of the pipe gallery. Connections shall be run to each filter as shown on the plans.

Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100.

Flanged piping shall be Class D, 125 lb. American Standard Flanged, faced and drilled.

Hydraulic valves shall be in accordance with Para. 11-04 and 11-05.

Pipe, valves and fittings shall be joined as specified under Section 8.

17-06. Re-Wash Piping:

Re-wash lines shall consist of 4-inch pipe connecting from the 16-inch filter effluent line to the 30-inch sewer. Pipe shall be bell and spigot, Class B, A.W.W.A. or Class 100. Flanged pipe shall be Class B, with 125 lb. American Standard Flanges, faced and drilled.

Hydraulic valves shall be in accordance with Para. 11-04 and 11-05.

Pipe, valves and fittings shall be joined as specified under Section 8

17-07. Rate-of-Flow Controllers:

Rate-of-flow controllers procured under Spec. 002, Advance Spec. Wpn, shall be installed, one on the effluent line of each filter as shown on the drawings. Each rate-of-flow controller shall be connected with the mercury filled actuator as specified in Para. 17-08 and with the gradual shut-off float control as specified in Par. 17-09.

17-08. Rate-of-Flow and Loss-of-Head Gauges:

The rate-of-flow and loss-of-head actuators shall be installed in pipe gallery on 3-inch pre-cast concrete slab placed over the gutters. The rate-of-flow actuator shall be connected with the rate of flow venturi by means of 3/8 inch pipes.

The loss-of-head actuator shall have a 3/8-inch connection extending up to connect with a 3/4-inch pipe extending through the filter wall with its center at Elevation 32.25. The end of the 3/4-inch pipe within the filter shall be equipped with bronze strainer. The other connection to the loss-of-head actuator shall be carried by 3/8-inch pipe to the inlet side of the venturi rate-of-flow controller.

Both the rate-of-flow and loss-of-head actuators shall have 1-inch black steel pipe cable guards extending from their tops upward to inclose the actuating cables which operate the respective gauges mounted on the operating table. Change of direction in the cable shall be made by means of sheaves as specified in Para. 16-07.

Cables, sheaves and miscellaneous parts are furnished with the equipment procured under Specification 502, Advance Spec. "E".

17-09. Gradual Shut-Off Control:

Each filter shall be equipped with a gradual shut-off control which shall be actuated by a float and cable from the water level within the filters to the rate of flow controller. The float shall be inclosed in a 2-1/2 inch steel tube with top elevation 36.25 and bottom in elevation 31.0.

The equipment shall be adjusted to shut off the filter effluent when the water level in the filter has fallen to elevation 32.0.

17-05. Rate-of-Flow and Loss-of-Head Gauges:

The rate-of-flow and loss-of-head actuators shall be installed in pipe gallery on 4-inch pre-cast concrete slab placed over the gutters. The rate-of-flow actuator shall be connected with the rate of flow venturi by means of 3/4 inch pipes.

The loss-of-head actuator shall have a 3/8-inch connection extending up to connect with a 3/4-inch pipe extending through the filter wall with its center at Elevation 82.25'. The end of the 3/4-inch pipe within the filter shall be equipped with bronze strainer. The other connection to the loss-of-head actuator shall be carried by 3/8-inch pipe to the inlet side of the venturi rate-of-flow controller.

Both the rate-of-flow and loss-of-head actuators shall have 1-inch black steel pipe cable guards extending from their tops upward to enclose the actuating cables which operate the respective gauges mounted on the operating table. Change of direction in the cable shall be made by means of sheaves as specified in Para. 16-07.

Orifice, sheave and miscellaneous parts are furnished with the equipment & placed under a contract with Venturi Meter Co. "A".

17-06. Gradual Shut-Off Control:

Each filter shall be equipped with a gradual shut-off control which shall be actuated by a float and cable from the water level within the filters to the rate of flow controller. The float shall be housed in a 2-1/2 inch steel tube with top elevation 86.25 and bottom at elevation 81.0.

The counterpoint shall be adjusted to shut off the filter effluent when the water level in the filter bed is at elevation 82.0.

17-09. (Cont'd)

Change in direction in the cable shall be made by means of sheaves as specified in Para. 16-07. That part of the cable which is above the filter operating floor shall be inclosed in 1-inch black steel pipe.

17-10. Pipe, Valves, and Fittings:

Connecting pipes as above specified shall be of standard weight galvanized steel with galvanized malleable iron fittings.

Valves shall be of bronze suitable for 125 lbs. working pressure.

Pipes shall be securely fastened to the adjacent structure and the installation for the three filter units shall be identical.

17-11. Floor Drain:

A 6-inch cast iron drain shall be installed as shown on the plans to terminate near the end of the pipe gallery adjacent to the wash water pump room. A 12" x 12" cast iron grating shall be placed over the drain outlet.

17-12. Cat-walk and Stairs:

The catwalk within the pipe gallery shall be of Class D-1 concrete with wood-float finish.

17-13. Pipe Railing:

Pipe railing of 1-1/2 inch black steel with either screwed or welded joints shall be installed as indicated on the plans. Base of the railing shall be securely anchored to the concrete structure.

17-14. Painting:

All large cast iron pipe, valves and fittings shall be coated with coal-tar base enamel. Metal pipe supports shall be coated with the same material.

17-09. (Cont'd)

Change in direction in the cable shall be made by means of sheaves as specified in Para. 16-07. That part of the cable which is above the filter operating floor shall be enclosed in 1-inch black steel pipe.

17-10. Pipe, Valves, and Fittings:

Connecting pipes as above specified shall be of standard weight galvanized steel with galvanized malleable iron fittings.

Valves shall be of bronze suitable for 125 lbs. working pressure.

Pipe shall be securely fastened to the adjacent structure and the installation for the three filter units shall be identical.

17-11. Floor Drain:

A 6-inch cast iron drain shall be installed as shown on the plans to terminate near the end of the pipe gallery adjacent to the wash water pump room. A 18" x 18" cast iron grating shall be placed over the drain outlet.

17-12. Cut-work and Shelves:

The cutwork within the pipe gallery shall be of Cyprus D-1 smooth with wood-float finish.

17-13. Pipe Bolting:

Joints shall be bushed as indicated on the plans. Draw of the bolting shall be normally centered to the companion flanges.

17-14. Painting:

All long ends iron pipe, valves and fittings shall be coated with coal-tar paste varnish. Metal pipe supports shall be coated with red metallic.

17-14. (Cont'd)

Loss-of-head and rate-of-flow actuators shall be coated with rust inhibiting paint of similar color to the original paint.

Small connecting pipe and fittings shall be painted light gray.

Brass valves and fittings shall not be painted.

All painting shall be in accordance with Section 42.

17-14. (Cont'd)

Hose-of-Hose and Pressure-Flow accessories shall be coated with rust inhibiting paint of similar color to the original paint.

Small communicating pipe and fittings shall be painted light gray.

Brass valves and fittings shall not be painted.

All painting shall be in accordance with Section 42.

SECTION 18

WASH WATER PUMP

18-01. Wash Water Pump:

The wash water pump procured under Spec. 502, Advance Spec. "F" shall be installed as shown on the drawings. The pumping unit shall be set and pipe connections shall be made in accordance with Paragraph 22-01.

18-02. Pipe Connections:

Suction shall be taken directly from the storage basin through an 18-inch header which shall terminate with an 18 x 16" tee. The 18-inch tee opening shall be plugged and backed with concrete for future extension. A 16-inch suction line shall be extended from the 18 x 16" tee to the pump. The discharge shall run through the pipe gallery as specified in Para. 17-04. All pipe and fittings shall be in accordance with Para. 22-02.

18-03. Pressure Recording Gauge:

The pressure recording gauge furnished with the pump shall be installed on the wall of the filter operating floor as shown on the plans.

Pipe connections shall be of 1/4-inch standard weight galvanized steel with galvanized malleable iron fittings.

18-04. Motor Starter:

The motor starter furnished with the pump shall be installed as shown on the plans with a push button control station on the filter operating floor.

18-05. Electrical Work:

All electrical work shall be in accordance with Section 32.

18-06. Painting:

Painting shall be as specified in Paragraph 22-16.

SECTION 18

WASH WATER PUMP

18-01. Wash Water Pump:

The wash water pump proposed under Spec. 502, Marine Spec. "A" shall be installed as shown on the drawings. The pumping unit shall be self-priming and compositions shall be made in accordance with Paragraph 22-01.

18-02. Pipe Connections:

Suction shall be taken directly from the storage basin through an 18-inch bellcar which shall terminate with an 18 x 16" tee. The 18-inch toe opening shall be plugged and backed with concrete for future extension. A 18-inch suction line shall be extended from the 18 x 16" tee to the pump. The discharge shall run through the pipe gallery as specified in Para. 17-06. All pipe and fittings shall be in accordance with Para. 22-02.

18-03. Pressure Recording Gauge:

The pressure recording gauge furnished with the pump shall be installed on the wall of the filter operating floor as shown on the plans.

Pipe connections shall be of 1/4-inch standard weight galvanized

18-04. Motor Starter:

The motor starter furnished with the pump shall be installed as shown on the plans with a push button control station on the filter operating floor.

18-05. Electrical Work:

All electrical work shall be in accordance with Section 23.

18-06. Painting:

Painting shall be as specified in Para graph 22-10.

SECTION 19

WASTE WASH WATER TANK

19-01. Scope:

A waste wash water tank shall be constructed at the location and to the elevations and dimensions as shown on the drawings together with inlet and outlet pipes, overflow weir, manholes and incidental equipment.

19-02. Concrete:

The tank shall be constructed of Class E-1 concrete with 6 x 6" No. 6 wire mesh reinforcing.

Additional steel reinforcing shall be used in the concrete side slopes where the same span pipe trenches and additional concrete shall be poured around all entering pipes as indicated on the drawings.

19-03. Main Sewer:

The main wash water sewer from Manhole No. 88-F shall be of 24-inch vitrified clay pipe or concrete pipe laid and joined in accordance with Section 10. The sewer from M.H. 88-F to the filter plant shall be 20-inch Class 100 cast iron pipe.

19-04. Blow-off From Well Transmission Main:

The 6-inch blow-off line from the 18-inch well transmission main shall be of Class 100 cast iron bell and spigot pipe, in accordance with Section 8.

19-05. Outlet Pipes:

One 8-inch outlet pipe shall be installed from the tank to Manhole No. 88-B. A second 8-inch pipe shall be installed for future use and shall be plugged inside of the tank. Both lines shall be Class 100 C.I. pipe laid in accordance with Section 8.

SECTION 19

WASTE WASH WATER TANK

19-01. Scope:

A waste wash water tank shall be constructed at the location and to the elevations and dimensions as shown on the drawings together with inlet and outlet pipes, overflow weir, manholes and incidental equipment.

19-02. Concrete:

The tank shall be constructed of Class B-1 concrete with 6 x 6" No. 8 wire mesh reinforcing.

Additional steel reinforcing shall be used in the concrete side slopes where the cone span pipe trenches and additional concrete shall be poured around all entering pipes as indicated on the drawings.

19-03. Main Sewer:

The main wash water sewer from Manhole No. 88-E shall be of 24-inch vitrified clay pipe or concrete pipe laid and joined in accordance with Section 10. The sewer from M.H. 88-E to the filter plant shall be 30-inch Class 100 cast iron pipe.

19-4. Blow-off Pipe and Treatment Units:

The 6-inch blow-off line from the 18-inch well transmission main shall be of Class 100 cast iron soil and eight pipe, in accordance with Section 8.

19-05. Outlet Pipes:

One 8-inch outlet pipe shall be installed from the tank to Manhole No. 88-E. A second 8-inch pipe shall be installed for future use and shall be plugged inside of the tank. Both lines shall be Class 100 C.I. pipe laid in accordance with Section 8.

SECTION 20

CHLORINATION

20-01. Scope of the Work:

Two chlorinating units with automatic control equipment and accessories have been procured under Spec. 502, Advance Spec. "B". This equipment shall be installed as shown on the drawings with all pipe work, conduits, manholes and incidental work.

The entire assembly shall be checked for correct installation and shall be properly adjusted and put into operation by the Manufacturer's representative. The automatic features shall be carefully checked, over the normal, maximum and minimum rates of pumpage and shall be adjusted to maintain correct dosage of chlorine throughout the entire range.

20-02. Differential Tubes from Venturi Meters:

One pair of differential tubes shall be run from the service water Venturi No. 1 to Differential Converter No. 1 as specified in Para. 23-02.

A second pair of tubes shall be run from the well water Venturi No. 2 as specified in Para. 13-03. The tubes shall be connected into the chlorine differential converters by the valved manifold arrangement as shown on the plans whereby either or both chlorinators may be controlled by either or both venturi tubes.

All of the piping above specified shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves ahall be bronze, suitable for 125 lbs. working pressure.

All pipe work shall be securely fastened to adjacent concrete or masonry.

SECTION 20

CHLORINATION

20-01. Scope of the Work:

Two chlorinating units with automatic control equipment and accessories have been provided under Spec. 2023, Advance Spec. "D". This equipment shall be installed as shown on the drawings with all pipe-work, conduits, manholes and incidental work.

The entire assembly shall be checked for correct installation and shall be properly adjusted and put into operation by the Manufacturer's representative. The automatic features shall be carefully checked, over the normal, maximum and minimum rates of pumpage and shall be adjusted to maintain correct dosage of chlorine throughout the entire range.

20-02. Differential Tubes From Venturi Meters:

One pair of differential tubes shall be run from the service water Venturi No. 1 to Differential Converter No. 1 as specified in Spec. 23-02.

A second pair of tubes shall be run from the well within Venturi No. 2 as specified in Spec. 18-03. The tubes shall be connected into the differential room plans by the method specified previously as shown on the plans whereby either or both chlorinators may be controlled by either or both venturi tubes.

All of the piping above specified shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves shall be bronze, suitable for 125 lbs. working pressure.

All pipe work shall be accurately fastened to adjacent concrete or masonry.

20-03. Water Service to Chlorinators:

Water service to the two chlorinators shall consist of a 1½-inch supply connecting into the manifold system as shown on the plans. The manifold shall have two sections each with a solenoid valve.

One solenoid valve shall be connected into the well pump circuit and shall control the starting and stopping of Chlorinator No. 2.

The other solenoid valve shall be connected into the circuits of service pumps Nos. 1, 2, and 3, with a relay in each circuit, so arranged as to start Chlorinator No. 1 when any one service pump or combination of service pumps is in operation. The solenoid valve shall close and stop the chlorinator when all of the service pumps are shut down. Pipe shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves shall be bronze suitable for 125 lbs. working pressure.

20-04. Chlorine Storage Room:

The chlorine storage room shall be equipped with the platform scale procured under Spec. 502, Advance Spec. "B".

A chlorine line of 3/4 inch extra heavy black wrought iron pipe shall be securely fastened to the northeast wall about 4 ft. above the floor.

The four tank manifold, furnished with the equipment, shall be securely set about 4 ft. above the scale platform and securely joined to the chlorine line. The 1-inch extra heavy chlorine feed line shall be run over the door opening thence down and through the partition wall into the pump room to serve the two chlorinators. One 3/4-inch tee shall be provided to serve each chlorinator as shown on the drawings. Joints shall be made up with litharge and glycerine for 200 lbs. chlorine gas working pressure.

20-02. Water Service to Chlorinators.

Water service to the two chlorinators shall consist of a 1½-inch supply connecting into the manifold system as shown on the plans. The manifold shall have two sections each with a solenoid valve.

One solenoid valve shall be connected into the well pump circuit and shall control the starting and stopping of Chlorinator No. 1.

The other solenoid valve shall be connected into the circuits of service pumps Nos. 1, 2, and 3, with a relay in each circuit, so arranged as to start Chlorinator No. 1 when any one service pump or combination of service pumps is in operation. The solenoid valve shall close and stop the chlorinator when all of the service pumps are shut down. Pipe shall be standard weight galvanized steel with galvanized malleable iron fittings. Valves shall be bronze suitable for 150 lbs. working pressure.

20-04. Chlorine Storage Room

The chlorine storage room shall be equipped with the platform scale procured under Spec. 502, Advance Sp. ed. "B".

A chlorine line of 3/4 inch outer heavy block wrought iron pipe shall be securely fastened to the north wall above the floor, [illegible]

The four tank manifold, furnished with the equipment, shall be securely set about 4 ft. above the scale platform and securely joined to the chlorine line. The 1-inch extra heavy chlorine feed line shall be run over the door opening through down and through the partition wall into the pump room to serve the two chlorinators. One 3/4-inch tee shall be provided to serve each chlorinator as shown on the drawings. Joints shall be made up with litharge and glycerine for 200 lbs. chlorine gas working pressure.

20-05. Chlorine Solution Discharge Lines:

All lines carrying chlorine solution from the chlorinators, to the indicated points of application, shall be of 1-inch hose furnished with the equipment.

The hose shall in all cases be run through 2-1/2 inch black steel pipe conduit. Conduit shall have long sweep bends at each change in direction and shall be securely fastened to the adjacent concrete or masonry structure. Under no conditions shall solution hose be joined within the conduit.

20-06. Chlorine Overflow Lines:

Drainage lines from make-up trays shall consist of hose, furnished with the equipment, installed in a 2-1/2 inch steel conduit as specified in Para. 20-05. The conduits shall terminate just above the steel plate cover over the discharge pit and the hose shall be extended well down into the outlet trap past the water seal so that gas cannot back up into the pump room.

20-07. Vacuum Relief Lines:

A relief line shall be run from each chlorinator to the outside atmosphere as shown on the plans. Suitable lengths of hose for this purpose will be furnished with the equipment.

The hose shall be run in 1½-inch steel conduit with continuous down gradient and shall be turned down at its outer end.

20-08. Chlorine Distribution Manifold:

A chlorine distribution manifold, fabricated from hard rubber, procured under Specification 502, Advance Spec. "B", shall be installed to take chlorine solution from either or both chlorinators and discharge the

Sheet 3 of 4

20-08. (Cont'd)

solution to any one or all of the injection points, A, B, and C, as shown on the plans.

The manifold shall be securely fastened to the wall of the building and particular care shall be exercised during construction to avoid damage to this equipment.

20-09. Painting:

Differential tubes and water service piping shall be painted light gray.

The water service manifold shall be painted light gray.

Solenoid valves shall be painted to match the original coating.

Chlorine gas piping shall be painted a bright red.

Conduits carrying chlorine hose shall be painted light gray.

All painting shall be in accordance with Section 42.

20-02. (Cont'd)

solution to any one or all of the infection points, A, B, and C, as shown on the plans.

The manifold shall be securely fastened to the wall of the building and particular care shall be exercised during construction to avoid damage to the equipment.

20-03. Painting:

Differential tubes and water service piping shall be painted light gray.

The water service manifold shall be painted light gray.

Solenoid valve shall be painted to match the original coating.

Chlorine gas piping shall be painted a bright red.

Conduits carrying chlorine lines shall be painted light gray.

All painting shall be in accordance with Section 15.

SECTION 22

PUMP ROOM AND CONTROL BALCONY

22-01. Service Pumps:

Three 1500 G.P.M. service pumps procured under Spec. 502, Advance Spec. "A", and Addendum No. 1, shall be installed as shown on the drawings. One pump is equipped with electric drive only and two pumps are equipped with electric drive on one end and gasoline engine drive on the other end. The three pumps shall be installed complete with suction and discharge piping, gasoline fuel and cooling pipe systems, drains and appurtenances, as shown on the drawings. Each pump shall be set in proper position and shall be leveled both ways from end to end so that shaft and couplings are in exact alignment. Thin steel wedge shims shall be used under the base, where necessary, to obtain proper alignment and the entire assembly shall then be grouted in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position.

Pump foundation shall be constructed to the dimensions and elevations shown on the plans. Anchor bolts shall be set in exact accordance with the Manufacturers' drawings. Class D-1 concrete shall be used with smooth finish above the floor line. The foundation for future pump No. 4 shall be constructed to the floor line and shall have the same finish as the floor.

SECTION 28

FIRE PUMP AND HOUSING MACHINERY

28-01. Service Pumps:

Three 1500 G.P.M. service pumps powered with 800 H.P. Advance Speed "A", and Addition No. 1, shall be installed as shown on the drawings. One pump is equipped with electric drive only and two pumps are equipped with electric drive on one end and gasoline engine drive on the other end. The three pumps shall be installed complete with suction and discharge piping, gasoline fuel and cooling pipe systems, drains and appurtenances, as shown on the drawings. Each pump shall be set in proper position and shall be leveled both ways from end to end so that shaft and couplings are in exact alignment. Thin steel wedge shims shall be used under the base, where necessary, to obtain proper alignment and the entire assembly shall then be grouted in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position with one part Portland cement and two parts clean sand. After the grout has set hard, the anchor bolts shall be tightened down to hold the base plate or frame in final position.

Pump foundation shall be constructed to the dimensions and elevations shown on the plans. Anchor bolts shall be set in exact accordance with the manufacturers' drawings. Class B-1 concrete shall be used with smooth finish above the floor line. The foundation for future pump No. 4 shall be constructed to the floor line and shall have the same finish as the floor.

22-02. Pipe Connections:

Pump suction and discharge piping shall be made up as shown on the drawings. The connecting pipes shall not be bolted to the pump flanges until they have been accurately aligned and permanently supported to make an exact fit without imposing any strain on the pump assembly.

Flanged pipe shall be Class "B" with 125 lb. American Standard Flanges, faced and drilled. Bell and spigot pipe shall be Class "B", A.W.W.A, or Class 150. Pipe shall be laid and joined in accordance with Section 8. All fittings shall be good for 150 lbs. working pressure.

All pipe lines shall be kept clean and free from dirt, grit, or other foreign matter which may lodge in pump impellers or other equipment and cause damage. Pipe lines shall in every case be thoroughly flushed with clean water before connecting with equipment.

22-03. Suction and Discharge Valves:

Gate valves on pump suction and discharge lines shall be A.W.W.A. standard iron body bronze mounted outside screw and yoke, flanged or bell ends as shown on the drawings, for 150 lb. working pressure.

Check valves shall be iron body bronze mounted, non-slam type with positive lubrication of moving parts from outside.

22-04. Pipe Vaults:

A concrete trench shall be constructed as shown on the plans, to carry the 16-inch suction header along the rear wall of the building. The trench shall have walls and floor constructed of Class D-1 concrete with 3-inch precast removable slab cover, of Class D-1 concrete, with two 1/2" round iron handles recessed in each section. The trench over valves shall

22-04. (Cont'd)

be covered with 1/4-inch non-slip steel plates, as shown on the drawings, each plate to have a recessed drop steel handle. Plates shall be thoroughly coated with an approved coal tar base enamel. Trenches shall be equipped with 4-inch trapped cast iron floor drains with perforated or grating type covers. Floors shall be pitched to drains.

22-05. Water Level Controls - High Pressure:

Two water level control units have been procured under Spec. 502, Advance Spec. "A" as fully described therein. One controller shall be connected with the electric motor driven pump No. 3 and the other controller with dual drive pump No. 1. Dual unit No. 2 shall be held in reserve for gasoline engine operation in case of electric power failure. This pump shall not have automatic control but space shall be provided on the panel board for a future controller.

22-06. Pump Controls - Low Water:

One low water level control with four circuits shall be provided to stop the three service pumps when the water level in the storage basin falls to elevation 16.0. The fourth circuit is provided for a future service pump. The controller shall be supported by a pedestal to be bolted to floor. The actuating mechanism shall consist of a float installed in the 8-inch pipe extending vertically into the clear water basin, the water level being transmitted to the electrical contactors by means of a shaft extending through the wall of the building with a sheave at its outer end the same to be rotated by a tape connected with the float.

The shaft shall extend directly from the controller without intermediate sheaves. The shaft assembly shall include a $1\frac{1}{2}$ inch wall sleeve

22-04. (Cont'd)

be covered with 1/4-inch non-slip steel plateway as shown on the drawings. each plate to have a recessed drop steel handle. Plates shall be thoroughly coated with an approved coat for base control. Thresholds shall be equipped with 4-inch tapped cast iron floor drains with perforated or grating type covers. Floors shall be pitched to drains.

22-05. Water Level Controls - High Pressure:

Two water level control units have been proposed under Spec. 802, Advance Spec. No. as fully described therein. One controller shall be connected with the electric motor driven pump No. 2 and the other controller with dual drive pump No. 1. Unit unit No. 2 shall be held in reserve for passing engine operation in case of electric power failure. This pump shall not have automatic control but these shall be provided on the panel board for a future controller.

22-06. Pump Controls - Low Water:

One low water level control with four electrodes shall be provided to stop the three service pumps when the water level in the storage basin falls to elevation 10.0. The fourth circuit is provided for a future service pump. The control shall be supported by a rod rigid to be bolted to floor. The actuating mechanism shall consist of a float installed in the 8-inch pipe extending vertically into the clear water basin, the water level being transmitted to the electrical contactors by means of a shaft extending through the wall of the building with a sleeve on its outer end the same to be retained by a rope connected with the float.

The shaft shall extend directly from the controller without intermediate stuffing. The shaft assembly shall include a 1½ inch wall sleeve

22-06. (Cont'd)

shaft bearings, held in place by split tapered bushings secured by lock nuts. The contacts shall be of the mercury filled type, actuated by cams on a rotating shaft. The cams shall have a wide range of adjustment so that the contacts may be set to stop any one of the pumps at a given water level. The controller shall be furnished with float, tape, counterweight and all other parts needed to make a complete assembly ready for operation. The maximum range of water levels will be El. 26.75 with full tank and El. 15.00 with empty tank.

All parts coming in contact with water shall be of non-corrosive material. The equipment shall be fully guaranteed against defects in material and workmanship for a period of one year.

22-07. Well Pump Controls:

Wells delivering raw water to the plant shall have push button start and stop switches mounted on the main control panel, as specified under Section 30. The well pumps shall be grouped as follows, with individual push button start and stop control for each group.

Group No. 1 - Wells 3, 2, and 10.

Group No. 2 - Wells 8, 5, and 9.

Group No. 3 - Wells 1, 6, and 7.

Group No. 4 - Well 4 (alone).

22-08. Water Service Piping:

Water services shall be taken from two $1\frac{1}{2}$-inch taps in the discharge header as shown on the plans. The $1\frac{1}{2}$-inch taps shall be increased at the goose-necks to 2-inch and branch services of the size shown shall be

22-08. (Contd)

shaft bearings, held in place by eight set-screw thrust collars secured by lock nuts. The contacts shall be of the mercury filled type, actuated by cams on a rotating shaft. The cams shall have a wide range of adjustment so that the contacts may be set to trip any one of the pumps at a given water level. The controller shall be furnished with float, tape, counterweight and all other parts needed to make a complete assembly ready for operation. The maximum range of water levels will be 21. 25.00 with tank and 21. 15.00 with empty tank.

All parts coming in contact with water shall be of non-corrosive material. The equipment shall be fully guaranteed against defects in material and workmanship for a period of one year.

22-07. Well Pump Control:

Wells delivering raw water to the plant shall have push button start and stop switches mounted on the main control panel, as specified under Section 80. The wells shall be grouped as follows; with individual push button start and stop control for each group.

Group No. 1 - Wells 2, 5, and 10.

Group No. 2 - Wells 6, 8, and 9.

Group No. 3 - Wells 1, 6, and 7.

Group No. 4 - Well 4 (Alone).

22-08. Water Service Piping:

Water connections shall be taken from two 12-inch taps in the discharge header as shown on the plans. The 12-inch taps shall be increased at the gate-valves to 8-inch and brass gate valves of the size shown shall be

22-08. (Cont'd)

carried to the points indicated; namely, chlorinating equipment, pressure gauge, automatic pump controllers, gasoline engine cooling systems, lavatory and hose bibs. All service piping shall be of standard weight galvanized steel with galvanized malleable iron fittings. Valve 2-inch and larger shall be cast iron, bronze mounted for 150 lbs. working pressure. Valves smaller than 2-inch shall have bronze body and working parts suitable for 150 lbs. pressure.

22-09. Ventilator:

A motor driven exhaust ventilator of 930 cu. ft. per minute capacity shall be installed as shown on the drawings, to exhaust air through a 9-1/2 inch galvanized sheet metal duct from the pump room to discharge through a louvered opening to the outside. The ventilator assembly shall be supported by a concrete base as shown. Motor characteristics shall be 1/8 H.P. - 110/220 volts, single phase, 1140 R.P.M.

Electrical work shall be done in accordance with Section 30.

22-10. Gasoline Engine Auxiliary Drive:

Gasoline engines for dual driven pumping units, together with fuel tanks and incidental equipment, have been procured under Spec. 502, Advance Spec. "A" and Addendum No. 1. Engines will be mounted on a steel base as an integral part of the pump assembly.

22-11. Fuel Tanks & Piping:

Two 280 gallon fuel tanks shall be buried at the location shown on the plans. Tanks shall slope 2 inches toward the fill pipe end and the top elevation of both tanks shall be 17.60 at the high end.

22-02. (Cont'd)

carried to the points indicated; namely, chlorinating equipment, pressure gauge, automatic pump controllers, heating engine cooling system, lavatory and hose bibs. All service piping shall be of standard weight galvanized steel with galvanized malleable iron fittings. Valve 3-inch and larger shall be cast iron, bronze mounted for 150 lbs. working pressure. Valves smaller than 3-inch shall have bronze body and working parts suitable for 150 lbs. pressure.

22-03. Ventilator:

A motor driven exhaust ventilator of 950 cu. ft. per minute capacity shall be installed as shown on the drawings, to exhaust air through a 8-1/2 inch galvanized sheet metal duct from the pump room to discharge through a louvered opening to the outside. The ventilator assembly shall be supported by a concrete base as shown. Motor characteristics shall be 1/8 H.P. - 110/220 volts, single phase, 1160 R.P.M.

Electrical work shall be done in accordance with Section 26.

22-10. Gasoline Engine Auxiliary Drives:

Gasoline engines for dual driven pumping units, together with fuel [illegible] equipment, have been procured under Spec. 502, drawing Spec. "A" and Addendum No. 1. Engines will be mounted on a steel base on integral part of the pump assembly.

22-11. Fuel Tanks & Piping:

Two 280 gallon fuel tanks shall be buried at the location shown on the plans. Tanks shall slope 2 inches toward the fill pipe end and the top elevation of both tanks shall be 17.00 at the high end.

22-11. (Cont'd)

Each tank shall be piped and valved as shown on the drawings. Pipe shall be standard weight galvanized steel with gasoline tight joints. All pipe lines carrying gasoline shall be pressure tested to 50 p.s.i. before being covered over. Leaks shall be repaired and the line retested until it is perfectly tight.

Extreme care shall be used to keep the storage tank and pipe lines absolutely clean and free from earth and other foreign matter. Before final connections are made, each pipe line shall be thoroughly blown out with air.

Each vent shall be equipped with a fine mesh insect screen at its top and an approved flame arrester just above the tank.

22-12. Hand Priming Pumps:

Manually operated hand priming pumps have been procured with the equipment. These pumps with one-gallon reserve tanks shall be installed as shown on the drawings to supply fuel directly to the engine carburetors. The assembly shall be securely fastened to the pump room wall with expansion bolts. Pipe work shall be in accordance with Para. 22-10.

22-13. Engine Cooling System:

The cooling system for gasoline engines shall consist of cold water supply admitted to the engine jacket through a temperature regulating valve which is controlled by the temperature of hot water passing upward and around the actuating bulb. In order to secure circulation, a $\frac{1}{2}$-inch cold water by-pass line shall be installed around the temperature control valve.

22-12. (Cont'd)

Each tank shall be piped and valved as shown on the drawings. Pipe shall be extended weight galvanized steel with gasoline tight joints. All pipe lines excepting gasoline shall be pressure tested to 50 p.s.i. before being covered over. Leaks shall be repaired and the line retested until it is perfectly tight.

Extreme care shall be used to keep the storage tank and pipe lines absolutely lint and free from earth and other foreign matter. Before final connections are made, each pipe line shall be thoroughly blown out with air.

Each vent shall be equipped with a fine mesh bronze screen at its top and an approved flame arrester just above the tank.

22-13. Hand Priming Pumps:

Manually operated hand priming pumps have been provided with this equipment. These pumps with one-gallon reserve tanks shall be installed as shown on the drawings to supply fuel directly to the engine carburetors. The assembly shall be securely fastened to the pump room wall with expansion bolts. Pipe work shall be in accordance with Para. 22-16.

22-14. Engine Cooling System:

The cooling system for cooling engines shall consist of cold water supply admitted to the engine jackets through a temperature regulating valve which is controlled by the temperature of hot water leaving engine and entering the cooling tank. In order to secure circulation, a 3/4-inch cold water by-pass line shall be installed around the thermostatic control valve.

22-13. (Cont'd)

The by-pass shall contain a solenoid valve to be energized from the 6 volt storage battery to open when the engine ignition is turned on. The by-pass line shall be fitted with a union and orifice plate with opening to admit one gallon of cold water per minute to the engine jacket. The control valve shall maintain an average temperature of 160° F.

A standard angle thermometer for hot water shall be installed in the waste pipe above the engine. Graduations shall be in degrees "F" from 50 to 212. The hot water waste line shall drain into an increaser above the floor so that the discharge will be visible.

All piping shall be standard weight galvanized steel, with galvanized malleable iron fittings; bronze valves and hose bib.

22-14. Exhaust System:

The exhaust system from gasoline engines shall be installed as shown on the plans. Piping shall be standard weight black steel with black iron fittings except where flexible steel sections are shown. Joints shall be made gas tight.

A 3-inch stack shall be provided at each engine, at the location indicated, the lower 2 feet to be imbedded in concrete. The connection from the engine to the stack shall be made with a length of flexible steel tubing.

Mufflers procured with the equipment shall be installed under the balcony, as shown, and shall be securely fastened thereto by means of pipe hangers. From the mufflers, connections shall be run to the 4-inch main

22-12. (Cont'd)

The by-pass shall contain a solenoid valve to be energized from the 6 volt storage battery to open when the engine ignition is turned on. The by-pass line shall be fitted with a union and orifice plate with opening to limit engine outlet of cold water per minute to the engine jacket. The control valve shall maintain an average temperature of 180° F.

A standard angle thermometer for hot water shall be installed in the waste pipe above the engine. Graduations shall be in degrees "F" from 30 to 212°. The hot water waste line shall drain into an increaser above the floor so that the dial will be visible.

All piping shall be standard weight galvanized steel, with galvanized malleable iron fittings; bronze valves and hose cib.

22-13. Exhaust System

The exhaust system from gasoline engines shall be installed as shown on the plans. Piping shall be standard weight black steel with black iron fittings except where flexible steel sections are shown. Joints shall be made gas tight.

A muffler shall be provided on each engine, at the location indicated, the lower 2 feet to be imbedded in concrete. The connection from the engine to the steel shall be made with a length of flexible steel tubing.

Mufflers provided with the equipment shall be installed under the balcony, as shown, and shall be securely fastened thereto by means of pipe hangers. From the mufflers, connections shall be run to the 4-inch main

22-14. (Cont'd)

exhaust stack which in turn shall extend through the roof of the pumping plant and upward along the wall of the filter plant to terminate with a long sweep bend.

The 4-inch stack shall be flashed and counterflashed where it extends through the roof and shall be securely fastened with iron straps to the wall of the filter plant above the pump room roof.

The 4-inch vertical run between the balcony floor and roof shall be covered with 2 inches of high temperature insulation with 7½ oz. canvas cover.

The 4-inch stack shall be equipped with a flange to carry its weight on the floor of the balcony. The exhaust assembly shall be constructed throughout with proper provision for expansion and contraction.

Drip legs with bleed cocks shall be installed to rid the exhaust piping of condensate. Half-inch drips shall be provided in both 3-inch stacks just above the pump room floor and in both 3-inch exhaust pipes.

22-15. Instrument Panel:

A board shall be provided as shown on the drawings for mounting one recording pressure gauge and two automatic pump controllers procured under Spec. 502, Advance Spec. "A". Space shall be left on the board for future instruments as shown on the plans. The board shall be of cement-asbestos or other hard durable composition which will retain its shape and not be affected by water. A hydraulic snubber shall be assembled and connected as shown to damp out pressure surges.

Pipe work shall be in accordance with Para. 22-07.

22-15. (Cont'd)

The entire assembly shall be supported by metal brackets fastened securely to the wall. All pipe work shall be concealed insofar as is possible, at the rear of the board.

Electrical work shall be in accordance with Section 30.

22-16. Painting:

Pumps, motors, and gasoline engines, light gray.

Suction and discharge piping and valves, above ground, light gray.

Hand-wheels on valves, bituminous, black.

Metal pipe vault covers, gray.

Water service piping above ground, light gray.

Ventilator and air duct, light gray.

Fuel tanks, and piping above ground, dark red or maroon.

Hand priming pump and piping, above ground, dark red or maroon.

Instrument panel, all exposed pipe and fittings, light gray.

Painting shall be in accordance with Section 42.

SECTION 23

DISCHARGE MAIN

23-01. Discharge Main:

The discharge lines from the various service pumps shall be Class " B", A.W.W.A. cast iron pipe either bell and spigot or with 125 lb. American Standard flanges faced and drilled. In lieu of Class "B" bell and spigot, Class 150 centrifugally-made pipe may be used. Pipe shall be laid in accordance with Section 8.

Discharge piping shall be located in accordance with the dimensions and elevations shown on the plans and shall be bell and spigot or flanged as indicated.

23-02. Discharge Main Venturi Meter:

A venturi meter procured under Spec. 502, Advance Spec. "D" shall be installed in a concrete vault on the main 16-inch discharge line as shown on the plans. The meter tube shall be set and supported as specified in Section 13, Para. 13-02. Four 1-inch galvanized steel differential tubes together with main valves, sediment legs, blow-off valves and other appurtenances shall be installed exactly as specified in Section 13, Para. 13-03, one pair to connect with the register-indicator-recorder; the other pair to connect with the chlorinating equipment.

23-03. Register-Indicator-Recorder:

A register-indicator-recorder instrument procured under Spec. 502, Advance Spec. "D" shall be installed as shown on the drawings and connected with the differential tubes exactly as specified in Section 13, Para. 13-04.

SECTION 25

DISCHARGE MAIN

25-01. Discharge Mains.

The discharge lines from the various service pumps shall be 10-inch "B", A.W.W.A. cast iron pipe either bell and spigot or with 125 lb. American Standard Flanges faced and drilled. In lieu of Class "B" bell and spigot, Class 150 centrifugally-cast pipe may be used. Pipe shall be laid in accordance with Section 8.

Discharge piping shall be located in accordance with the dimensions and elevations shown on the plans and shall be bell and spigot or flanged as indicated.

25-02. Discharge Main Venturi Meter:

A venturi meter procured under Spec. 502, Advance Spec. "D" shall be installed in a concrete vault on the main 10-inch discharge line as shown on the plans. The meter tube shall be set and supported as specified in Section 13, Para. 13-02. Four 1-inch galvanized steel differential tubes together with main valves, equipment legs, blow-off valve and other appurtenances shall be installed as specified in Section 13, Para. 13-03. One pair to connect with the register-indicator-recorder; the other pair to connect with the chlorinating equipment.

25-03. Registator-Indicator-Recorder:

A transistor-indicator-recorder instrument procured under Spec. 502, Advance Spec. "D" shall be installed as shown on the drawings and connected with the differential tubes exactly as specified in Section 13, Para. 13-04.