DIVISION 23

SECTION 23 25 19

WATER TREATMENT FOR STEAM SYSTEM FEEDWATER

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following steam boiler feedwater chemical-treatment systems:

1. Chemical-feed equipment and separate automatic amines chemical injection equipment and controls.
2. A manual shunt (bypass) chemical shot-feeder for each boiler.
3. Boiler water-treatment chemicals.
4. Services of Water Treatment Firm.

B. Related Sections:

1. Section 01 51 23 - Temporary Heating
2. Section 23 05 00 – Common Work Results For HVAC
3. Section 23 05 13 - Common Motor Requirements For HVAC Equipment
4. Section 23 05 23 - General Duty Valves For HVAC Piping
5. Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
6. Section 23 05 53 - Identification for HVAC Piping and Equipment
7. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC
8. Section 23 07 00 - HVAC Insulation
9. Section 23 09 13 - Instrumentation and Control for HVAC
10. Section 23 09 14 - Natural Gas and CO Gas Leak Detection Equipment
11. Section 23 09 23 - Control Dampers
12. Section 23 09 24 - Steam Flow Meters
13. Section 23 22 13 - Steam and Condensate Heating Piping
14. Section 23 25 19 - Water Treatment for Steam System Feedwater
15. Section 23 31 13 - Metal Ducts
16. Section 23 33 00 - Air Duct Accessories
17. Section 23 34 16 - Boiler Room Combustion Air Makeup And Ventilation System
18. Section 23 51 00 - Chimney Liner
19. Section 23 51 16 - Prefabricated Breechings and Accessories
20. Section 23 51 23 - Gas Vents
21. Section 23 52 39 - Firetube Boilers
22. Section 23 53 12 - Vacuum Condensate Pumps
23. Section 23 53 13 - Boiler Feedwater Pumps

1.02 PERFORMANCE REQUIREMENTS

A. Water quality for steam boiler feedwater systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base steam boiler feedwater treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Product data defining chemical products being supplied, including cleaning chemicals.

B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: Power and control wiring, clearly differentiating between manufacturer installed and field installed wiring.

C. Field quality-control test reports.

D. Other Informational Submittals:

1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.

2. Water Analysis: Submit an analysis of the raw water quality available at Development site.

E. Submit samples of the laboratory standard forms, for approval.

F. Test Report: Perform tests on the boiler water, condensate returns, New York City make-up water and feedwater biweekly and submit written copies of the test results biweekly. The results shall be submitted on the Water Treatment Firm's laboratory standard pre-approved forms. List condition of the water, chemical dosages to be used, conditions of equipment and all other accessories. Testing and reporting of test results shall continue for the one-year duration of the warranty period and also during any time period that the boilers are used for temporary heat.

G. Manufacturer's Instructions:

1. Recommended feed rates of each chemical plant.

2. Recommended operating conditions for each system including cycles of concentration, chemical test limits and water treatment system set points.

3. Control sequence.

H. Written guarantee by the Water Treatment Firm and the Contractor.

I. Certificate of cleaning by the Water Treatment Firm after completion of the boilout.

J. Maintenance Materials: test kits and accessories; chemicals.

K. Maintenance data: Maintenance manual.

L. Certificate: Contractor's Start-Up and demonstration affidavit.

1.04 QUALITY ASSURANCE

A. HVAC Water-Treatment Service Provider Qualifications: An independent professional HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying boiler feedwater treatment as specified in this Section.

1. A well-equipped laboratory managed by qualified personnel.
2. Knowledgeable and experienced key personnel who are chemical engineers or chemists and who have been in the field of industrial water treatment and water analysis for over five (5) years.
3. Water Treatment Firm shall be approved by NYCHA. The contractor shall submit a list of at least three (3) installations of similar capacity in New York City, which have been successfully tested by the proposed water treatment firm for a period of five (5) consecutive years.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. All chemicals, testing methods, application techniques and levels of concentration recommended by the Water Treatment Firm shall comply with the American Society of Mechanical Engineers (ASME) Guidelines, American Boiler Manufacturers Association (ABMA) and boiler manufacturer's recommendations.

1.05 GUARANTEE

A. The Water Treatment Firm and the Contractor shall guarantee in writing, that the water systems and any component parts thereof, will experience no more than minimal scale and sludge formation, corrosion, pitting, algae and slime growth, during the warranty period (and temporary heat time period) when treated in strict accordance with the Water Treatment Firm's recommendations. Priming or foaming caused by residual oils, excessive alkalinity or excessive dissolved solids shall additionally be eliminated during the warranty period (and temporary heat time period). The warranty period shall extend one calendar year beyond the date of Substantial Completion. The warranty period shall not run concurrently with the required maintenance during temporary heat.

1.06 MAINTENANCE

A. Extra Materials: Furnish a one-year supply of water treatment chemicals and test kits. The one year period shall start after Substantial Completion.

PART 2 - PRODUCTS

2.01 WATER TREATMENT FIRMS

Cascade Water Services, Inc.
Nalco Chemical Company
Acqua Treat Limited
J.V. Company Inc.
1st Purity Inc./Purity Laboratories, Inc.
Syntec
Betz-Entec
Or approved equal

2.02 CHEMICAL TREATMENT SCOPE OF WORK

A. Water Meter: Provide a water meter on the boiler city feed water line to the boiler feed water tank. Meter shall be an electric contacting water meter that shall provide an electric signal each time a preset amount of water passes through the meter. Meter shall interlock with the chemical feed pumps.

1. Galvanized steel conduit for enclosing connecting wires or flexible (Sealtite) cable shall be provided.

B. Chemical Feed Set:

1. Provide a packaged chemical feed system consisting of 55-gallon polyethylene tank, two chemical feed pumps, agitator and all other items and accessories as required for a complete operational installation. Chemical feed set shall consist of the following components:

a. 55 gallon vertically mounted chemical tank, fabricated from high-density polyethylene with molded fiberglass cover that has a recess for mounting pump, agitator, and liquid-level switch.

b. One (1) 1/4 HP direct drive agitator, with 750-rpm totally enclosed non-ventilated (TENV) motor, 115/1/60 power, mounted on tank with angle adjustment. Provide stainless steel clamp and motor mount, with stainless steel shaft and propeller.

c. Two (2) V-10 piston type reciprocating plunger, positive displacement pumps, driven by 115/1 /60 1/4 HP totally enclosed fan cooled (TEFC) motors. Maximum pumps discharge pressure capability shall be 1000 psig.

d. Each pump shall be fitted with double check valves and relief valve and suction and discharge piping.

e. Strainer and shutoff valve in suction piping.

f. Low level cutoff and alarm.

g. Structural steel base.

h. On/Off control switch for agitator.

i. Selector switch for chemical feed pumps.

j. Provide a unit panel with common power for all pumps. Each pump shall have protective devices.

k. Metering device pre-set to deliver the required chemical dosages based on raw make-up water, feedwater, condensate and boiler water site analysis tests.

C. Chemicals for boilers shall be fed into boiler feed line downstream of the boiler feed pump set discharge check valves. Connection into the feed water tank shall not be permitted. All water connections that do not add water to the boiler system (ex. cold water quench to sump, makeup to vacuum pump) shall be connected upstream of the treatment water meter. Chemical pumps shall be interlocked with the operation of boiler feedwater control valves. Contractor shall install discharge manifold header so that any chemical feed pump can be coupled with any boiler feedwater control valves. The amount of chemical dosages shall be based on the amount of water registered by the water meter installed on the city make-up water line. The chemicals shall be able to maintain the boiler water pH level as recommended by the Water Treatment Firm consistent with ASME, ABMA and boiler manufacturer's recommendations. Boiler water pH level shall be compatible with the specific treatment chemicals used.

1. Sequence of Operations:

a. The chemical feed pumps shall be interlocked with the operation of feedwater control valves. The chemical feed pump shall be energized by the signal sent from the electric contacting water meter installed on the City feedwater line to the boiler feedwater receiver tank. The duration of the pumping cycle shall be determined by a count down type of timer. Timer shall be set based upon the volumetric flow rate and volume of chemicals to be dispensed as determined by the Water Treatment Firm.

b. If proper boiler water level is restored while the chemical pumps are still in their timed pumping cycle, the chemical pumps cycle shall be terminated prematurely. The timers of the chemical pumping cycle shall have the capability of restarting the chemical pumps and completing the previously interrupted pumping cycle upon the next feedwater cycle. Time-out type timers that do not complete the previously interrupted pumping cycle shall not be acceptable.

D. System Cleaner: Alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

E. Boiler System Treatment as recommended by the Water Treatment Firm shall include:

1. Agent to reduce deposits and adjust pH.
2. Corrosion inhibitors.

F. Provide steel test cabinet with local fluorescent light capable of accommodating test burettes and associated reagents. Provide test kits required by chemicals used.

G. Furnish and install a chemical shunt (bypass) feeder for each boiler to provide capability to manually inject boiler water chemicals directly into the boiler as shown on the Contract Drawings and as specified herein. The shunt feeder shall be Vertical Style –

Dish Bottom In rated for max. pressure of 200 PSI at 200 F. The tank shall be 9 gauge steel and the cap shall be cast iron with Buna N "O" ring wide mouth, easy open – easy close. The shunt feed shall have a gauge glass. The shunt feeder shall be Syntec Co. Model VTF-5 (5 gallons) or approved equal.

H. Furnish and install a separate, preassembled, packaged automatic amines chemical feed system to feed amines into the steam header as shown on the Drawings and as specified herein. The system shall be model CTS-40-P-LC04 as manufactured by Cleaver Brooks Corp., integrally factory provided with a Pulsafeeder Corp. model MicroVison programmable microprocessor controller, or approved equal. System shall be capable of misting amines at various times of the day in specified quantity. Provide a 40 gallon tank and pump system with minimum 120% secondary containment in conformance with EPA 49CFR, to feed amines to steam header as shown on the drawings. The metering pump shall be Pulsafeeder Corp. model Pulsatron Series C, size LC04 solenoid type pump, or approved equal. Metering pumps shall be provided with the following features, or approved equal:

1. Solenoid type pump shall be capable of adjustable, manual control from adjustable stroke length, from zero-to-100%, throughout the rated capacity of the pump.
2. Pump shall have circuit protection against voltage and current upsets. Solenoid shall be protected against thermal overload with auto-reset.
3. The pump shall be Water Resistant, acceptable for outdoor and indoor applications.
4. Capacity: 0.24 Gallons Per Day, minimum; 24.0 Gallons Per Day, maximum.
5. Discharge Pressure: 80 PSIG, maximum.
6. The pump shall have ball guided ball check Valve systems to prevent back flow and enhance outstanding priming characteristics.
7. The liquid end of the pump and the injection quill shall be made of PVDF = Polyvinylidene Fluoride.
8. The balls in ball check design shall be made of ceramic material.
9. Injection nozzles shall be capable of handling temperatures of up to 250°F.
10. Pumps shall be equipped with durable leak-free bleed valve assembly to ensure safe and easy priming.
11. Pump shall be rated for operation with 120V/1-Ph/60Hz/0.60 Amps electrical power.
12. Integral double-lined 40 gallon capacity chemical storage tank shall be provided with the following features:

    a. Tank shall meet or exceed secondary containment regulations set under EPA 49CFR.
    b. Tank shall be square and natural colored, of 20"wide x 20"long x 37.25"high dimensions.
    c. Tank shall be designed with pump mounting surface, female threaded connections and twist lid inspection port.

d. Tank shall be constructed of Low Density Polyethylene.

13. The Contractor shall provide a cold water makeup flow meter in the cold water makeup to the feedwater receiver, located as shown on the Contract Drawings. Cold water makeup flow meter shall be Carlon Meter Corp., model 200MRS Industrial Series Water Meter, or approved equal, equipped with capability of remote electronic transmission of readout via 18-gauge two-wire cable and normally open reed switch rated at 100 mA, 24V AC/DC, rated for operation from 2-to-160 GPM flow rate, with 2-inches NPT threaded connections. The water meter shall continuously monitor the amount of makeup cold water being fed to the boiler feedwater system. The Pulsafeeder Corp. MicroVision microprocessor controller shall send the amines injection pump a start signal to run for an adjustable flow rate and adjustable time duration, based on the amount of makeup water introduced into the feedwater system. The MicroVision microprocessor controller shall hold the pump start signal closed for an adjustable time duration during each cycle. The pump itself shall be adjusted to deliver a precise flow rate, by means of an adjustable stroke, so that a precise pre-determined amount of amines chemicals shall be injected into the steam header during each cycle.

I. The contractor shall retain a water treatment company to maintain boiler water quality throughout the Warranty/Guarantee period. The contractor shall obtain NYCHA's approval for the water treatment company selected and shall analyze the water quality at least once a week and submit weekly water quality reports to NYCHA's Development superintendent.

J. The contractor shall be responsible for maintaining the required water quality, as specified herein after.

K. All water treatment chemicals shall be EPA, OSHA, NYS and NYC approved. Water treatment company products and services shall be ISO 9002 certified.

L. The water treatment company shall provide operator training and professional services to the NYCHA development superintendent, assistant superintendent, borough field superintendent, and the heating plant technicians for the proper handling and testing of chemicals as specified herein.

M. The water treatment company shall provide a chemical test kit for the heating plant technician with the proper testing procedure and a laminated copy of this procedure, so it can be posted in the boiler plant.

2.03 CHEMICAL PRODUCTS

A. Boiler chemical products shall minimize scale and corrosion on heat transfer surfaces. The individual chemical products are:

1. Liquid Sodium Hydroxide (Na OH) 50% in solution..
2. Liquid Diethylaminoethanol (NIN-Diethylethanolamine) Neutralizing Amines (30% in solution)

3. Liquid Sodium Sulfite (Bisulfate, catalyzed cobalt chloride) 15% in solution to be in acid form.

4. The use of NTA, polymer, nitrates or phosphate is not permitted.

B. The five (5) gallon containers shall be labeled with the product description that will include percentage of product in solution, pH level, density, boiling and freezing points of the products. The container covers shall also be color coded as follows:

1. Sodium Hydroxide (Red).
2. Sodium Sulfite (Blue).
3. Amines (Yellow).

C. Provide Material Safety Data Sheets (MSDS) to ensure a safe work place and comply with all State and Federal laws pertaining to the handling of hazardous materials. MSDS shall accompany all first time orders. MSDS shall include an emergency number to call in case of spills and/or accidents involving the chemical products supplied.

D. The boiler chemical product shall be capable of being fed into each boiler through the manual shunt feeder.

E. The liquid sodium sulfite (catalyzed oxygen scavenger) shall be injected into the condensate receiver tank below the water line without the need for mixing or diluting.

F. Boiler water quality control limits shall be as follows:

Test	**Min.**	**Max.**
Sulfite	30 PPM	60 PPM
p-Alk.	100 PPM	200 PPM
Chloride	----	120 PPM
Conductivity (umohs)	1500	3000
Passivating with Sodium Nitrite, Sodium Tetraborate and Tolytriazole, if used in lieu of sodium sulfite oxygen scavenger	1,000 PPM	1,500 PPM
pH Boiler Water if using Sodium Sulfite Oxygen Scavenger	10.5	11.5
pH Boiler Water if using Sodium Nitrite Passivation	7.5	9.5
Solids	3,500 PPM of TDS; 300 PPM of Suspended Solids	
Phosphates if used for scale control	10 PPM	20 PPM
pH Condensate Return	8.0	9.0

Note: Test for proper pH of the condensate return shall be performed. The sample of condensate return shall be taken from the steam drip assembly locasted in the farthest tank room of the building from the boiler plant. The pH shall be above 7.5. A pH valu less than 7.5 may indicate some concern with treatment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install chemical feeder system complete with tanks, pumps, valves, piping, control panel, controls and accessories.

B. Install test cabinet complete with all glassware and reagents, at location as directed by NYCHA's Representative.

3.02 CLEANING OF HEATING PLANT

A. Waterside Cleaning

1. Inspection for Foreign Objects: Prior to starting the boiler(s), an inspection shall be made to insure that no foreign matter such as tools, equipment rags, etc., have been left in the boiler(s).
2. Checks before Filling: Before putting water into the new boiler(s), verify that firing equipment is in operating condition to the extent that this is possible without actually lighting a fire in an empty boiler.
3. Operation to Clean the System: Fill the boiler(s) to the proper waterline and operate the boiler(s) with steam in the entire system for a few days to bring the oil and dirt back from the system to the boiler(s).
4. Boiling Out

    a. Fill the boiler(s) to the normal waterline

    b. Remove plug from tapping on highest point on the boiler(s).

    c. Provide a boilout compound of caustic soda and trisodium phosphate in the proportions of one (1) pound of each chemical per fifty (50) gallons of water.

    d. Mix the chemicals with water and pour into the boiler(s) through the opening.

    e. Replace the plug.

    f. Start the firing equipment and slowly bring the water temperature up to at least 180°F. and check operating, limit, and safety controls. Review manufacturer's recommendations for boiler and burner startup.

    g. Simmer the water for at least five (5) hours.

    h. Stop the firing equipment and allow the boiler(s) to cool down.

    i. Drain the boiler(s).

    j. Wash the boiler(s) thoroughly, using a high pressure water stream.

    k. Fill the boiler(s) to the normal waterline.

    l. Add boiler water treatment compound as required.

m. Boil the water or heat it to a temperature of 180°F promptly.

n. The boiler(s) are now ready to be put into service or standby.

5. Second Boilout for Stubborn Cases: If initial boilout does not remove all the oil and grease, Contractor shall perform another boilout using a surface blowoff. Proceed as follows:

a. Fill the boiler(s) until water reaches the top of water gauge glass.

b. Add caustic soda and trisodium phosphate in the proportions of one pound of each chemical per fifty (50) gallons of water.

c. Start the firing equipment and operate sufficiently to simmer the water without producing steam pressure.

d. Simmer for a minimum of five (5) hours.

e. Manually feed water to the boiler to permit a steady trickle of water to run out the overflow pipe.

f. Continue this slow simmering and trickle of overflow for several hours until the water coming out of the overflow is clear.

g. Stop the firing equipment and allow the boiler(s) to cool down.

h. Drain the boiler(s).

i. Remove covers and plugs from all washout openings and wash the waterside of the boiler(s) thoroughly, using a high pressure water stream.

j. Refill boiler(s) till one (1) inch of water shows in the gauge glass.

k. If gauge glass does not appear to be clean, repeat steps (a) through (j) and boil out the boiler(s) for a longer time.

l. Add a charge of boiler water treatment compound.

m. Close boiler(s).

n. Boil, or bring water temperature to at least 180°F promptly.

o. The boiler(s) are now ready to be put into service or standby.

3.03 TREATMENT OF BOILER WATER

A. The Contractor shall employ the services of a qualified Water Treatment Firm, who shall maintain the boiler water at optimum condition to inhibit corrosion, pitting, priming or foaming due to residual oils or chemical unbalance, rust, scale and sludge formation. The services of the Water Treatment Firm shall begin at the time of the hydrostatic testing of the boilers and shall continue until the end of the warranty period. This time period covers any time that the boilers are used for temporary heat. During this time, a certified laboratory report of the water condition of each boiler shall be forwarded to NYCHA biweekly. Failure of the Contractor to submit the bi-weekly test reports during the temporary heat time period and during the one year warranty period after Substantial Completion shall require the Contractor to secure the diagnostic inspection services of a metallurgist who is a licensed Professional Engineer registered in the State of New York. The expenses for securing the services of the metallurgist

and any costs associated with performing any required remedial work identified by the metallurgist shall be borne by the Contractor.

B. The following parameters shall be monitored as required: pH, hardness, suspended solids and total dissolved solids (by either chloride or conductivity measurements) and oxygen content. Sulfite or nitrite levels shall be monitored depending upon which treatment method is used. Soluble phosphate shall be monitored if phosphate is used for scale formation control.

3.04 FIELD QUALITY CONTROL

A. It is the intent of these specifications to provide complete systems of chemical treatment to protect all boiler equipment from scale formations, priming or foaming, corrosion, and water systems from algae and slime growth. Perform field test procedures and issue reports of such tests.

B. Boiler blowdown and reduction of the dosage of caustic soda (NaOH) may be used to reduce high alkalinity. The final chemical treatments shall be based on steam, condensate, boiler water, raw water makeup and boiler feedwater analysis.

C. During the treatment period, in addition to performing bi-weekly tests and submitting test reports, the Water Treatment Firm shall review the test procedures and test reports with NYCHA's development site boiler plant operating engineer. All surfaces shall be inspected for corrosion and scaling. All chemical feeding equipment shall be inspected. Modifications to the approved treatment program will be made as required based on specific site needs.

D. Instruct and train maintenance personnel in the operation of systems installed. Training shall be for a minimum of 4 hours. Secure written confirmation that instruction has been provided and approved maintenance manuals received.

E. The vendor shall have the necessary equipment to transport the chemical containers up or down flights of stairs.

3.05 OPERATOR TRAINING AND PROFESSIONAL SERVICES

A. Provide training to heating plant technicians in the use and handling of chemical products. Training shall be for a minimum of 4 hours. Secure written confirmation that instruction has been provided and approved maintenance manuals received. Training shall include the following:

1. Step-by-step procedure for performing water analyses.
2. A step-by-step chemical handling and testing procedure booklet shall be provided.

B. Provide necessary water quality test kits.

END OF SECTION

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