National Park Service
Denver Service Center

TABLE

YELLOWSTONE NATIONAL PARK
CANYON VILLAGE

IFB 1570-82C
PHASE II DOMESTIC WATER SYSTEM

PACKAGE NO. 141
JUNE 7, 1982
VOLUME 2

PROJECT MANUAL

NO DEPOSIT IS REQUIRED

FOR

DRAWINGS & SPECIFICATIONS

PLEASE RETURN TO ISSUING OFFICE

FOLLOWING OPENING OF BIDS

PART 1: GENERAL

1-1 DESCRIPTIONS:

A. The work of this section consists of the design, furnishing, erecting and removing of forms for cast-in-place concrete.

B. Related work includes sections 03300, Cast-in-Place Concrete; and 03210, Reinforcing Steel.

1-2 QUALITY ASSURANCE:

A. Reference Standards: American Concrete Institute Standards (ACI), 301 Specifications for Structural Concrete for Buildings, Chapter 4, Formwork. ACI 347, Recommended Practice for Concrete Formwork (Chapters 1 through 5) and as modified herein.

B. Design Criteria: Design formwork for the loads, lateral pressure and allowable stresses outlined in Chapter 1 of ACI 347.

C. Maximum Allowable Tolerances

1. Variation from plumb.

a. Lines and surfaces of columns, piers and walls in any 10 feet of length, 1/4 inch; in 40 feet or more, 1 inch.

b. Control-joint grooves, and other conspicuous lines. In any 20 feet of length, 1/4-inch; in 40 feet or more, 1/2-inch.

2. Variation from level or specified grade in slabs, beams and roof. In any 10 feet of length, 1/4-inch; in any 20 feet of length, 3/8-inch; in 40 feet or more, 3/4-inch.

3. Variation of the linear building lines from established position in plan and related position of columns, walls and partitions; in any bay, 1/2-inch; in any 20 feet of length, 1/2-inch; in 40 feet or more, 1 inch.

4. Refer to ACI 301, Table 4.3.1 for additional requirements.

1-3 SUBMITTALS: Contractor is to submit to the Contracting Officer a letter of certification from the manufacturer attesting that the form bond breaking agent is acceptable for use in potable water structures. See Paragraph 2-9

PART 2: MATERIALS

2-1 GENERAL: Where "Smooth Form Finish," or "Grout Cleaned Finish" is specified, use prefabricated plywood panel forms, job-built plywood forms, forms lined with plywood, or steel forms. For reservoir walls, use two-foot wide form material to form the circular portion of the reservoir. The forms may be steel or plywood.

2-2 STEEL FORMS: Symons "Steel-Ply," Simplex "Industrial Steel Frame Forms," Universal "Uniform." Forms shall be clean, straight and true without surface defects.

2-3 PLYWOOD FORMS: Product standard PS-1, waterproof, resin-bonded exterior type Douglas Fir or Larch. Forms shall be clean, straight and true, without surface defects.

2-4 LUMBER: Douglas Fir or Larch, straight, uniform width and thickness, clean and free from offsets, holes, dents, and other surface defects.

2-5 CHAMFER STRIPS: Clear white pine, surface against concrete planed.

2-6 FORM TIES:

A. Permanently embedded snap ties with waterseal washers. Provide spreader cones on ties, diameter shall not exceed 1 inch.

B. With sufficient strength and rigidity to maintain forms in proper location without use of auxiliary spreaders.

C. In surfaces that will be exposed to view the form ties shall be uniformly spaced and aligned in vertical and horizontal rows.

2-7 JOINTS: All joints in the circular water reservoir walls and slabs shall be as shown on the drawings.

2-8 POLYETHYLENE FILM: Product Standard PS17; 6 mil.

2-9 FORM BOND BREAKING AGENT: Shall be non-staining agent that will allow the removal of forms without damaging or discoloring concrete.

PART 3: EXECUTION

3-1 GENERAL:

A. Erect forms substantial and sufficiently tight to prevent leakage of mortar and braced or tied to maintain the desired position, shape and alignment before, during and after concrete placement. At vertical wall joints where forms overlay existing concrete, a mortar tight joint shall be required. Use a bead of silicone caulking or foam joint filler against concrete before placing form.

B. Provide temporary openings at the bottom of column and wall forms and at other locations where necessary to facilitate cleaning and inspection.

C. Temporary openings in wall or column forms used to limit the free fall of concrete to a maximum of 4 feet shall be located to facilitate placing and compaction of the concrete. Such openings in walls shall not exceed 10 feet laterally to avoid moving concrete laterally more than 5 feet.

D. If tremies of proper lengths are used for depositing concrete in walls or columns, temporary openings for concrete placement will not be required.

E. Whenever the top of a wall will be exposed to weathering, do not extend the forms on one side above the top of the wall; bring to true line and grade.

F. At other locations, bring forms to a true line and grade, or provide a wooden guide strip at the proper location on the forms so that the top surface can be finished with a screed or template for concrete which is to have a specified elevation, slope or contour.

G. At horizontal construction joints in walls, do not extend the forms on one side more than 2 feet above the joint.

H. Flat segmental forms not more than 24 inches wide may be used for forming curved surfaces 25 feet in diameter or larger.

I. Where concrete is placed against rock, remove all loose pieces of rock and clean the exposed surface with a high pressure hose.

J. Where concrete is placed against gravel or crushed rock which does not contain at least 25 percent material passing a No. 4 sieve, cover such surfaces with polyethylene film to protect the concrete from loss of water. Lap joints in the film at least 4 inches.

K. The circular ring wall footing for the reservoir shall have a smooth steel trowelled finish. Layers of polyethylene film shall be folded and laid on top of the wall footing in accordance with the Drawings before the wall forms are placed on the wall footing. This surface must be smooth to allow for slippage on top of the wall footing during the horizontal post-tensioning of the tank wall.

3-2 EMBEDDED ITEMS:

A. Anchor bolts, castings, steel shapes, conduits, sleeves, masonry anchorage and other materials that are to be embedded in the concrete shall be accurately positioned in the forms and securely anchored. Do not embed in the reservoir wall concrete conduits, sleeves, or other materials unless specifically shown on the Drawings.

B. Install conduits in walls or slabs with reinforcement in both faces between the two faces of reinforcing steel.

C. In slabs which have only a single face of reinforcing steel, place conduits near the center of the slab.

D. Unless installed in pipe sleeves, provide anchor bolts with sufficient threads to permit a nut to be installed on the concrete side of the form or template. Install a second nut on the other side of the form or template and adjust the two nuts so the bolt will be held rigidly in proper position.

E. Assure embedments are clean when installed.

3-3 PREPARATION OF FORM SURFACES:

A. Remove mortar, grout, and other foreign material from form surfaces.

B. Coat form surfaces with form release agent before either the reinforcing steel or concrete is placed.

C. Do not allow form coating to:

1. Stand in puddles in the forms.

2. Come in contact with the reinforcing steel.

3. Come in contact with adjacent hardened concrete against which fresh concrete is to be placed.

3-4 EDGES AND CORNERS:

A. Place chamfer strips in forms to bevel exposed edges and projecting corners. Tool the top edges of walls and slabs.

B. Form beveled edges for all vertical and horizontal corners of equipment bases unless indicated otherwise on the Drawings.

C. Chamfer strips shall be 3/4-inch.

3-5 REMOVAL:

A. Carefully remove forms only after concrete is able to support all dead and live loads.

B. Determine the strength of concrete from site cured cylinders, cured in the same manner as the formed concrete.

C. If job cured cylinder test reports are not available for formed concrete the form supports shall remain in place for not less than the following periods of time. These periods represent cumulative number of days or fractions thereof not necessarily consecutive, during which the temperature of the concrete is above $50^{o}F$.

Centering under Beams	14 days	Columns	24 hours
Floor slabs	7 days	Sides of beams and all other parts	24 hours
Walls	24 hours		
Reservoir top slab	Only after satisfactory post-tensioning.		

D. Reshoring shall not be permitted.

E. After removal, metal form ties shall be recessed a minimum of 1 inch from surfaces.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

1-3 SUBMITTALS:

A. Shop Drawings.

1. Show sizes, quantity and dimensions for fabrication and placing sequence and location of reinforcing bars and bar supports and accessories.

2. Indicate on bar schedules stirrup spacing and diagrams of bent bars.

B. Certificates, submit copies each of mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered.

1-4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver to site in bundles marked with metal tags indicating bar size, length and location.

B. Carefully handle and store on supports which will keep the steel from coming in contact with the ground. Cover to prevent additional rusting and foreign substances.

PART 2 - PRODUCTS

2-1 REINFORCEMENT BARS:

A. Bars: Steel reinforcements, shall be new, deformed billet steel, meeting ASTM Standard A-615; for rebars No. 4 and larger, Grade 60; for No. 3 rebars and designated reinforcement, Grade 40. Bend Test: Meet 180° bend at 60° F. minimum temperature per ACI 301.

B. Welded wire fabric shall conform to the gage and mesh size of plain wire specified, and shall conform to ASTM A-185.

C. Tie wire: Annealed steel, Fed. Spec. QQ-W-461, 16-gage minimum.

D. Bar Supports:

1. Conform to "Bar Support Specifications," CRSI Manual of Standard Practice.

2. Where concrete surface will be exposed, the portions of the supports or accessories within 1/2 inch of the concrete surface shall be non-corrosive or protected against corrosion (plastic covered).

E. Fabrication: In accordance with CRSI Manual of Standard Practice except for the allowable tolerances specified herein in 1-2B.

PART 3 - EXECUTION

3-1 PREPARATION:

A. Remove all mud, oil, loose rust or mill scale and other foreign material that may reduce bond.

B. Rust or mill scale which is "tight" will be permissible without cleaning or brushing provided weights, dimensions, cross sectional area, and tensile properties meet requirements of ASTM A615.

3-2 INSTALLATION:

A. Bar Placement.

1. Conform to CRSI Manual of Standard Practice.

B. Bar Supports.

1. Provide minimum number of supports as required by ACI 315.

2. Do not use pebbles, pieces of broken stone, common or face brick, metal pipe or wood blocks to support reinforcement.

3. On ground, where necessary, solid concrete bricks may be used to support wire chairs that in turn support the reinforcing steel (in slab on grade.)

4. Tie reinforcement to chairs or supports to secure them from displacement during concrete placement.

C. Placement Tolerances

1. Clear distance to formed surface: See 3.2D, Concrete Cover.

2. Spacing between bars: -1/4 inch.

3. Top bars in slabs and beams: See 3.2D Concrete Cover.

4. Crosswise of members: spaced evenly within 2 inches.

5. Lengthwise of members: $\pm$ 2 inches.

6. Maximum bar movement to avoid interference with other reinforcing steel, conduits or embedded items: one bar diameter. If bars are moved more than one bar diameter, or enough to exceed the above tolerances, the resulting arrangement of bars may be rejected by the Contracting Officer.

D. Concrete Cover.

1. Except as otherwise indicated on the Drawings, provide the following minimum concrete cover for reinforcement.

a. Unformed surfaces adjacent to the earth, 3 inches.

b. Formed or top surfaces exposed to weather or saturated air, submerged or in contact with earth, 2 inches.

c. Interior locations; Beams, girders and columns, 1-1/2 inches; slabs, walls and joists, 3/4-inch.

2. Cover for reinforcing steel shall not be less than the minimum given above (no minus tolerance), and shall not exceed the minimum by more than 1/4-inch where concrete thickness is 24 inches or less, or more than 1/2-inch where the concrete thickness is more than 24 inches.

E. Do not heat, bend or cut bars without Contracting Officer's approval.

F. Splices.

1. Do not splice bars except at locations shown on the Drawings.

2. Minimum lap distance shall be as shown on the Drawings. If not shown, splices shall be as specified in ACI 318.

G. Welded wire fabric.

1. Install in longest practicable length.

2. Lap adjoining pieces one full mesh plus 2 inches minimum.

3. Do not make laps midway between simply supported members or directly over support members of continuous structures.

4. Offset laps in adjacent widths to prevent continuous laps.

5. Extend fabric through contraction joints and construction joints unless otherwise indicated on the Drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION:

A. This section covers the furnishing and installation of post-tensioning tendons and accessories and the stressing of the tendons.

B. Related work specified elsewhere includes: Sections 03101, Concrete Formwork and 03300, Cast-in-Place Concrete.

1-2 QUALITY ASSURANCE:

A. Reference Standards:

1. American Concrete Institute (ACI) Standards:

a. 318, Building Code Requirements for Reinforced Concrete.

b. 315, Manual of Standard Practice for Detailing Reinforced Concrete.

c. 301, Specifications for Structural Concrete for Buildings.

2. Concrete Reinforcing Steel Institute, (CRSI) Manual of Standard Practice.

3. Prestressed Concrete Institute (PCI), Post-Tensioning Manual.

4. As modified by the Contract Documents.

B. Tendons shall be fabricated by a company with at least five years experience in fabrication and technical background to meet requirements of the Contract Documents.

C. Post-Tensioning Specialist: A specialist shall be at the site to direct the field handling, placement, and stressing of tendons. The specialist shall have had five years' minimum comparable experience in post-tensioning reservoirs now giving satisfactory service, and shall have at least 5 years' experience and technical knowledge in the particular post-tensioning system used.

1-3 SUBMITTALS

A. Shop Drawings. Show tendon properties, sizes, spacing, quantities, dimensions, accessories, locations and anchorages on drawings. Indicate tendon coding, stressing sequence and initial and final forces.

B. Detailed computations clearly presented indicating minimum forces required, assumed prestressing losses, final working stresses and stressing sequence,

to be submitted with shop drawings. Computations shall be performed by a registered engineer specializing in prestressed concrete design.

C. Certificates: Certified mill reports on the prestressing steel used. Show ultimate strength, modulus of elasticity and percent elongation at rupture.

D. Reports on three individual prior static tests and three individual prior dynamic tests made in accordance with Chapter 3, PCI Post-Tensioning Manual.

1-4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Tendons shall be delivered clearly identified for location. Each shipment shall be accompanied by a cutting list indicating number of tendons, length, code of tendons, anchorages wedges, grommets and support chairs. Fabricate tendons in a sequence and quantity as to avoid project slow down or lengthy storage at the site.

B. Tendons shall be protected at the site against weather and damage. Rusting will not be allowed. Damage to sheathing covering of tendons will not be allowed. Burning or welding shall not be done in vicinity of tendons.

PART 2: MATERIALS

2-1 PRESTRESS TENDONS:

A. Strands shall be 0.6 inch diameter, 7-wire, stress relieved strand, grade 270, conforming to ASTM A416.

B. Anchorages shall develop at least 95 percent of minimum specified ultimate strength of prestressing steel without exceeding anticipated set. The total elongation under ultimate load of tendon shall not be less than 2 percent measured in a minimum gauge length of 10 feet.

C. All tendons shall be unbonded and shall be completely and permanently protected against corrosion by a properly applied coating of galvanizing, epoxy, grease or other material approved by Contracting Officer. The coating shall remain ductile and free from cracks. It shall not become fluid over the entire range of temperatures anticipated for the structure. The coating shall be chemically stable, non-reactive to cement, concrete, or its sheathing. It shall be continuous over the entire tendon length.

D. Sheathing for tendons shall have sufficient strength and water resistance to resist deterioration and unrepairable damage. Sheathing shall be continuous over the tendon length, and shall prevent intrusion of cement paste and escape of coating material. All tears or holes in sheathing shall be repaired prior to concrete placement.

E. Couplings shall not be used except at locations specifically indicated on Contract Documents.

PART 3: EXECUTION

3-1 INSTALLATION:

A. Tendon supports shall be adequate to prevent displacement. Tie tendons to reinforcement or chairs to secure in proper location. Tendons are to be secure at a maximum of 4 foot centers.

B. Placement tolerances: Tendons are to be positioned in exact locations shown. Deviations, when required, shall be no more than ± 1/8 inch.

C. Concrete cover minimums:

1. Concrete cast against earth	3 inches
2. Concrete exposed to earth, weather, saturated air, or submerged	1.5 inches
3. Other concrete:	
slabs, walls, joists	3/4 inch
beams, columns	1.5 inches

D. Concrete shall be placed so that alignment of tendons remains unchanged.

3-2 STRESSING

A. Post-tensioning operation shall not begin until site cured test cylinders have been tested and indicate that concrete has attained the strength called for in Contract Documents.

B. Prestressing force shall be determined by both of following methods:

1. Measurement of tendon elongation.

2. Reading of jacking force on calibrated gage or load cell, or by use of a calibrated dynamometer.

C. Cause of any difference in force determination between paragraphs 3-1B1 and 3-1B2 above greater than five percent shall be ascertained and corrected. Accurate logs of actual tendon elongations and jacking forces shall be kept by Contractor and submitted to Contracting Officer at any time, upon request.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

PART 1: GENERAL

1-1 DESCRIPTION:

A. This section covers the furnishing and installation of waterstops.

B. Related work specified elsewhere includes: Section 03300, Cast-in-Place Concrete.

1-2 QUALITY ASSURANCE: Reference standards.

A. U.S. Corps of Engineers, CRD C-572.

B. Tennessee Valley Authority (T.V.A.) Specification No. PF-1001.

1-3 PRODUCT HANDLING:

A. Waterstops shall be delivered in standard roll lengths of at least 50 feet each.

B. Protect waterstops from damage, sun and weather during storage.

C. Sealant may contain toxins or irritants; avoid contact with skin.

1-4 INSPECTION: Prior to concrete placement and after waterstops have been positioned, waterstops are to be inspected by Contracting Officer for correct splicing and for correct, secure positioning.

PART 2: MATERIALS

2-1 MATERIALS:

A. All waterstops shall be manufactured from virgin polyvinyl chloride plastic compound, and shall not contain any scrap or reclaimed material.

1. Shall be rated for at least 125 feet head of water.

2. Shall be flat, ribbed, 3/8-inch thick, 6 inches wide, without center bulb.

B. Furnish electrically heated splicing iron per waterstop manufacturer's recommendations for welding operations.

C. Adhesive joint sealant shall be moisture cured, one component, polyurethane-base, non-sag, elastomeric sealant. Shall meet Federal Spec. TT-S-002301.

PART 3: EXECUTION

3-1 GENERAL: Install waterstops and sealants as described herein, in Section 03300, and as shown on the Drawings.

3-2 PREPARATION:

A. Waterstops shall be cut and/or spliced so that they are at least the full length of the concrete joint.

B. End cuts shall be straight and square.

C. Field splicing shall be butt splices only and shall not be performed until the splicing iron has reached 425 degrees F.

1. Square cut ends to be butt spliced together so that they are matched.

2. Heat waterstop ends with splicing iron until the material melts. There will be 1/8-inch bead of melted material all around edges to be joined. Do not overheat so that material chars.

3. Remove the splicing iron from the splice, press the melted ends together immediately and maintain ends in this position at least 15 seconds. Accelerate cooling with water, if desired. Do not trim.

D. Factory-made splices shall be furnished for vertical or horizontal flat ells, tees, crosses or special configurations.

E. Joint sealant shall be applied to clean concrete surfaces and joints. Curing compound residues and any other foreign matter must be thoroughly removed. Primer required and must be compatible with manufacturer's product.

3-3 INSTALLATION: Waterstop is to be held securely in place to prevent misalignment during concrete placement on both sides of joint.

A. Do not drive nails or provide holes through the center 3/4 of width.

B. Lap splices or unwelded splices will not be allowed.

C. Waterstop and concrete joint shall be thoroughly clean before placing concrete.

D. One-half of width of waterstop only shall extend into each side of joint.

E. Waterstops are not to be folded over during positioning or concrete placement.

F. Space waterstops to avoid space conflicts with pipes, flanges, bars, holes, etc. If space conflict exists, see Contracting Officer for resolution.

G. Sealant should be applied in temperatures of 40 degrees F. and above. Sealant should be gunned into clean joint with hand or power operated caulking gear. Allow one week cure before total water immersion.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

PART 1: GENERAL

1-1 DESCRIPTION:

A. This section covers all cast-in-place concrete, and includes furnishing materials, transporting, placing, finishing, curing and other appurtenant items of construction.

B. Related work specified elsewhere includes Sections 03101, Concrete Formwork; 03210, Reinforcing Steel; 03230, Post-Tension Tendons; 03253, Waterstops; and 03700, Disinfecting and Testing Reservoirs.

1-2 QUALITY ASSURANCE:

A. Reference Standards: except as noted or modified in this section, all concrete materials, transporting, placing, finishing and curing shall conform to requirements of following standard specifications; American Concrete Institute Standards (ACI):

1. 301, Specifications for Structural Concrete for Buildings.

2. 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

3. Committee 304, Placing Concrete by Pumping Methods.

4. 305, Recommended Practice for Hot Weather Concreting.

5. 306, Recommended Practice for Cold Weather Concreting.

6. 309, Recommended Practice for Consolidation of Concrete.

7. 318, Building Code Requirements for Reinforced Concrete.

8. 214, Recommended Practice for Evaluation of Compression Test Results of Field Concrete.

9. 302, Recommended Practice for Concrete Floor and Slab Construction.

B. Contractor shall keep at least one copy of above listed ACI publications, latest edition, in project field office at all times.

1-3 SUBMITTALS:

A. Test Results: perform and submit test reports to Contracting Officer for following products in accordance with above general reference standards and specific standards of these specifications.

B. Proposed mix design: See Table A at end of Section. Prior to commencing work, the Contractor shall furnish mix design and shall submit certified reports describing proposed concrete mix design which shall be in conformance with ACI 301, Paragraph 3.8.2, Method #1 or Method #2, and including:

1. Fine aggregates - source, type, gradation, deleterious substances and bulk specific gravity on basis of weight of saturated surface - dry aggregate. ASTM C128.

2. Coarse aggregate - source, type, gradation, deleterious substances and bulk specific gravity on basis of weight of saturated surface - dry aggregate. ASTM C127.

3. Ratio of fine to total aggregates.

4. Weight (surface dry) of each aggregate per cubic yard.

5. Total water content in gallons per cubic yard and proposed source.

6. Slump on which design is based.

7. Brand, type and quantity of cement.

8. Brand, type and quantity of admixtures.

9. Air content.

10. Required average strength (1 test in 10 to fall below specified design strength). See ACI 214.

11. Results of two sets of compression tests, two cylinders per test, of proposed mix. One set of two cylinders to be tested at 7 days and the other set at 28 days.

12. Results of the control record of the 30 consecutive strength tests of similar mixes obtained within past year used to determine standard deviation. Tests used in establishing standard deviation shall represent concrete produced for specified strengths within 1000 psi of that required for this work.

C. A list of all intended curing methods, including a description of curing materials to be used.

D. Cylinder compression tests: Certified test reports are required for work specified in 1-3, B.10., above, and 3-10, A.

1-4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Cement

1. Store in weather tight enclosures and protect against dampness, contamination and warehouse set.

2. Do not use cement that has become caked or lumpy.

B. Aggregates.

1. Stockpile to prevent excessive segregation, or contamination with other materials or other sizes of aggregates.

2. Use only one supply source for each aggregate stock pile.

3. The bottom 6 inches of all aggregate piles in contact with ground shall not be used.

C. Admixtures.

1. Store to prevent contamination, evaporation or damage.

2. Protect liquid admixtures from freezing or harmful temperature ranges.

3. Agitate emulsions prior to use.

D. Rubber and plastic materials. Store in cool place away from direct sunlight.

E. Mixing and transporting ready-mixed concrete.

1. Maximum elapsed time from time water is added to mix until concrete is in place shall not exceed 45 minutes.

2. Minimum time for mixing concrete shall not be less than 5 minutes for a batch of 5 cubic yards or less. For batches larger than 5 cubic yards minimum, mixing time shall be increased 5 minutes for every additional 5 cubic yards, or fraction thereof.

1-5 JOB CONDITIONS

A. Environmental requirements.

1. Do not place concrete during rain, sleet or snow unless adequate protection is provided.

2. Do not allow rain water to increase mixing water or damage surface finish.

B. Cold Weather Concreting - Conform to ACI 306, "Recommended Practice for Cold Weather Concreting."

1. Temperature of concrete when placed shall not be less than following:

Air Temp. °F.	Minimum Concrete Temp. °F. Sections with least dimension	
	Under 12"	12" and Over
30 to 45	60	50
0 to 30	65	55
Below 0	70	60

2. When placed, heated concrete shall not be warmer than 80° F.

3. Prior to placing concrete, all ice, snow, surface and subsurface frost shall be removed, and temperature of surfaces to be in contact with new concrete shall be raised to temperature specified for sections 12 inches and over in 1-5, B.1., above.

4. Protect concrete from freezing during specified curing period.

5. Heated enclosures shall be strong and windproof to insure adequate protection of corners, edges and thin sections.

6. Do not permit heating units to locally heat or dry concrete.

7. Do not use combustion heaters during first 24 hours unless concrete is protected from exposure to exhaust gases which contain carbon dioxide.

C. Hot Weather Concreting - Conform to ACI 305, "Recommended Practice for Hot Weather Concreting."

1. Take precautions when ambient air temperature is 90° F. or above.

2. Temperature of concrete when placed shall not exceed 85° F.

3. Cool forms and reinforcing to a maximum of 90° F. by spraying with water prior to placing concrete.

4. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.

5. Set-retarding and water-reducing admixtures may be used with Contracting Officer's approval when ambient air temperature is 90° F. or above to offset accelerating effects of high temperature.

D. Concrete Reservoir, Placing Sequence. To reduce to a minimum the effect of shrinkage cracks, concrete for reservoir bottom, roof, deck, walls shall be placed as follows:

1. Bottom slab. The bottom slab shall be made in one continuous pour without construction joints. The only joint will be at the perimeter where the closure strip intersects the tank wall and the bottom slab, as detailed on the Drawings.

2. Walls.

a. Divide walls into sections by construction joints shown on Drawings.

b. Place concrete near pilaster of each wall section first.

c. Place sections alternately, first on one side and then on other side of previously placed section.

d. Do not place two abutting sections within 48 hours, unless otherwise authorized by Contracting Officer.

e. No horizontal construction joints are allowed in wall sections.

3. Top slab, place in one continuous pour.

1-6 GUARANTEE

A. In case of leakage or other defects that appear within the one-year correction period, in tanks that are designed to contain liquid, the Contractor will be responsible for making the required repairs. Leakage through the side walls shall be defined as the appearance of free liquid showing stream flow or excessive dampness on the exterior surface, the source of which is from the inside of the tank.

1-7 DESIGN CRITERIA:

A. Live Loads:

W.T.P.		0.75 M.G. Reservoir	
Snow	150 psf	Snow	150 psf
Office and Laboratory	150 psf	Soil (2.0 ft.)	240 psf
Chlorine Storage	250 psf		
Powdered Carbon Storage	200 psf	Water Weight	62.4 pcf
Lime and Alum Storage	500 psf		
Operations Area	150 psf		
Permanganate Storage	400 psf		
Gallery	200 psf		
Tank	812 psf		
Water Weight	62.4 pcf		

Seismic Zone 3, Uniform Building Code.

B. Foundation Design in accordance with Report 5499W, dated November 1979, by Chen and Associates, Inc., Denver. Allowable soil pressure: W.T.P. - 6000 psf .75 MG Reservoir - 8000 psf. Backfill pressure: equivalent fluid pressure: W.T.P. - 80 pcf, .75 MG Reservoir - 50 pcf.

PART 2: MATERIALS

2-1 CONCRETE MATERIALS

A. Cement: ASTM 150, Type II Modified.

B. Aggregates.

1. Fine aggregates - ASTM C33

2. Coarse aggregate - ASTM C33 except that air-cooled blast furnace slag will not be allowed. Nominal maximum size of coarse aggregate shall not be larger than:

a. 1/5 narrowest dimension between sides of forms, nor

b. 1/3 depth of slabs, nor

c. 3/4 minimum clear spacing between reinforcing bars, bundles of bars.

d. One inch for slabs having No. 6 or smaller bars.

e. 1/3 the smallest inside diameter of the hose or pipe when pumping concrete.

C. Water. Shall be clean, fresh, and free from deleterious substances.

D. Admixtures.

1. Fly ash or calcium chloride is not permitted.

2. Air-entraining agent: ASTM C260.

3. Water-reducing and retarding: ASTM C494. Use only with Contracting Officer's approval except as specified.

4. Use only admixtures specified.

2-2 CONCRETE PRODUCTION

A. Ready-mixed concrete. Mixed and delivered, ASTM C94.

B. Proportioning.

1. Proportion ingredients to produce a well-graded mix of high density and maximum workability consistent with approved mix design.

2. Entrained air - maximum and minimum for concrete exposed to weather.

6 ± 1 percent for 3/4-inch coarse aggregate
5 ± 1.5 percent for 1 inch coarse aggregate
4.5 ± 1.5 percent for 1-1/2 inch coarse aggregate
Refer to Table 3.4.1 of ACI 301 for further requirements.
Entrained air shall be limited to 4.5± 0.5 percent for all pumped concrete.

3. Entrained air - maximum and minimum for concrete required to be watertight, including concrete for all liquid containing structures.

6 ± 1 percent for 3/4 or 1 inch coarse aggregate
5 ± 1 percent for 1-1/2 inch coarse aggregate.
Entrained air shall be limited to 4.5 ± 0.5 percent for all pumped concrete.

4. Strength.

a. Design and proportion concrete to meet the design compressive strengths listed in Table "A" at the end of this Section.

b. Water/cement ratios greater than those shown above may be used provided such ratios do not exceed 0.50 for 4000 psi concrete, air entrained, at 28-day strength and are established on basis of either laboratory trial batches or of field experience in accordance with quality provisions of ACI 318, Chapter 4.

5. Slump. A tolerance of 1 inch above maximum listed in Table "A" will be allowed provided average for all batches or most recent 10 batches, whichever is fewer, does not exceed the maximum.

2-3 CONCRETE ACCESSORY MATERIALS:

A. Curing materials.

1. Sheet material: ASTM C171

2. Liquid membrane: ASTM C309. Contractor is to submit to the Contracting Officer a letter of certification from the manufacturer attesting that the liquid agent is acceptable for use in potable water structures.

B. Floor hardener materials: Use colorless aqueous solution containing not less than 2 lbs. of zinc and/or magnesium fluosilicate per gallon or sodium silicate solution having a specific gravity of 16.7 degrees Baune, or an approved proprietary hardener of proven and satisfactory performance delivered ready for use in the manufacturer's original containers.

C. Joint sealers.

1. Cold - application type: ASTM D1850.
2. Hot-poured elastic type: ASTM D1190.
3. Hydrostatic pressure resistant sealant: Sikaflex 427, or 405/406, or approved equal.

D. Vapor barrier material. Polyethylene sheet: Product Standard PS17, 6 mil.

E. Dovetail anchor slots: Heckmann Building Products, No. 100, Standard Dovetail Anchor Slot, 1 inch wide by 1 inch deep, 16 gage galvanized steel, or approved equal. Space at 2'-0" o.c.

PART 3: EXECUTION

3-1 INSPECTION BEFORE PLACING CONCRETE:

A. Assure that excavations and form work are completed.

B. Assure that dirt, mud, encrusted concrete, debris and excess water has been removed.

C. Check that reinforcement and post-tensioning are properly positioned and secured in place.

D. Verify that expansion joint material, anchors, waterstops and other embedded items are secured in proper position.

E. Verify that all required tests for pipes under slabs have been completed.

3-2 PREPARATION:

A. General.

1. Remove any hardened concrete and foreign material from inner surface of conveying equipment.

2. Prepare slab subgrades in accordance with ACI 301, Chapter 11.

3. Moisten subgrade prior to placement, but do not cause water to pond, nor muddy or soft spots to appear.

4. Designate limits of each placement and obtain Contracting Officer's approval of entire installation prior to proceeding.

B. Concrete placed against gravel or crushed stone.

1. Level all rock surfaces with base course before placing polyethylene sheeting.

2. Level all rock surfaces under footings and foundations with lean concrete (4 sacks cement per cubic yard).

C. Concrete placed against rock.

1. Remove all loose pieces of rock.

2. Clean exposed rock surface with high pressure water hosing.

D. Concrete placed against hardened or existing concrete.

1. Prior to placing fresh concrete against surface of hardened concrete, roughen, clean (including the cleaning of curing compound) and thoroughly wet hardened surface to sound concrete.

2. Omit coarse aggregate from mix when placing first batch or batches of fresh concrete against hardened concrete. Cover hardened concrete with a mortar puddle to a depth of at least 2 inches at every point before continuing with normal mix of concrete.

3-3 PLACEMENT:

A. Conveying.

1. Convey concrete from mixer to final position as rapidly as practicable without segregation or loss of material.

2. Use only metal or metal-lined chutes with maximum length of 20 feet, having a maximum slope of 1 vertical to 2 horizontal, and a minimum slope of 1 vertical to 3 horizontal.

3. Provide a hopper at the end of long belt conveyors and chutes not meeting the requirements in 2 above.

4. Conveying by pumping methods shall conform to ACI 304, Chapter 9.

a. Maximum loss of slump, 2 inches.

b. Do not pump concrete having a slump of less than 2 inches nor more than 5 inches, in accordance with Table "A".

c. Do not use aluminum or aluminum alloy pipe to convey concrete.

B. Depositing.

1. Deposit concrete in a continuous operation until section is completed.

2. Regulate rate of placement so concrete remains plastic and flows into position.

3. Place concrete in approximately horizontal layers 18 inches maximum thickness for liquid containing structures and 24 inches for all other structures.

4. Each layer of concrete shall be plastic when covered with following layer.

5. Rate of vertical rise not less than 2 feet per hour.

6. Provide vertical joints as necessary to comply with these requirements.

7. Maximum height of concrete free fall, 4 feet.

8. Use a tremie for placing concrete in columns and walls to prevent free fall of more than 4 feet. Do not allow concrete to fall on reinforcement or other objects that would cause segregation.

9. Tremies shall have varying lengths to limit free fall of concrete to 4 feet at all times.

10. Do not exceed 6 feet of vertical height for any portion of wall or column placed monolithically with floor or roof slab.

11. Concrete in walls or columns shall set at least 24 hours before concrete is placed in structural systems to be supported by such walls or columns.

12. Allow concrete to throughly settle before top is finished. Remove all laitance, debris, and surplus water from surfaces at tops of forms by screeding, scraping, or other effective means.

13. Overfill forms wherever top of a wall will be exposed to weathering and after concrete has settled, screed off excess.

14. The bottom 24 inches of the reservoir walls shall have a maximum 3/8 inch aggregate size concrete placed, vibrate this layer prior to placing the standard 3/4-inch aggregate concrete. There shall be no horizontal construction joints i the reservoir walls. Concrete shall be compacted by good vibration methods to prevent honeycombing and cold joints.

C. Consolidation.

1. During and immediately after placement, thoroughly compact and work around all reinforcements, embedments, and corners of forms.

2. Use mechanical vibrators that will maintain at least 9000 cycles per minute when immersed in concrete.

3. Minimum horsepower per vibrator shall be 1-1/2.

4. Number and type of vibrators shall be acceptable to Contracting Officer.

5. Do not use vibrators to transport concrete laterally in forms.

6. Vertically insert vibrators at points approximately 18 inches apart and to a depth to penetrate 6 inches into the preceding layer.

7. Vibrate each location for a length of time to obtain adequate consolidation (generally 5 to 15 seconds).

3-4 JOINTS:

A. Watertight joints.

1. At all locations shown on Drawings.

2. No horizontal joints permitted in tank walls. All vertical tank wall joints shall be with waterstop.

B. Expansion and contraction joints. At locations shown on Drawings.

C. Construction joints.

1. Where shown on Drawings.

2. Obtain Contracting Officer's approval for location of construction joints not shown on Drawings.

3. Locate joints as follows:
a. Columns and walls
1) At underside of haunches, column capitals, and at floor levels.
2) All haunches and column capitals shall be considered as parts of supported floor or roof and shall be placed monolithically therewith.
3) Joint at column bases shall be a minimum of six inches above the tank floor slab, or as shown on the Drawings. Construction joints in beams, girders and slabs shall be perpendicular to planes of their surfaces, and shall be at midspan.

3-5 EMBEDDED ITEMS:

A. Refer to Section 03101 - CONCRETE FORMWORK, PART 3, 3-2

3-6 FINISHING EXPOSED SURFACES:

A. Slabs, not including tank bottom slabs (settling, filter, flocculation, etc.), and reservoir slab.
1. Provide surface confoming to proper elevation and contours with all aggregates completely embedded in mortar. Maximum variation from level in any 10 feet section - ± 1/8 inch.
2. Finish slabs except at tanks as Class 4 slabs. See ACI 302. Finish in this sequence: Screeding, darbying or bull floating, edging, jointing, floating, troweling.
B. Tank and Reservoir slabs:
1. Provide surface conforming to proper elevations and contours with all aggregates completely embedded in mortar. Maximum variation from level in any 10 feet section - ± 1/4 inch.
2. Finish slabs as Class 4 slabs in ACI 302. Finish slabs in this sequence: Screeding, bull floating, floating, troweling, second troweling.

3-7 CURING:

A. Concrete except at the circular reservoir shall be kept continuously wet for at least 7 days after placement. As an alternate, concrete shall be sprayed with membrane curing compound immediately after removal of forms, or immediately after final finishing operation on unformed surfaces. Use at least minimum coverage recommended by manufacturers of curing compound. Apply in two coats, with the second coat applied perpendicular to the first coat.
B. Reservoir floor slab shall be cured by keeping the slab continuously wet. Dam edges of slab and pond water minimum two inches deep over entire surface. Maintain water on slab throughout construction period until tank is ready for filling.
C. Reservoir walls shall be kept continuously wet for at least seven days after casting. See 3-7, F, below, for alternate method with membrane curing compound.
D. Concrete closure strip at reservoir floor shall be kept continuously wet similar to reservoir floor.
E. Reservoir roof slab and other reservoir concrete shall be cured by keeping continuously wet for at least seven days after placement by continuous sprinkling.

F. Concrete slabs to receive floor hardener are to be cured in the following manner. A layer of Visqueen is to be placed on the fresh concrete and kept wet for 7 days. A solid layer of plywood, min. ½" thick, is to be placed over the plastic to prevent it from tearing until the floor hardener is applied. The floor hardener is to be applied to the slab no sooner than 30 days after placing the slab.

G. As an alternate to the wet cure for reservoir walls, leave the forms in place for at least three days when the average temperature is above 70° F. or 7 days when the average temperature is above 50°F. Wood forms shall be kept continuously wet during this time. When forms are removed, a membrane curing compound (approved for use with potable water) shall be immediately applied in two coats, 300 square feet per gallon per coat. Coats are to be applied in a direction perpendicular to each other.

3-8 FINISHING FORMED SURFACES:

A. Rough form finish - all surfaces not exposed to view such as surfaces in contact with earth.

1. Provide a flush surface and use a power grinder, if necessary, to remove all fins and projections.

2. Clean, wet and fill all tie holes with patching mortar.

B. Smooth form finish - all exposed surfaces not generally exposed to view, including submerged surfaces of tanks.

1. Use form facing to produce a smooth, hard, uniform surface.

2. Keep number of seams to a minimum.

3. Remove all fins and projections.

4. Clean, wet, and fill all tie holes with patching mortar.

5. Repair and patch all defects.

C. Grout cleaned finish - all concrete surfaces exposed to view.

1. Complete operations for smooth form finish.

2. Wet surface and apply grout mix of 1 part of Portland Cement and 1-1/2 parts of fine sand. Substitute white Portland Cement for gray as required to match surrounding concrete.

3. Rub surface with cork float or stone to fill all air bubbles and holes.

4. Remove excess grout by rubbing with a rubber float, burlap bag, or other means.

5. Do not begin cleaning until all contiguous surfaces are completed and accessible.

D. Repair of defective concrete.

1. Reservoir walls must not have honeycombing or unspecified cold joints or cracks. Contractor shall remove the complete wall and replace it if honeycombing, cold jointing or cracking is excessive in the opinion of the Contracting Officer. Minor honeycombing shall be repaired within 24 hours of removal of forms.

2. Defective concrete holes or honeycomb in formed concrete shall be repaired by removing defective concrete to sound concrete, having edges square to avoid feathering. Clean and thoroughly dampen surface. Fill with Masterflow 713 grout, or equal, mixed and applied per manufacturer's recommendations.

3. Cracks, unspecified cold joints or areas of apparent leakage (evidenced by damp spots on walls) in tank walls shall be repaired by injecting epoxy sealant into the crack or joint in the following manner.

a. Clean cracks and surfaces to be sealed.

b. Apply valves to crack surface (both sides of wall if crack extends through wall).

c. Seal surface of crack between valves with Sikadur Hi-Mod Gel 390, or approved equal.

d. Inject under pressure Sikadur Hi-Mod LV 350 epoxy resin, or approved equal, into cracks through valves.

e. Clean walls of valves and Sikadur Hi-Mod Gel 390, or approved equal.

f. Cover inside crack surfaces with 6 mil thick coat of grey Sikagard Hi-Bild epoxy coating, or approved equal.

g. All of the above work with epoxies to be performed in accordance with manufacturers' recommendations and temperature-time requirements.

4. Repair work shall conform to Chapter 9 of ACI 301. Adequately cure all repair work.

3-9 RESERVOIR CONSTRUCTION PROCEDURE:

A. Construct the wall footing, floor slab with monolithic interior footings, and then columns. Leave the floor slab, wall footings and wall unconnected by a closure strip as shown on Drawings.

B. Place sliding joint with plastic film bond breaker on top of wall footing.

1. Form wall, install vertical and horizontal tendons, reinforcement accessories, and waterstops at each wall section.

2. Place concrete in reservoir wall section.

3. Complete all wall sections.

C. Prestress vertical tendons in reservoir wall in proper sequence.

D. Loosen wood shims at wall base and prestress horizontal tendons in proper sequence, then remove wood blocking.

E. Allow fourteen days between Steps D and F.

F. Construct concrete roof slab.

G. Allow 28 days between Steps D and H.

H. Place concrete closure strip.

3-10 QUALITY CONTROL:

A. Concrete tests. This work shall be the responsibility of the Contractor, and shall be in accordance with requirements of ACI 301, Chapter 16 - Testing, except as noted or modified in this Section.

1. Strength test.

a. Mold and cure three cylinders from each sample. Cylinders are to be furnished by the Contractor. "Have independent testing lab paid for by Contractor, take, cure and test samples." Samples are to be site cured, under the same conditions as the concrete in the structure.

b. Test one at 7 days for information and two at 28 days for acceptance.

2. Minimum samples. Perform tests and collect compression test cylinders for the following minimum samples for each 28-day strength concrete used in the work for each days' placing:

Quantity	Number of Samples
50 cubic yards or less	one
50 to 100 cubic yards	two (one for each 50 cubic yards)
100 cubic yards or more	two plus one sample for each additional 100 cubic yards (take samples at evenly spaced intervals)

3. Sample marking.

a. Mark or tag each sample of compression test cylinders with date and time of day cylinders were made.

b. Identify location in work where concrete represented by cylinders was placed.

c. Identify delivery truck or batch number, air content, and slump.

4. Slump test. Conduct test for each strength test sample and whenever consistency of concrete appears to vary.

5. Air content. Conduct test from one of first three batches mixed each day and for each strength test sample.

B. Acceptance of concrete. Strength level of concrete will be considered satisfactory so long as average of all sets of three consecutive strength test results equals or exceeds average specified design 28-day strength and no individual strength test result falls below average specified design strength by more than 500 psi.

C. Failure of test cylinder results.

1. Upon failure of test cylinder results, Contracting Officer may require Contractor to obtain and test at least three 2-inch diameter cored samples from area in question. Test to conform to ASTM C42.

2. Concrete will be considered adequate if average of three cores is at least 85% of, and if no single core is less than 75% of, average specified design 28-day strength.

3. Upon failure of core test results, Contracting Officer may require Contractor to perform load tests as specified in ACI 318, Chapter 20.

4. It shall be the responsibility of the Contractor to replace all concrete according to the Contract Documents deemed inadequate by the Contracting Officer.

5. Fill all core holes as specified for repairing defective concrete.

D. Prior to placement of concrete by pumping, the concrete mix shall be tested for pumpability using the same equipment, lengths of lines and heights as will be required for placement of concrete in this work. Any adjustment in the mix design shall have verifying compression test reports prior to using.

3-11 FLOOR HARDENER:

A. Application. Apply hardener to exposed interior concrete floors where indicated on the drawings. Floors shall be thoroughly cured, cleaned, and perfectly dry with all work above them completed. Apply zinc and/or magnesium fluosilicate evenly, using three coats and allowing 24 hours between coats. Apply first coat 1/3 of full strength, second coat 1/2 full strength, and the third coat 2/3 full strength. Allow each coat to remain wet on the concrete surface for 15 minutes. Apply sodium silicate evenly, using three coats, allowing 24 hours between coats. Apply sodium silicate full-strength at the rate of 1/3 gallon per 100 square feet. Apply approved propietary hardeners in conformance with the manufacturer's instructions. After the final coat is completed and dry, remove surplus hardener from the surface by scrubbing and mopping with water.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

TABLE A

CONCRETE REQUIREMENTS

Location	Design Strength* 28-day	Weight #/CF	Cement Type	Minimum Cement Factor sks/yd.	Maximum Water/Cement Ratio by weight	Slump +or-1"	Required** Admixtures	ASTM Coarse Aggregate Designation
Circular Reservoir Closure Strip, all wall footings, columns and slabs	4000 psi	150	II Modified	6.0	0.40	3"	AE, PDA	No. 67 (3/4)
Circular Reservoir Walls	4000 psi	150	II Modified	6.5	0.40	5"	AE, PDA	No. 67 (3/4) No. 7 (3/8) (Bottom 24" of wall)
All other Cast-in-Place --	4000 psi	150	II Modified	6.0	0.44	4"	AE, PDA	No. 67 (3/4)

NOTE: Use no materials containing any chlorides, sulfates or other corrosives.

*This is not the average 28-day compressive strength used for concrete mix design. It is the lower strength used for structural design, see ACI 214.

**AE - Air Entrainment
PDA - Protex Dispersing Agent, or equal

END

PART 1: GENERAL:

1-1 DESCRIPTION:

A. This section covers prestressed, precast concrete members, including product design not shown on Contract Documents, manufacture, transportation, erection and other items such as anchors, inserts, storage and protection of precast, prestressed concrete units.

B. Related work specified elsewhere includes Section 04230, Reinforced Unit Masonry.

1-2 QUALITY ASSURANCE:

A. Acceptable manufacturer shall be a company specializing in providing precast, prestressed concrete products and services for at least five previous years.

B. Acceptable erector shall be a company regularly engaged in erection of precast, prestressed structural concrete for at least five previous years.

C. Acceptable welders shall be qualified within past year in accordance with American Welding Society (AWS) D1.1.

D. Testing to be in compliance with applicable provisions of Prestressed Concrete Institute MNL-116, Manual for Quality Control for Plants and Production of Precast, Prestressed Concrete Products.

E. Reference Standards: Except as noted or modified in this Section, all design, materials, manufacturing, curing, finishing, transportation, storing, and erection shall conform to requirements of the following:

1. American Concrete Institute (ACI) Standards.

a. 318, Building Code Requirements for Reinforced Concrete.

b. 301, Specifications for Structural Concrete for Buildings.

2. Prestressed Concrete Institute (PCI) Standard MNL-116, Manual for Quality Control for Plants and Production of Precast, Prestressed Concrete Products, Divisions I, II, III, IV, and V.

1-3 SUBMITTALS:

A. Product design, clearly showing assumed values, live loads, dead loads, design calculations, conclusions. Design is to conform to ACI 318.

B. Production drawings showing elevations, sections and details indicating quantities and position of reinforcement, anchors, inserts, etc., and estimated cambers.

C. Erection drawings showing locations of all material furnished by manufacturer, sections and details of connections, erection sequence and handling requirements.

D. Reports of tests on concrete. Six compression test cylinders shall be cast each day of concreting operations, and for each change in concrete mix design. Control test specimens shall be tested as necessary to determine when to transfer stress. At least one cylinder from each set shall be tested at 28 days.

1-4 PRODUCT HANDLING:

A. Members shall be lifted and supported during manufacturing, stockpiling, transporting and erecting operations only at lifting or supporting points as shown on the shop drawings.

B. Store members off ground and in a way that identification marks are discernible.

C. Do not use upper member of stacked tier as storage area for shorter member or heavy equipment.

1-5 DESIGN CRITERIA: The following values are to be used in this work.

Roof snow load	150 psf
Seismic zone	3 (Uniform Building Code)

PART 2 - MATERIALS:

2-1 MATERIALS: Shall be suitable for prestressed, precast construction.

Prestressing Strand	ASTM A416, Ultimate Stress 270 KSI
Reinforcing Steel	ASTM A615, Grade 60
Welded Wire Fabric	ASTM A185
Steel Plates and Shapes	ASTM A 36
Concrete	Minimum compressive strength of 5000 psi at 28 days.
Cement	ASTM C150, Type I or Type III
Aggregates	ASTM C33
Water	Clean and free from deleterious substances
Lifting System	Swift lift anchor system from Superior Concrete Accessories, Inc., or approved manufactured lifting anchorage system.

The use of calcium chloride, chloride ions of other salts is not permitted.

2-2 MANUFACTURE:

A. Shall be in conformance with PCI MNL-116.

B. Tolerances: shall conform to PCI MNL-116.

C. Finishes:

1. Standard underside resulting from casting against approved forms, using clean, true forms. No major or unsightly imperfections, honeycomb or defects will be permitted.

2. Standard top resulting from vibrating screed and additional hand finishing at projections. No major imperfections, honeycomb or defects will be permitted.

3. Exposed vertical ends: Strands shall be left recessed and the ends of member shall receive a sacked finish.

D. Fasteners shall be cast into units as detailed or required by design or Contract Documents.

E. Shop markings, or identification markings, shall be placed at a location not finally to be exposed, and shall indicate location and position in accordance with erection drawings.

F. Prestressed, precast members will be rejected for any of the following:

1. Length variation in excess of 1/2-inch (1/4-inch each end) of adjacent units or 1 inch maximum between the longest and shortest units.

2. Edges varying from a straight line, more than 3/16 inch and from parallel within a maximum variation of 3/16 inch at any point.

3. Deviation from design camber, differential camber between adjacent members of same design, or warp or camber which cannot be controlled by fastening system between members.

4. Improperly placed accessories or block-outs.

5. Unsatisfactory surface finish.

6. Exposure of wire mesh, reinforcing steel or prestressing strand, except where cut-off at ends.

7. Honeycomb, fractures, chips or spalls which cannot be repaired to the satisfaction of Contracting Officer.

G. Holes and openings: All openings which are beyond the limitations of field modification shall be provided by the prestressed, precast unit manufacturer. The manufacturer's submittals shall state the limitations for field cutting and modification. Members may be field drilled, provided prior approval is obtained from Contracting Officer and provided no contact is made within 1-1/2 inches of prestressing strands.

PART 3: ERECTION:

3-1 INSTALLATION: Members shall be set in position in accordance with erection plans and shall rest solidly on supports without rocking.

3-2 ALIGNMENT: Members shall be properly aligned and leveled. Variations between adjacent members shall be leveled by loading in a way and to a degree acceptable to Contracting Officer.

3-3 FIELD WELDING: To be done using equipment and materials compatible to the base materials. Weld all connections which involve leveling the units first, then with the leveling loads removed, anchor members to support as indicated on Shop Drawings and Contract Documents.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

SECTION 03700 DISINFECTING AND TESTING RESERVOIRS

PART 1: GENERAL

1-1 DESCRIPTION:

A. Furnish all labor, equipment, materials necessary to clean, disinfect and test the circular 0.75 million gallon reservoir.

B. For related work, see Section 03300, Cast-in-Place Concrete.

PART 2: MATERIALS

2-1 MATERIALS:

Water	Clean and free of deleterious substances
Calcium Hypochloride	Containing 65 percent chlorine

PART 3: EXECUTION

3-1 PREPARATION: After construction of the reservoir has been completed, and before backfilling, the inside of the roof and wall shall be broom-cleaned. The floor shall be squeegeed of curing water and washed with clean water. After the brooming and the removal of all debris, all cracks and joints shall be properly sealed in accordance with provisions of Section 03300; 3-8, D. Completely hose down the interior surfaces of the reservoir with water under pressure and drain the wash water from the reservoir.

3-2 DISINFECTING: Use calcium hypochloride containing 65 percent chlorine. Dissolve one pound of this compound to 75 gallons of water. The entire inside of the reservoir shall be thoroughly wetted with water, and while wet the chlorine solution shall be sprayed evenly at the rate of one gallon per 150 square feet over the floor, walls, column, ceiling, and miscellaneous metal. The spraying shall be done so that no areas shall be occupied after spraying, thus, the ladder must be sprayed as the sprayer is climbing the ladder. All persons in the tank must be equipped with oxygen masks during the spraying operation. The time use of the mask must be carefully observed. Other protection devices may be used, but any device must protect everyone inside the tank.

3-3 TESTING: After the reservoir has been cleaned and disinfected, the tank shall be filled to the overflow and allowed to stand full for at least 72 hours. During the first 72 hours, the surface of the water may drop, and shall be continually refilled to the overflow.

A. The water level elevation shall be determined by using a surveyor's level and level rod; after a lapse of another 72 hours, the water level shall again be determined in the same manner as the initial reading was determined. If during the 72 hours the water level has dropped more than 0.50 inches, the reservoir will not be considered sufficiently watertight.

B. If the test fails to meet the above requirements, the reservoir shall be drained, repaired, disinfected, and again tested for watertightness. For the second test, and any other tests thereafter, the Contractor will be charged for all water used at the cost of water to be established by the Contracting Officer.

C. Damp spots on the exterior wall areas or the wall faces shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand. Damp spot areas shall be cleaned and repaired. See Section 03300, 3-8, D, 3.

3-4 BACTERIOLOGICAL EXAMINATION. After the system has been thoroughly flushed take samples from representative points in the system in sterile bottles and submit to proper authorities as directed for bacteriological examination. If their report is unsatisfactory, repeat the disinfecting procedure until satisfactory results are obtained.

Part 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section primarily relates to mortar and grout work associated with pipelines, utilities and mechanical work. It consists of providing mortar for masonry work indicated and specified in other sections. Non-shrink grout for sealing joints on precast concrete manhole sections, patching around pipe at holes through existing concrete, and patching holes is included.

1-2 QUALITY ASSURANCE:

A. Standards: American Society for Testing and Materials (ASTM) and manufacturer's printed recommendations.

1-3 PRODUCT HANDLING:

A. Delivery: Deliver materials in manufacturer's original unopened, protective packaging.

B. Storage: Store cementitious materials, where directed, under cover, off the ground.

1-4 JOB CONDITIONS: Do not use mortar in work when temperature of outside air is below 40 degrees F. unless suitable approved means are provided to heat materials. Insure mortar will harden without freezing.

PART 2: MATERIALS

2-1 MORTAR:

A. Cement: ASTM C150; 1 part.

B. Sand: ASTM C144; 5 parts.

C. Hydrated Lime: ASTM C207 Type S; 1-1/4 parts.

D. Water: Clean and Potable.

E. Strength: 2,000 psi; tests by Contractor if requested by Contracting Officer due to problems encountered.

2-2 NON-SHRINK GROUT:

A. Non-shrink, non-metallic grout shall be: U.S. Grout "5-STAR," Protex "Propak," Master Builders "Masterflo 713," or approved equal.

PART 3: EXECUTION

3-1 MORTAR: Mix all cementitious materials and sand in mechanical batch mixer for a minimum of 5 minutes after adding all materials. While mixer is in operation, add 3/4 required water, 1/2 sand, and all lime and cement; then remainder of sand. Allow batch to mix briefly; add water in small quantities until mortar is of a workable consistency. If mortar begin to stiffen from evaporation or from absorption of part of mixing water, retemper immediately; remix.

3-2 GROUT: All non-shrink grout shall be mixed and applied in accordance with manufacturer's recommendations for the purpose intended; mixture should be a stiff grout, non-flowable.

PART 4: MEASUREMENT AND PAYMENT

4-1 MORTAR AND GROUT: No measurement will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: Furnish all mortar and grout materials, equipment incidentals and labor necessary for mixing the grout and mortar for use in Reinforced Unit Masonry, Section 04230, specified in Contract Documents. Materials and proportions shall be consistently the same for each type of site exposed masonry, consisting of cement, additives and lime: the same type by the same manufacturer; aggregate: exactly the same from the same source. For related work specified elsewhere, see Section 04230, Reinforced Unit Masonry.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Reinforced Unit Masonry, Section 04230. Utility Mortar and Grout, Section 04100 (for use in patching concrete only).

1-3 STANDARDS: Meet requirements and recommendations of applicable portions of latest editions of standards listed.

1-4 PRODUCT HANDLING:

A. Deliver cement lime and other manufactured materials in unbroken bags, barrels, packages or other containers.

B. Deliver, handle and store materials to prevent inclusion of foreign materials or damage by water or breakage.

C. Protect perishable materials by storing in weathertight enclosures.

D. Do not use cement that has hardened or partially set. Remove from site.

E. Store aggregates in clean bins or platforms having hard, clean surfaces.

F. Permit aggregates to drain 12 hours before use.

1-5 JOB CONDITIONS:

A. When air temperature falls below 40°F, mortar materials and grout materials shall be treated as follows:

Air Temperature °F	Heating of Materials	Protection
Below 40°	Heat mixing water. Maintain mortar and grout temperatures between 50°F and 100°F until placed.	Cover materials to prevent damage, dissipation, or inclusion of foreign materials.

Air Temperature °F	Heating of Materials	Protection
Below 32°	In addition to the above, heat the aggregate. No frozen materials shall be used.	In addition to the above, provide wind breaks for working areas when wind velocities are above 15 mph.
Below 20°	Discontinue work.	Protect all materials to prevent dissipation inclusion of foreign materials, or damage by freezing, water or winds.

PART 2: MATERIALS

2-1 MATERIALS: Minimum standards for materials used for grout and mortar:

A.	Cement:	ASTM C150, Type I, II, or III.
B.	Sand for Mortar:	ASTM C144. Clean, sharp, hard siliceous, free from loam, silt or other impurities.
C.	Aggregates for Grout:	Fine aggregate, ASTM C33. Coarse aggregate ASTM C33, except that blast furnace slag will not be allowed.
D.	Hydrated Lime:	ASTM C207, Type S.
E.	Lime Putty:	Made from hydrated lime.
F.	Omicron-OM Water Proofing:	By Master Builders, Inc. or approved equal.
G.	Water:	Clean and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances, and shall not contain more than 5% common salt.
H.	Color:	Best quality pigments as manufactured by Frank D. Davis Co. or Medusa Custom Color, or approved equal. Provide color for mortar in all exposed exterior masonry, toned to match block, as selected by Contracting Officer. Package color in 5 to 10 pound amounts to add to mortar mix for consistant color results.

2-2 MIXES:

A. Mortar used between courses shall be modified Type S mortar conforming to ASTM C270, and have proportions by volume as follows: 1 part Portland Cement, 1-1/4 part hydrated lime or lime putty, 5 parts damp loose sand. Add two pounds of Omicron-OM and one package (5 to 10 pounds) color.

B. Grout used to fill block cores, bond beam block and areas with rein- forcing bars shall conform to the following proportions by volume: 1 part Portland cement, 0 to 1/10 parts hydrated lime or lime putty, not less than 2-1/4 nor more than 3 parts fine aggregate, not less than one part nor more than two parts pea-sized gravel. Add one pound Omicron-OM per sack of cementitious material.

C. Mortar shall have an average compressive strength of 1,800 psi at 28 days. Grout shall have an average compressive strength of 3,000 psi at 28 days.

PART 3: EXECUTION

3-1 PREPARATION:

A. Provide method of measuring materials on job so that specified proportions can be controlled and accurately maintained.

B. ANTI-FREEZE SUBSTANCES: No anti-freeze liquids, salts or other substances shall be used in the mortar to lower the freezing point without approval of the Contracting Officer.

C. Mixers and all other equipment and tools shall be kept clean.

3-2 MIXING:

A. Omicron-OM and mortar color for exterior masonry are dry solid materials. Introduce into mixer along with aggregate per manufacturer's recommendations.

B. Workability or consistency of mortar on the board shall be such that the mortar is sufficiently wet to be worked under trowel. Mortar which has begun to set, or is not used within 2-1/2 hours after initial mixing shall be discarded. Mortar which has stiffened within the 2-1/2 hour period due to evaporation shall be retempered. All mortar shall be thoroughly mixed and be without segregation.

C. Grout shall be thoroughly mixed, without segregation. Only enough water shall be added to provide the mix with the lowest slump necessary for proper placement. Grout shall be placed within 45 minutes of time of initial mixing or be discarded.

D. Mortar and grout are to be delivered, properly mixed and with proper timing to the location where they are to be placed.

PART 4: MEASUREMENT AND PAYMENT

4.1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing all materials (except mortar and grout), equipment, supplies, accessories, anchors and labor necessary in connection with all unit masonry work.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Cement and Lime Mortar and Grout, Section 04110.

1-3 QUALITY ASSURANCE:

A. Split face units shall be approved equal to "Burnish Brown", as manufactured by AMCOR, Inc. of Salt Lake City, Utah; however, aggregate shall be Utilite Expanded Shale, or approved equal.

B. REFERENCE STANDARDS:

1. American Society for Testing Materials (ASTM) latest edition.
2. American Welding Society (AWS).
3. Federal Specifications (FS).
4. Welding Operations, Certified according to AWS A-1.0.
5. National Concrete Masonry Association (NCMA). Comply with applicable portions thereof.

1-4 SUBMITTALS:

A. SAMPLE PANEL: Before the installation of any masonry materials, erect a sample panel 4 feet long by 4 feet high and of the proper thickness, showing proposed reinforcing, bond, mortar joint and workmanship of masonry materials. No approval shall be requested or given until panel has had time to dry and set and has been cleaned and water repellant coating applied by the same methods that are proposed to be used for all work. Additional panel or panels shall be constructed as required until approval is given. No work shall progress until the sample panel has been approved by the Contracting Officer. The panel shall then become the standard of comparison for all masonry work built of the same material. The panel shall not be destroyed or moved until the work is complete, and shall be removed upon completion of masonry work.

B. Submit certification of conformance of block units to specified ASTM Standards and Specifications to Contracting Officer for approval. Submit sample of split face units for approval of color and shape.

1-5 PRODUCT HANDLING:

A. Stack block on platforms, cover or store in manner that will protect block from contact with soil and weather.

B. Protect block units from damage.

1-6 JOB CONDITIONS: With the following air temperatures, the precautions listed shall be observed:

Air Temperature °F	Heating of Materials	Protection
Above 40°	------	Cover walls with plastic or canvas at end of work day to prevent water entering masonry.
Below 40°	Maintain mortar and grout temperatures between 50°F and 100°F until placed.	Cover walls and materials to prevent damage. Cover shall be plastic or canvas.
Below 32°	In addition to the above, thaw all masonry units that have been wet and frozen.	In addition to the above, with wind velocities of 15 mph, provide wind breaks during the workdays for work areas. Prevent masonry wetting and freezing. Maintain masonry above 32°F by using auxiliary heat and insulated blankets for 24 hours after laying masonry units.
Below 20°	Discontinue work.	Prevent the wetting and freezing of masonry. Maintain masonry above 32°F by using auxiliary heat and insulated blankets for 24 hours after laying masonry units.

1-7 WARRANTY: Provide five (5) year limited warranty for water repellant coating.

PART 2: MATERIALS

2-1 MATERIALS:

A. Concrete Blocks: 8 inches by 16 inches nominal face dimensions, by thickness and shapes as indicated. Hollow units shall be 2 core and shall conform to ASTM C90, Type N-1. Solid units shall conform to ASTM C145, Type N-1. Split face units shall by shaped as indicated. Furnish all half blocks, end and closure blocks as required or detailed. Aggregates shall comply with ASTM C331.

B. Water Repellant Coating: Mineral gum or acrylic base in a non-staining hydrocarbon carrier forming a clear, penetrating water repellant coating with minimum 7% solids. Products: Chemstop, Heavy Duty; L&M Construction Chemicals, Inc.; Hydro Pel; Process Solvent Co., Sure Klean Weatherseal 209, or approved equal.

C. Anchors: Dovetail anchors shall be 16 gauge, galvanized 7/8 inches by 5-1/2 inches.

D. Horizontal Joint Reinforcing:	ASTM A82 standard ladder type, galvanized, AA Wire Products Co. Cavity-Lok AA530 (without drip) and Blok-Lok AA500; and Partition-Lok and Corner-Lok, as appropriate, or approved equal.
E. Reinforcing Bars:	ASTM A615; Grade 60 for #4 bars and larger, Grade 40 for #3 bars.
F. Water:	Clean and free from deleterious substances.
G. Steel Plate and Shapes:	ASTM A-36.
H. Welding Electrodes:	AWS A5.1.
I. Galvanized Finish, Wire:	ASTM A116, Class 3.
J. Flat Lath for Covering Block Cores:	FS QQ-L-101, Type F, 3.4 pounds per square yard expanded metal, galvanized.
K. Flat Steel Bar Anchor:	ASTM A36, Galvanized.
L. Rigid Insulation:	FS HH-1-524B, Type II, Class A or B, self-extinguishing, 1-1/2 inches thick, R=7.

M. Insulation Adhesive: As approved by insulation manufacturer.

N. Thru Wall Flashing: Shall consist of sheet of copper weighing 3 ounces per square foot, bonded to and between two layers of asphalt impregnated cotton or fiberglass fabric.

PART 3: EXECUTION

3-1 WORKMANSHIP:

A. Lay masonry plumb, true to line, with level, accurately spaced courses. Keep story pole plumb throughout. Lay corners, reveal plumb, true. Space courses so that backing masonry will level off flush with face work at joint where metal ties are used in lieu of masonry bond. Build in work required to be built in with masonry, including anchors, wall plugs, accessories, insulation, as erection progresses. For cutting, patching of masonry required to accommodate work of others; use masonry mechanics. Step back unfinished work for joining with new work; toothing may be resorted to only when so approved.

B. Cut masonry units with power equipment designed for the purpose. Set one course on floor slab as an outline to define core reinforcing, various room areas and as an aid for roughing-in of pipes, conduits. All switch boxes receptacle boxes, access panels shall be built within partitions. Set all bucks, blocking, grounds and anchors as required.

C. Consult other trades in advance and make provisions for installation of their work in order to avoid cutting and patching. Build in work specified under other sections of the Specifications as the work progresses. Set steel lintels in beds of mortar. Fill solid with mortar around jambs and head of metal door bucks and frame. Rake joint 1/4 inch between metal frame and masonry.

3-2 PLACING:

A. Lay all units except exterior veneer units in running bond with units half-lapped; tool joints slightly concave where exposed and strike flush where unexposed or plastered. Lay exterior fluted veneer units in stacked bond and strike flush all joints.

B. Place specified Cavity-Lok type horizontal joint reinforcement continuous in every second course, starting at first course above floor line. In alternate courses provide Blok-Lok type reinforcement continuous, separate unit in each wythe of masonry.

1. Provide Corner-Lok at all external corners at every joint and provide Partition-Lok at every second joint tying in with Blok-Lok.

C. Shove all vertical and bed joints full as units are laid.

D. Provide lateral and/or vertical shoring or supports as required for wind bracing.

E. At all vertical reinforcing and lateral reinforcing in bond beam courses and lintels, completely fill void in block with grout to provide full anchorage to reinforcing. Fill voids adjacent to metal jambs.

1. Grouting shall comply with Uniform Building Code Requirements for Hollow Unit Masonry, Section 2415 (a) General and (b) Low-Lift Grouted Construction.

F. Joints in all masonry uniform in size not exceeding 3/8 inch nor less than 1/4 inch.

G. Install dovetail type anchors where adjoining concrete walls or columns at maximum 16 inches on center vertically.

H. Install thru wall flashing at locations indicated.

I. Provide weep holes at 32 inches on center by installing oiled rope or plastic tubing. Provide weep holes at lower thru wall flashing, at counter flashing and at top of foundation. Remove oiled rope after mortar has set.

J. Comply with cold weather requirements as listed under 1-6 above and general construction requirements as indicated in Uniform Building Code, Section 2416 (e) Minimum Bar Spacing, (f) Splices in Reinforcement, and (g) Protection for Reinforcement.

K. Install insulation by resting on wall tie and securing to interior wythe of masonry with recommended adhesive.

3-3 MASONRY CLEANING:

A. During progress of the work, make every effort to keep walls clean. Allow mortar smears to dry a short period and promptly remove by trowel or stiff fiber brush or both. Promptly remove mortar burrs. Take care to avoid damage to mortar joint when brushing.

B. At the conclusion of work, remove all scaffolding and debris and leave wall in a clean condition. Point up all exposed masonry, fill all holes and joints; remove loose mortar, cut out defective joints and repoint where necessary. Thoroughly clean exposed masonry surfaces.

C. All mild methods of cleaning must be exhausted before acid solutions are used. Use acid solutions of one part hydrochloric acid and nine parts water, applying with stiff fiber brush only upon Contracting Officer's approval after other methods have not sufficed to clean surfaces. Saturate wall with clean water thoroughly before using acid; flush down completely after using acid.

D. Cleaning of masonry work will not be considered complete until all stains, runs and other discolorations are entirely removed.

E. Apply water repellant-coating on exterior wall faces in one or two coats at approximately 50 square feet (contact square foot) per gallon, as recommended by manufacturer.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing all miscellaneous metalwork. This includes the following items:

- Structural Steel
- Steel Stairways
- Aluminum Handrails
- Steel Guard Chains
- Steel Weir Plates
- Steel Troughs
- Aluminum Grating
- Access Hatches
- Hardware
- Expansion Bolts
- Pipe Supports
- Manhole Steps
- Iron Pipe Handrail
- Metal Stair Nosings

1-2 RELATED WORK SPECIFIED ELESWHERE: Painting - Section 09900.

1-3 QUALITY ASSURANCE:

American Society for Testing and Materials (ASTM), American Institute of Steel Construction (AISC), American Welding Society (AWS).

1-4 SUBMITTALS: Submit shop drawings for all fabricated components and pipe support plans. Submit literature for all fasteners, steps and hardware.

PART 2: MATERIALS

2-1 STRUCTURAL STEEL: Structural steel shall meet the requirements of the ASTM Standard Specification for Structural Steel ANSI/ASTM A36. Items covered in this designation include hoist and trolley beams, supports for mixing equipment, and support of troughs and chemical loading platforms.

2-2 STEEL STAIRWAYS: Steel stairways shall be constructed in accordance with the details set forth in the drawings.

2-3 STEEL DOORFRAME: The steel doorframe for door No. 407 shall be fabricated as shown on the drawings. It shall consist of 1/4-inch thick plate, 3-inch x 3-inch x 1/4-inch steel angles, and anchors as indicated. All members shall be shop primed.

2-4 STEEL GUARD CHAINS: The guard chains shall be electric welded, bright (polished) finish, machine chain with twist link, size 2 and No. 9 gage (5/32-inch). The fittings for attaching the chain to the pipe posts and walls shall also have a bright finish. The catch hook for unhooking the chain shall be spring-loaded.

2-5 STEEL WEIR PLATES: The weir plates shall be 1/4-inch A36 steel plate, as shown on the drawings. All edges that will be weirs shall be cut smooth and true without variation over the entire length. All burrs and rough edges shall be ground to provide smooth surfaces and sharp edges. Connection holes shall be correctly located to match bolt holes in the surface to which the weir shall be fastened.

2-6 STEEL TROUGHS: The troughs shall be 1/4-inch A36 steel plate as shown on the drawings. All surfaces must be smooth-cut and burrs removed. All joints between sections shall be watertight. All bends or folds in the plate shall be made with equipment designed to make uniform angles and bend radii. All welding shall be completed in the shop unless field welds are approved by the Contracting Officer. After fabrication, the plates and joint pieces shall be cleaned and shop-primed.

2-7 ALUMINUM GRATING: Aluminum floor grating shown on the drawings shall be serrated parallel bearing bars placed edgewise and jointed by straight cross bars. Serrated bearing bars shall be on 1-3/16-inch centers and cross bars shall be secured to the bearing bars by swaging. Ends of cross bars are to be trimmed flush with outside face of each outside bearing bar. Bearing bars shall be 1-1/2-inches high and 3/16-inch thick.

Grating shall be approved equal to Gary Grating type GAL, or Rockwell-Standard Corp., Grating Division.

2-8 ACCESS HATCHES: The access hatches shall be aluminum. They shall be flush mounted in a concrete curb. The door leaves shall be 1/4-inch aluminum diamond pattern plate with aluminum stiffeners as required to withstand a live load of 300 pounds per square foot. The channel frame shall be 1/4-inch aluminum with an anchor flange around the perimeter. The doors shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators, and a hold-open arm with a release handle. A snap lock with a removable handle shall be provided. All hardware shall be cadmium plated. A 1-1/2-inch drainage coupling shall be located such that the drain pipe can be conveniently routed.

On outdoor applications the drain shall be piped to discharge above grade. On inside applications with curbs the pipe will drain to the adjacent floor level thru the curb horizontally. For flush inside applications the drain will be piped to a convenient discharge location, as approved by the Contracting Officer. Submit plans for drainage.

The access hatches shall be similar and equal to Type J as manufactured by the Bilco Company, New Haven, Connecticut.

2-9 ALUMINUM HANDRAIL: The handrails shall be prefabricated or component form for onsite installation. All rails and posts shall be 1-1/2-inch diameter aluminum pipe (1.89-inch O.D. and 1-61-inch I.D.). They shall be manufactured from 6063 aluminum pipe and shall have a 204R clear satin anodized finish. Fittings shall be of one piece extrusion machined to final shape. Blind rivets, self-tapping screws, and fasteners shall be stainless steel. Post spacing and handrail location shall be as shown on the drawings. In no case shall post spacing exceed 6 feet, 0 inches. Posts and intermediate rails shall be single, unspliced lengths of pipe. A single unspliced length of top rail to be attached to a minimum of three posts where possible. An aluminum kick plate is to be installed as part of the handrail.

Handrails shall be approved equal to Enerco Aluma-rail of Enerco Metal Products co., Connectorial System by Julius Blum & Co., Inc., or Reyno Rail II of Reynolds Metals Company.

2-10 HARDWARE: All hardware, including nuts, bolts, and washers shall be cadmium-plated, and shall conform to ASTM Standard A 307.

2-11 EXPANSION BOLTS: Expansion bolts and anchors shall be stainless steel.

Where expansion bolts are used to fasten to concrete, they shall be approved equal to Molly Parabolt or Phillips Redhead. Where expansion bolts are used to fasten to concrete block, they shall be approved equal to Rawl -3 anchors.

2-12 PIPE SUPPORTS: For wall supported piping use Grinnell Figure 195 together with Figure 120 or 137 U-bolts.

For floor supported piping use Grinnel figure 264, or approved equal with galvanized steel stand pipe and standard 125-pound flange bolted to the floor.

For suspended piping use Grinnel Figure 212 pipe clamps together with Grinnel Figure 248 3/4-inch eyerods, Figure 230 turnbuckles, and Figure 281 concrete inserts, or brackets equivalent to Unistrut system, or approved equal.

2-13 MANHOLE STEPS: The manhole steps shall be manufactured of aluminum alloy 6005-T5, conforming to the requirements of ASTM Standard B-221. The rungs shall be solid with serrated top surface. The bars shall be of such cross-sectional area and configuration that they will withstand a single concentrated live load of 300 pounds.

The manhole steps shall be approved equal to Model 12653A as manufactured by Alcoa, or Neenah R1982.

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing rough and finish carpentry and millwork and installation of finished hardware.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

A. Roof Insulation, and Vapor Barrier, Section 07240

B. Preformed Metal Roof, Section 07410

C. Finish Hardware, Section 08710

D. Painting, Section 09900

E. Gypsum Drywall Construction, Section 09250

1-3 QUALITY ASSURANCE:

A. Reference Standards:

1. American Institute of Timber Construction (AITC)
2. Architectural Woodwork Institute (AWI)
3. Uniform Building Code (UBC)
4. American Plywood Association (APA)
5. Federal Specifications (FS)
6. Manufacturer's printed recommendations.

B. Grading: Mark or certificate required for all wood; use only recognized official marks of association under whose rule it is graded.

C. Treatment of all wood shall comply with the regulations of American Wood Preservers Association, AWPA.

1-4 SUBMITTALS:

A. In accordance with Section 01300, submit shop and erection drawings indicating materials and species, arrangement, thickness, size of parts, construction, fastenings, blocking, clearances, joints assembly and erection details, supplied finishes and surfacing, built-in hardware, and required connections to work of other trades.

B. Along with shop and erection drawings, submit structural calculations indicating the integrity of fasteners to resist all loading conditions indicated in the structural specifications. Loads are: wind - 20 pounds per square foot; wind uplift - 30 pounds per square foot; snowload - 150 pounds per square foot.

1-5 PRODUCT HANDLING: Store lumber and millwork, where directed, off the ground, with protective covers. Do not expose wood to extreme changes of temperature and humidity.

PART 2: MATERIALS

2-1 WOOD: S4S, free from warpage, stain, rot, or other imperfections affecting strength, durability, and appearance. Moisture content not to exceed 19% for yard lumber and 12% for finish lumber. Lumber 2 inches thick and less, kiln dried. For exposed work, hand selected.

A. Framing Lumber: Framing, studs and Blocking - Standard or Better, Hem-Fir. (Compression parallel to grain 925 psi).

B. Sheathing: 4 feet by 8 feet, APA rated sheathing, 32/16, EXP1, plywood only, thickness as shown. Any 1/2 inch thickness plywood shall have 4 plys minimum.

2-2 TREATMENT: Clear petroleum solvent solution containing a minimum of 5 percent chlorophenols, Kem Penta Wood Preservative by Sherwin-Williams, 101 Prospect Avenue, N.W., Cleveland, Ohio 44115, or approved equal. Solution shall contain a minimum of 2.9 percent of pentachlorophenol and a water repellent.

2-3 ROUGH HARDWARE: Nails, spikes, screws, bolts, nuts, washers, anchors, and similar items of proper size to rigidly secure members in place. All exterior fastenings, galvanized or aluminum.

2-4 INSECT SCREENING: Comply with FS RR-W-365, Type VII (Aluminum Alloy) 18 x 14 heavy gauge. Finish - dark bronze.

2-5 FRAMING ANCHORS: Metal framing anchors, minimum 18 gauge galvanized steel or joist hangers, minimum 12 gauge galvanized steel, as required. Anchors and hangers ICBO approved, research recommendation No. 2894 UBC.

2-6 LAVATORY COUNTER: AWI Custom with 1/16 inch thick high density plastic faces and edges.

PART 3: EXECUTION

3-1 LAYOUT: Establish elevations; furnish, set, and maintain batter boards; lay out wood framing and millwork.

3-2 FRAMING: Sizes and spacings as shown.

A. Installation: Cut framing square on bearings, closely fit; accurately set to required lines and levels; secure rigidly in place at bearings and connections. Do not cut, notch, or bore framing members for passage of pipes or conduits without approval. Reinforce framing members where damaged by cutting.

B. Shims: Do not use shims for leveling on wood or metal bearings. Use slate or tile shims with full bearing for leveling on masonry or concrete.

C. Studding: Provide double studs at openings; triple studs at corners; studs at all vertical joints of applied material.

D. Plywood Sheathing: Nail at 12 inches on center at intermediate supports and 6 inches on center at edges with 10d common nails driven at a slight angle. Apply sheets with the long edge perpendicular to the framing and with joints staggered. Butt joints loosely and drive nails below surface of sheathing.

E. Blocking: Bolt securely to concrete with 1/2 inch machine bolts at 4 feet on center. Nail to wood twice at each joint. Use treated material in contact with concrete. Install to insure true lines in applied finishing.

F. For nailing, framing details, anchorage, and bracing. Follow nailing schedule of UBC.

G. Sleepers: Use 2 inch by 4 inch material as indicated. Use closure strips at all edges and openings. Nail at each bearing or at 12 inches on center. Install with faces true to line and plumb.

3-3 TREATMENT: Treat all blocking, sills in contact with concrete, masonry, or roofing systems. Lumber shall be at or below specified moisture content just prior to treatment. Mill, cut, and sand wood prior to treatment. Coat all surfaces.

A. Preferred-Immersion Method: Soak wood for 3 minutes, plywood for 30 seconds, and blocking for 30 minutes.

B. Brush Method: Apply 2 brush coats. Apply second coat between 15 and 30 minutes after application of first coat. On plywood, apply 1 brush coat.

C. Typical Wood Treatment: Apply preservative, 2 coats at 150 square feet per gallon, to specified wood.

3-4 HARDWARE:

A. Receive, store and be responsible for all finish hardware.

B. Properly tag, index, and file all keys.

C. Apply hardware in accordance with manufacturer's instructions, fit accurately, apply securely and adjust carefully.

D. Use care not to injure work when applying hardware.

3-5 MILLWORK: AWI Custom.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of the furnishing and installing of buried insulation for structures and pipelines where indicated.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Ductile Iron Pipe - Section 15062. Concrete Work - Section 03300, Meters - Section 15170.

1-3 SUBMITTALS: Submit manufacturer's literature and sample.

1-4 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM).

1-5 PRODUCT HANDLING: Insulation boards will be carefully handled to prevent damage and will be protected from direct sunlight. They will be stored in a fire-safe manner.

PART 2: MATERIALS

2-1 FLAT INSULATION: The buried insulation shall be 16-inch and/or 2 feet by 8 feet by 2 inches thick (or longer) boards of Dow SM rigid styrofoam or approved equal. The board will be extruded with a high density skin.

2-2 PHYSICAL PROPERTIES:

Density	(ASTM C303)	1.5 - 3.0 lb/ft.^{2}
Compressive Strength for Deformation	(ASTM D1621)	40 psi
Water Absorption	(ASTM D2842)	0.7% by volume
Water Vapor Transmission	(ASTM C355)	0.6 Perm-inch
Aged Thermal Conductivity K	(ASTM C177 and/or C513)	5-year 1-inch sample - 75°F.
@ 40°F. mean	0.135 (0.25 max.)	BTU/hr./ft^2/°F./in.
@ 75°F. mean	0.200 (0.27 max.)	BTU/hr./ft^2/°F./in.
Fresh Thermal Conductivity K	0.11	BTU/hr./ft^2/°F./in.

Exceptions to density are allowed if thermal, strength, water absorption, and water vapor transmission standards are not violated and if within structural capacity of facility to be insulated.

2-3 ADHESIVE FOR STRUCTURE APPLICATION: Where insulation board is to be applied to structure use Dow Styrofoam Mastic No. 11, or mastic recommended by manufacturer of insulation board, or approved equal. For application to bottoms of roofs, covers, or other locations where no supporting force is assured, use a system recommended by the manufacturer.

PART 3: EXECUTION

3-1 INSTALLATION FOR BURIED PIPE: 24-inch and 16-inch by 8-foot styrofoam boards shall be placed 6-inches above the top of the pipe on a compacted backfill bed in areas indicated on the drawing. The boards will be placed side by side to form a 40-inch total width and connected in an approved manner to prevent separation with adhesive tape or clips. The boards will then be backfilled carefully to lines indicated on the drawing and protected from breakage or skin damage. Wherever pipelines cross within 3 feet under or over culverts, or as required by Contracting Officer, insulate pipeline 10 feet beyond outside surfaces of culvert or other heat sink. Grade pipe as directed to provide 1 foot minimum clearance.

3-2 INSTALLATION FOR VERTICAL WALLS: Adhere insulation to walls in a horizontal position, closely butted and with vertical joints staggered. Apply mastic according to the manufacturer's recommendation. Backfill carefully such that material larger than 1-inch is not against insulation.

3-3 INSTALLATION FOR TOP OF HORIZONTAL SURFACES: Adhere insulation to surfaces in a staggered arrangement but closely butted with no gaps larger than 1/8-inch. If larger, close per manufacturer's recommendation. Carefully place 2 inches of sandy material to form a protective layer to prevent damage to the skin or use alternative methods as approved by the Contracting Officer. Place upper layers of fill in a manner to prevent intrusion through this protective layer and damage to the insulation.

3-4 INSTALLATION FOR UNDER HORIZONTAL SURFACES: Adhere insulation permanently per manufacturer's recommendations.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates except for buried pipeline insulation.

4-2 BURIED PIPELINE INSULATION: The unit of measurement for payment will be the linear foot. Measurement will be the projected length along the center line of the pipe, from the beginning to end of the insulated section. All related materials and work is included. Quantities so measured will be paid for at the Contract unit price.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing urethane foam board insulation with required vapor barriers between wood nailers complete for the installation of metal roof panels. Insulation shall provide the cold roof assembly with a "U" value of 0.05.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 03420 - Precast Deck

B. Section 06097 - Carpentry Work

C. Section 07410 - Preformed Wall and Roof Panels

1-3 CONTRACTOR QUALIFICATION: Applicator shall be fully experienced in the application of asphalt applied insulation and felts. He shall be approved by the roofing manufacturer to apply insulation and vapor barrier as indicated on which Surety Bonds can be issued.

1-4 QUALITY ASSURANCE: Insulation Specification based on Johns-Manville Spec. No. 501 in order to establish continuity and a standard of quality.

1-5 STANDARDS: Meet requirements and recommendation of applicable portions of latest editions of standards listed.

A. Federal Specifications (FS)

B. American Association of Testing & Materials (ASTM)

1-6 SUBMITTALS:

A. Submit product data of the manufacturer's specifications and application instructions for all roof insulation, felts, asphalt, etc. used for approval before starting any work.

B. No work shall start until one (1) copy of approved product data is on the job site.

PART 2: MATERIALS

2-1 PRODUCTS:

A. Plastic Cement FS C153.

B. Wood Sleepers, see Section 06097, Carpentry Work.

C. Concrete Primer: ASTM D-41 as recommended by Manufacturer of felts.

D. Felts: Asbestos, asphalt saturated and coated:

1. 23 pound.

2. 15 pound ASTM D250.

[NOTE: Fiber Glass Felts (12 pound complying with ASTM D-2178, Type IV) may be used in lieu of asbestos felts.]

E. Bitumen: Asphalt ASTM D-312 Types II and III.

F. Insulation: Urethane Board Asphalt facing top and bottom to provide "U" value for roof assembly of 0.05. Minimum compressive strength shall be 40 pounds per square foot and conforming to FS HH-1-530A Type II, Grade 2, Class 2, Style D.

G. Fasteners:

1. Bolts - 1/2 inch diameter steel

2. Nails - large head roofing nails.

PART 3: EXECUTION

3-1 INSPECTION:

A. Verify that work of other trades which penetrates roof deck or requires men and equipment to traverse roof deck has been completed.

B. Examine surfaces for inadequate anchorage, foreign material, moisture, and unevenness which would prevent the execution and quality of application of insulation sleepers and vapor barrier system as specified. Turn short screws into insert anchors to keep them clean and visible after felt placement.

C. Do not proceed with application of insulation and vapor barrier system until defects are corrected. Fill voids exceeding allowable tolerance with plastic cement and strike smooth.

D. Store all materials above ground and maintain in dry condition.

3-2 BITUMEN TEMPERATURE:

A. Maximum bitumen temperature in kettle: Type II and III, 475°F. Discard bitumen heated above specified maximum.

B. Minimum bitumen temperature at time and point of application: Type II, 325°F; Type III, 350°F.

C. Provide thermostatic controls and visible thermometer on kettle and maintain in working order and keep calibrated.

3-3 MINIMUM RATE OF APPLICATION OF PRIMER AND ASPHALT:

A. Primer on Deck: 1 gallon per 100 square feet.

B. Between primed deck and first vapor barrier felt - 23 pounds per 100 square feet.

C. Between layers of felt, 20 pounds per 100 square feet.

D. Between insulation and vapor barrier 34 pounds per 100 square feet.

3-4 INSTALLATION:

A. Cover concrete joints with 8 inch wide strips of 23-pound felt secured down with asphalt or cement spot applied to prevent any passage of asphalt through the joints.

B. Directly over the concrete decking install 2-ply vapor barrier felts with second ply shingled into the first. Apply shingle lapped felts to achieve 2-ply coverage over total deck surface. Use asphalt to suit the roof slope: Type II for maximum 2/12 slope; Type III for slope over 2/12. Apply asphalt at rates indicated. Edges of the felt shall be turned up on, but not cemented to, all vertical surfaces to a height of 6 inches and shall overhang all roof edges a similar amount. At locations where there are to be penetrations of the vapor barrier appropriate sealing material shall be provided.

C. Wood sleepers shall be secured down at a maximum 4 feet on center with 1/2 inch diameter bolts into preset insert anchors in the prestressed concrete tees through an 8 inch wide application of plastic cement.

D. Apply the units of insulation between the sleepers with long joints continuous and short joints staggered. Mop the full width under each unit of insulation with hot asphalt at a minimum rate of 35 pounds per square per layer of insulation. Allow asphalt to cool to be just tacky enough to hold and not melt the insulation. Insulation shall not be left exposed to the weather. No more insulation shall be applied than can be completely covered with the roofing on the same day.

E. Dry applied top felt; secure 15-pound felts with 4 inch lap joints shingle fashion over flush insulation and sleepers. Seal felt joints with plastic cement. Nail dry felt down to sleepers at 9 inches on center.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing preformed metal panels as indicated. Contractor shall provide all material, labor and equipment required to complete and finish the installation. Panels are to perform these functions:

A. Obliquely installed panels with insulation and vapor barriers to form cold roof.

B. Vertically installed panels to form exterior wall sections.

C. Horizontally installed panels to form a soffit.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

A. Precast Deck, Section 03420.

B. Carpentry Work, Section 06097.

C. Roof Insulation and Vapor Barrier, Section 07240.

1-3 STANDARDS: Meet requirements and recommendations of applicable portions of standards listed.

A. American Society for Testing and Materials (ASTM)

B. Underwriter's Laboratories (UL)

C. Federal Specifications (FS)

D. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)

1-4 QUALITY ASSURANCE: All sections indicated and trade names used are those of the H. H. Robertson Co. and are to establish continuity and a standard of quality. Products manufactured by Cyclops Corp., Elwin G. Smith Division, or Inryco, or approved equal, are acceptable.

1-5 FLAME SPREAD RATING: Finished material shall have a flame spread rating of less than 50 as tested by Underwriters Laboratories, Inc. Classification 40U8.18BUPX. It shall be fire-tested, approved and listed by the Factory Mutual Laboratories.

1-6 SUBMITTALS:

A. Submit specifications and installation instructions for each item specified. Include manufacturer's certification as may be required to show compliance with these specifications.

B. Submit detailed erection drawings showing layout and types of specified materials and accessories, gauges to be supplied, anchorage details, all conditions requiring closure panels, special jointing or other accessories.

C. Submit structural calculations indicating the integrity of panels, and fasteners to resist all loading conditions indicated herein. Loads are: wind - 20 pounds per square foot; wind uplift - 30 pounds per square foot; snowload - 150 pounds per square foot.

1-7 GUARANTEE: Prior to acceptance of the metal panel installations provide guarantee which shall include the cold roof system, exterior wall sections and soffit for a period of two (2) years. Repairs will be made to maintain a watertight condition at no expense to the Government. This shall be a written guarantee presented for the approval of the Contracting Officer.

PART 2: MATERIALS

2-1 MATERIAL: Materials installed shall be new, undamaged, and equal to or better than that specified:

A. Preformed Panels: The panels to be installed shall be ribbed steel similar and equal to H. H. Robertson SR3 - Vara 3 Wall, 36 inches wide, 1.7 inch deep ribs at 12 inches on center. The panels shall be capable of withstanding the wind and live loads as designated. (See 1.6-C.) Minimum thickness sheet steel (ASTM A366) shall be 18 gauge, hot dip galvanized to G-90 coating (ASTM A361). Preformed corners shall be factory welded, ground smooth and post painted. Lap joints shall be diset 6 inches.

B. Flashings: The flashing shall be factory formed of material matching and equal to roof, wall and soffit panels. Recommended procedures of the SMACNA shall be followed.

C. Wood Support: The panel supports shall be formed of wood members, blocking and sleepers on concrete deck for roof panels and wood fascia trusses and plywood for wall and soffit panels.

D. Fasteners: Stainless steel sheet metal screws and hex head wood screws colored to match panels with neoprene washers.

E. Closures: To completely close joints and connections where required, a premolded neoprene sheeting shall be used. Caulking, where required, shall be per manufacturer's recommendation.

F. Finish: ASTM A366; before forming, chemically clean, then hot-dip zinc coating to G-90 thickness. Next apply flexibilized epoxy base coat to a total dry film thickness of 3 mils + 0.1 mil both sides. Stucco-embossed 50 percent silicone modified polyester color coat, minimum dry film thickness of 0.8 mil.

A sample shall withstand a minimum of 60 days EMMAQUA weathering test exposure (Exterior Equatorial Mount with Mirrors and Water Spray) and/or 200,000 Langleys of ultra-violet radiation without cracking, peeling, blistering or loss of adhesion. Maximum color change, after removal of all exterior or surface deposits such as dirt, or chalk, shall not exceed 2 NBS units. Color shall closely match Robertson's Standard, Mocha 1243. The following performance requirements must be met by the coating:

1. Salt Spray: A sample shall withstand a salt-fog test for a minimum of 1,000 hours in accordance with ASTM B117, and have no more than a few #9-8 blisters along scribe.

2. Pollution-resistance Test: A flat specimen, with no protected edges, shall be subjected to 30 cycles of Kesternich testing without blistering, or loss of adhesion and only slight edge creepage.

PART 3: EXECUTION

3-1 ERECTION DRAWINGS: Erection drawings (See 1.6, Submittals) shall be prepared showing the location of units, closers, trim and dimensions of trim and the kinds of spacing of fasteners for each connection.

3-2 FIELD ERECTION:

A. No exposed fasteners are permitted. Provide a thermally responsive clip to secure the roof sheet to the structural supports.

B. Side laps shall be secured without sheet metal screws.

C. Lap joints shall be sealed with one sealant bead at side laps; two sealant beads at end laps.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing sealants around exterior openings, for masonry control joints, and for concrete, for intersection of dissimilar materials and where necessary to complete sealing of joints. This work is basically associated with the various buildings and structures involved with the project.

1-2 QUALITY ASSURANCE: Standards, Federal Specifications (FS) and manufacturers' printed recommendations.

1-3 SUBMITTALS: In accordance with Section 01300, submit manufacturer's technical data and printed recommendations.

PART 2: MATERIALS

2-1 SEALANTS: Sealant shall be approved equal to 2 Part Polysulphide "Seal of Approval" as manufactured by Thiokol or General Electric Silicone "Silpruf", guaranteed against staining.

PART 3: EXECUTION

3-1 PREPARATION: Allow 30 days for curing concrete work; 15 days for curing masonry work. Brush surfaces with a stiff bristle brush to remove loose materials. Apply primer as recommended by manufacturer using a clean brush. No primer is required for primed millwork. Around joints, protect areas with masking tape or other approved method. Remove splashed primer from adjacent surfaces immediately by flooding with toluene or xylene; wipe with a clean cloth. Install backup material as recommended by the manufacturer.

3-2 APPLICATION: In joints, apply with hand caulking or air pressure gun using proper size nozzle. Install backing so as to maintain width to depth ratio with minimum depth of 1/8 inch and maximum depth as recommended by manufacturer. Tool joint surfaces to compress compound into joint insuring complete contact with surface to be sealed and a watertight joint. Remove excess materials leaving joint smooth and even.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing all metal doors and frames and window frames as shown and as specified herein.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

A. Painting, Section 09900

B. Miscellaneous Metal, Section 05500

1-3 QUALITY CRITERIA:

A. Approved Manufacturer: Manufacturers shall furnish doors conforming to the construction requirements of this specification. Submittals shall have all information required below.

1-4 SUBMITTALS:

A. Shop Drawings: Submit manufacturer's shop drawings for doors and accessories furnished under this section for approval, in accordance with Section 01300, Submittals.

1. Submit shop drawings covering each type of door and frame, frame conditions, and complete anchorage details, supplemented by suitable schedules covering doors and frames.

2. Show glass and undercut opening sizes and locations in doors.

3. Indicate size, gauge, and location of reinforcement for hardware on shop drawings.

B. Certifications:

1. Heat transmission test shall be certified by an approved independent testing laboratory.

2. Fire rated doors, frames, and hardware shall be approved combinations as listed in Underwriter's Laboratories Building Materials List.

PART 2: MATERIALS

2-1 BASIC MATERIAL:

A. Sheet steel for frames shall be hot-rolled prime quality carbon steel, ASTM A-366.

2-2 FRAMES:

A. Frames shall be combination buck, frame and trim type.

B. Minimum Gauges: Frames for all door openings - 16 gauge minimum.

C. Brake-form Steel Sheets: Provide profiles and shapes free of warp, buckles, fractures or other defects.

D. Corners and connections shall be mitered and welded with exposed welds ground flush and smooth. (Knock-down type frames are not acceptable.)

E. Anchors:

1. Provide an anchor at each jamb for each 2 feet 6 inches of door or window height or fraction thereof.

2. Vary anchor types to provide positive fastening to adjacent construction, provide special anchors as detailed.

3. Secure a metal clip angle at bottom of each door jamb member for anchoring to floor, with a minimum of 2 fasteners.

F. Provide 3 holes for each strike jamb and 2 holes for header of double frames for application of door silencers, except exterior doors.

G. Form 5/8-inch minimum stop integral with frame.

H. Provide two 16 gauge steel spreaders for double rabbeted frames tack welded to the bottom of both jambs.

I. Masonry Anchors: Provide with standard masonry anchors of not less than 18 gauge steel.

J. Concrete Anchor: Provide 1/4 inch flat head machine bolt and expansion anchors with 12 gauge U-shaped spacer welded to frame at each anchor.

K. UL Anchors: Provide at labeled frames.

2-3 DOORS:

A. Face sheet shall be of 18 gauge steel.

B. Doors shall be 1-3/4 inches thick with continuously welded edges, dressed and ground smooth, and with no visible seams on door faces or vertical edges.

C. Internal Stiffeners:

1. Surface sheets shall be supported by "Z", channel, or continuous truss members not less than 16 gauge (28 gauge for continuous truss), spaced not more than 6 inches on center and internally spot welded to both surface sheets at maximum of 4 inches on center.

2. Top edge of all doors shall be closed flush with continuous 16 gauge channel members extending full width of door. (Plastic or rubber insert not acceptable.)

3. Edges of doors shall be supported by 16 gauge interior edge channels extending full height of door.

D. Sound Deadening: Internal surface shall be treated with a sound-deadening material to eliminate metallic ring.

E. Sound Retardant: Install rock wool sound retardant material in doors with a density of 3.5 pounds and a thickness of 50% greater than the door thickness before compression.

F. Clearances:

1. Between doors and frames at head and jamb 1/8 inch.

2. At sill where no threshold is used 1/2 inch. Where threshold is used 1/8 inch between door and threshold.

3. Bevel edges of single acting doors 1/8 inch in 2 inches.

G. Glazing Stops:

1. Doors to be glazed shall be provided with 18 gauge stops to secure glass. Stops shall have all corners fully mitered and welded.

2. Glazing stop shall be permanently secured to the exterior side of the door by concealed internal welding. Interior glazing stop shall be held in place with countersunk oval head screws.

3. Where a "B" labeled fire door requires glazing, provide as shown on drawings.

2-4 LABELED FIRE DOORS AND FRAMES:

A. Doors and frames designated to be labeled shall bear the UL label.

B. Furnish statement on label that construction provides the required heat transmission rating when a rating is indicated in door schedule.

2-5 PREPARATION FOR FINISHED HARDWARE

A. Doors and frames shall be factory reinforced, drilled, and tapped for mortise template hardware in accordance with approved hardware schedule. Obtain current hardware templates from hardware supplier.

B. Provide welded-in reinforcing plates for surface applied hardware.

C. Frame Reinforcement: Thickness and sizes for frame reinforcement shall be as follows.

1. Butt Hinges: 3/16 plate 12 inches long and full width of frame profile.

2. Closer: 10 gauge channel section 12 inches long and full width of frame trim.

3. Reinforcements for strikes, flush bolts, and all other surface mounted hardware: 12 gauge.

D. Door Reinforcement: Thickness and sizes for door hardware reinforcement shall be as follows.

1. Butt Hinges: 3/16 inch plate 9 inches long welded to 16 gauge interior edge channels.

2. Surface applied closers: 12 gauge box section minimum 4 inches deep and 12 inches long weld to top and edge channels.

3. Locksets, deadbolts, panic devices: 12 gauge steel spot welded to interior edge channels.

4. Reinforcement for pull plates, flush bolts, and all other surface mounted hardware: 12 gauge steel spot welded to internal stiffeners.

E. Coined or extruded holes will not be acceptable to obtain minimum gauge thicknesses specified above.

2-6 FINISH:

A. Doors and frames shall be leveled and ground smooth.

B. Apply mineral filler to eliminate weld scars and other blemishes.

C. Apply factory coat of rust inhibitive metal primer.

PART 3: EXECUTION

3-1 DELIVERY, STORAGE AND HANDLING:

A. Deliver, store, and handle hollow metal work in a manner to prevent damage and deterioration.

B. Store doors upright, in a protected dry area, at least 1 inch or more off the ground or floor and at least 1/4 inch between individual pieces.

C. Protect exposed finish surfaces of prefinished items with masking tape.

3-2 INSTALLATION OF FRAMES:

A. See Section 04230, Reinforced Unit Masonry, for additional installation instruction.

B. Exercise care in setting of frames to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.

C. Secure anchorages and connections to adjacent construction.

D. Remove factory applied spreader bar before setting frame and apply exact length wood spreader bars at bottom and center of door to maintain correct spacing between jambs.

3-3 INSTALLATION OF DOORS:

A. Apply hardware in accordance with hardware manufacturer's templates and instruction. Hardware and specialties shall be as specified in Section 08710, Hardware.

B. Adjust operable parts for correct function.

C. Remove hardware, with exception of prime-coated items, tag, box, and reinstall after finish painting is complete.

D. Installation of fire doors and frames shall conform to the National Fire Protection Association Pamphlet No. 80.

E. Clearances shall be as specified in 2.3 above.

3-4 PRIME COAT TOUCH-UP:

A. Immediately after erection, areas where prime coat has been damaged shall be sanded smooth and touched up with same primer as applied at shop.

B. Remove rust before above specified touch-up is applied. Touch-up shall not be obvious.

3-5 DOOR SCHEDULE: Dimensions and other requirements for each door are noted on Door Schedule. Each door is identified by a door mark as shown on drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing an upward acting, insulated, flush face, steel, sectional door of size as indicated. The work also includes installing tracks, counterbalance, and door hardware for manual operation.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Miscellaneous Metalwork, Section 05500.

1-3 STANDARDS: All materials, devices needed to comply with the requirements of the standards listed:

A. American Society for Testing Materials (ASTM)

B. Federal Specifications (FS)

1-4 QUALITY ASSURANCE: Unit described herein is a manually operated door with wedge action seal.

1-5 SHOP DRAWINGS: Submit manufacturer's shop drawings for metal overhead doors and accessories furnished under this Section for approval, in accordance with Section 01300, Submittals.

1-6 GUARANTEE: Provide one (1) year guarantee for all materials including door sealing performance quality.

PART 2: MATERIALS

2-1 STEEL: Gauge as indicated and galvanized with 1.25 ounces of zinc per square foot and chemically treated to accept paint. Conform to standards specified in Section 05500, Miscellaneous Metalwork.

2-2 MATERIALS:

A. Door Panels: 16 gauge rolled steel with reinforcing providing dent resistance and rigidity along with flush external appearance. 2 inches nominal thickness. 24 gauge back panel insulation retainer.

B. Finish: Manufacturer's standard prime finish.

C. Track: Standard 2-inch track of 13 gauge steel with wedge-type sealing action at jamb closure.

D. Insulation: Door sections shall hold in place 2 inches of urethane insulation conforming to FS HH-1-530A, Type III, Grade 2, Class 1, U value of 0.109.

E. Counterbalance: Live shaft torsion spring.

F. Rollers: Hardened steel tires suitable for operation in 2-inch track.

G. Hinges: Graduated tubular pin type of 13 gauge galvanized steel, compatible with 2-inch track and wedge-type sealing.

H. Track supports: Steel angle 1-1/2 inches x 1-1/2 inches x 1/8 inch (minimum).

I. Perimeter Sealing:

1. Sill: Y-type weatherseal with rubber tip.

2. Jamb: Compressible gasket.

J. Cables: Galvanized or airplane lift cables with minimum 8 to 1 safety factor.

K. Hardware: Manual operation.

1. Lock: Cremone type bolt engaging tracks at both sides of door.

2. Handles: Chrome steel on both interior and exterior.

L. Glass: Insulating glass with 1/8 inch DS "A" safety glass each face with 1/2 inch air space: comply with Section 08800.

PART 3: EXECUTION

3-1 INSTALLATION: Installation shall be accomplished in accordance with manufacturer's recommendations. See drawings for door location. Door shall be plumbed and in proper operating condition with all hardware fully attached. Provide all necessary hangers, anchors, etc. to suspend from and secure to structure as required.

3-2 ADJUSTMENT: Provide the necessary servicing and adjustment for proper operation of the door for a period of one (1) year from the date of installation. Adjustment shall include adjusting torsion spring, track alignment, self-leveling characteristics of the door and other adjustments for proper operation of the door.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing all labor, material and equipment necessary to furnish and install aluminum windows as shown on drawings and specified herein.

1-2 SUBMITTALS:

A Shop Drawings: Submit seven copies of manufacturer's shop drawings for windows and accessories furnished under this section for approval, in accordance with section 01300.

1-3 STANDARDS: Meet requirements and recommendations of applicable portions of the latest editions of standards listed.

A. American Society for Testing and Materials (ASTM)
B. Architectural Aluminum Manufacturers Association (AAMA)
C. Aluminum Association (AA)

1-4 RELATED WORK SPECIFIED ELSEWHERE: Glazing, Section 08800.

1-5 QUALITY ASSURANCE:

A. Acceptable Manufacturers: Details indicated refer to Wausau Metal Corporation Series 2250T Thermal Barrier type window in order to establish continuity and a standard of quality. Products of other manufacturers approved as equal may be substituted.

B. Erector Qualfications: Not less than five (5) years experience in installation of aluminum windows.

C. Testing Agency: Meet requirements of AAMA 1.03.2.

D. Allowable Tolerances:

1. Material tolerances:

   a. Solid extrusions: Minimum nominal metal thickness 0.125 inch $\pm$ 0.006 inch.

   b. Hollow extrusions: Minimum nominal metal thickness 0.125 inch $\pm$ 0.010 inch.

2. Size tolerances: Dimensions with $\pm$ 1/16 inch.

E. Source Quality Control:

1. Air Infiltration Test:

a. ASTM E283-73.
b. Maximum infiltration 0.20 CMF per foot crack length.

2. Water penetration test:

a. ASTM E331-70.
b. No water penetration for 15 minutes when window is subjected to rate of flow of 5 gallon per hour psf with differential pressure across window unit of 6.24 psf.

3. Wind Load Test:

a. ASTM E330.
b. Minimum 30 psf positive and negative load for 10 seconds.
c. Maximum deformation of frame or sash member 4/10% of span length.
d. No damage to fasteners or hardware.

1-4 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Store windows in upright position off ground on dunnage.

B. Protect from weather and damage.

C. Store in designated areas as close as possible to point of installation.

1-5 GUARANTEE:

A. Guarantee windows against failure of materials or workmanship to include excessive leakage or air infiltration, excessive deflections, faulty operation of sash, deterioration of finish or metal in excess of normal weathering, and defects in hardware and weatherstripping.

B. Guarantee to extend to five (5) years.

PART 2: MATERIALS

2-1 MATERIALS:

A. Aluminum Extrusions:

1. ASTM B221.
2. Alloy 6063.
3. Temper T5.

B. Aluminum Finish: Aluminum Association (AA) Designation AA-M C22 A42 (dark bronze to match Kawneer Permanodic No. 40).

C. Thermal Break Material: Semi-rigid elastomeric material, neoprene, PVC or polyurethane.

D. Screens: 18 x 16 aluminum mesh.

E. Fasteners and Hardware: Manufacturer's standard.

F. Weatherstrip: Hypalon coated neoprene.

G. Protective Coatings: Methacrylate lacquer: As recommended by manufacturer.

2-2 FABRICATION:

A. Conform to reviewed shop drawings.

B. Mechanical Assemblies:

1. Fit corner joints rigid and weathertight.

2. Fasteners concealed when window is installed and closed.

3. Rotating or sliding parts assembly:

a. Aluminum or stainless steel to nonmetallic.
b. Nylon to aluminum.
c. Do not use aluminum to aluminum.

C. Protective Coatings:

1. Factory applied.

2. Solvent-clean metal surface.

3. Apply zinc chromate wash primer with zinc chromate primer to aluminum in contact with galvanically incompatible metal.

4. Apply methacrylate lacquer to aluminum surfaces to be installed in contact with concrete or mortar.

D. Weatherstrip:

1. Install double weather stripping in retaining grooves designed as integral part of ventilator section.

2. Weatherstripping to be continuous at corners.

E. Hardware:

1. Hardware shall consist of white bronze surface mounted strikes. Cam handles must be attached to the sash member with stainless steel screws threaded into hardened metal grommet fasteners. Threading directly into the aluminum extrusion will not be allowed.

2. Hardware shall consist of extra heavy duty aluminum 4-bar adjustors with heavy duty .188 inch aluminum balance arms. Adjustors shall contain sliding pivots with nylon friction shoe in a 6063-ST6 aluminum alloy extruded track. The friction shoe shall be friction adjustable. Adjustment shall be position for easy access within the vent opening at the jambs. All moving arms shall pivot on nylon surfaces and bushings for quiet operation. Lubrication shall not be required to insure satisfactory operation.

3. Attach with corrosion-resistant fasteners.

4. Accessible for adjustment and replacement from inside building without damage to window.

5. Provide eye at top of all vents for ease of operation.

6. Provide pole hook and pole, for operation of vents, along with keyhole type storage receiver.

F. Screens: Extruded aluminum frame with vinyl spline, held in place with spring-loaded plungers.

G. Mullions:

1. Support to permit movement from expansion and contraction without damage to window assembly.

H. Temperature Exposure: Provide test results from an accredited independent laboratory complying with the following criteria:

Interior chamber temperature to be held at +70°F while exterior ambient temperature is reduced to -15°F.

Interior rail of frame and ventilator must maintain a temperature of not less than 42°F as indicated by thermocouple temperature sensing.

Test performed with still air inside and outside.

I. Water Drainage: Provision shall be made to drain all enclosed areas of the window unit, to the exterior by means of drain holes with a minimum 5/16 inch diameter.

PART 3: EXECUTION

3-1 INSPECTION:

A. Assure that window openings conform with dimensions and tolerances shown on plans.

B. Check that surfaces to contact windows are free of debris.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3-2 INSTALLATION:

A. Comply with manufacturer's instructions for installation of units, hardware, operators, and other components.

B. Set units plumb, level, and true to line, without warp or rack of frames or sash.

C. Anchor frames solidly to surrounding construction to prevent distortion or misalignment.

D. Install break metal with matching finish as indicated.

E. Apply protective coating to separate aluminum from galvanically incompatible materials.

F. Install pole receiver where directed.

3-3 ADJUST AND CLEAN:

A. Adjust movable units to operate smoothly and to be weathertight when closed.

B. Lubricate hardware and moving parts.

C. Clean aluminum surfaces and remove excess sealants.

D. Remove debris from work site.

E. Leave window units in closed position to protect against dirt and elements.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: Except as otherwise specified, furnish hardware as required in the listed specifications. Type and function are scheduled in Hardware Schedule. Do not limit the specified operative or functional feature of the hardware by modifications required because of construction characteristics.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

A. Carpentry Work, Section 06097.

B. Metal doors and frames, Section 08100.

1-3 STANDARDS: Meet requirements and recommendations of applicable portions of standards listed.

A. American National Standards Institute (ANSI)
B. American Society of Architectural Hardware Consultants (ASAHC)
C. Builders' Hardware Manufacturers Association (BHMA)
D. National Builders' Hardware Association (NBHA)
E. Underwriters Laboratories (UL)

1-4 QUALIFICATIONS: Firm technically qualified and experienced in detailing and fitting of finished hardware. Refinement such as butt knuckle clearance, strike lip lengths adjustments, beveling or rabbeting or rounding of lock faces and centering of brackets will be expected and indicated in the submitted Schedule of Hardware.

1-5 TEMPLATES: Furnish template hinges in accordance with ANSI A156.7-72. Furnish templates as required to permit fabrication and delivery of the metal doors and frames on schedule. Where two or more hardware items are to be mounted on the same door, coordinate between the manufacturers as needed to prevent interference.

1-6 SUBMITTALS: In accordance with section 01300, submit 8 copies of a hardware schedule in sets as shown in ASAHC publication "Scheduling Sequence and Scheduling Format". Include complete keying information or furnish separate keying schedule. Furnish with schedule a sample list covering each different hardware item, identifying the manufacturer's name and catalog number; and referencing the specification standard and type called for herein. In addition, submit certificates, signed by a responsible official of the manufacturer, stating that the locks and door closures meet the quality requirements of the respective ANSI standards. Certificates may be submitted as an original and copies.

1-7 QUALITY ASSURANCE: No modifications of doors or frames shall void the U.L. label requirements indicated in the Door Schedule.

1-8 PACKING, MARKING, AND LABELING: Deliver hardware in the manufacturer's original packages. Package each article individually in a substantial container, and mark in coordination with the Hardware Schedule. Package change keys as specified in paragraph 2-3, Keying.

PART 2: MATERIALS

2-1 HARDWARE FINISHES: BHMA Standard 1301 (1970). Make finish, except as otherwise specified, BHMA Code No. 630.

A. Door closer cover finish to be sprayed aluminum.

B. Door stops: Finish Code 626.

2-2 FASTENING: Supply fasteners in the proper type, size, quantity, and finish with each article of hardware. Furnish machine screws and expansion shields for attachment to concrete or masonry. Make fasteners exposed to the weather in finished work of brass, bronze, or stainless steel, as applicable.

2-3 KEYING: Furnish a construction master key system. Stamp keys for cylinder locks with change number and the inscription "U.S. Property - Do Not Duplicate". Supply keys as follows: 2 change keys for each lock and 6 master keys for each master-keyed set. Deliver change keys in one package, properly tagged and designated as to lock location. Deliver master keys to the Contracting Officer by registered mail.

Locks are to be keyed to system in Park. Provide demountable knobs.

2-4 BUTT HINGES: ANSI A156.1-70 4-1/2 inches by 4-1/2 inches.

A. Furnish hinges with pins nonremovable when the door with lock is closed or reverse bevel doors, where either exterior or interior.

B. Option: Oil-impregnated bearings may be substituted for ball-bearings.

2-5 LOCKSETS, LATCHSETS, AND LOCK TRIM: ANSI A156.2-75.

A. Locks, locksets, and latchsets: Series 4000, Grade 1, as scheduled.

1. Furnish by single manufacturer.

2. Cylinder locks: Schlage "F", keyway six pin zero bitted keys.

3. Provide strike boxes on strikes mortised into doors or frames.

B. Lock trim: ANSI A156.2, paragraph 11.2 for forged trim. Use matching visible trim throughout the project. Trim pattern shall be Schlage "Orbit" or Corbin "863" similar design from other manufacturers, subject to approval.

2-6 CLOSERS: ANSI A156.4.

A. Supply surface mounted, modern type overhead closers with cover (series 2000) as required for PT-1. Mounting plates and other accessories for complete installation shall be furnished as required by conditions. Furnish all closers to be the products of one manufacturer.

2-7 DOOR PROTECTION PLATES: ANSI A156.6, type J100, in matte finish, brown, solid plastic and stainless steel. Furnish plastic kick plates 12 inches high and for width 2 inches less than width of door. Furnish stainless steel armor plates 34 inch high and for width 2 inches less than width of door.

2-8 AUXILIARY HARDWARE: BHMA 1201 and ANSI A156.6.

A. Doorstops and door holders, furnish as scheduled. Use 90° hold-open position, except where otherwise specified.

B. Thresholds: Type J600, aluminum with flat corrugated top except where otherwise scheduled for exit devices or other special applications.

2-9 HARDWARE SETS:

A. Hardware Set #1

Each door to have:

1-1/2 pr.	Butts	A5112 4-1/2 inches x 4-1/2 inches NRP (Door 401)
2 pr.	Butts	A5112 4-1/2 inches x 4-1/2 inches NRP (Door 601)
1 ea.	Lockset	4000-F81
1 ea.	Closer	C72021
1 ea.	Kickplate	
1 ea.	Wall Stop	L12101
1 ea.	Threshold	Pemko 171A x Door Width or Equal
1 ea.	Weatherstrip	Pemko 305DR x Door Width or Equal
2 ea.	Weatherstrip	Pemko 305DR x Door Height or Equal
1 ea.	Door Bottom	Pemko 315DN x Door Width or Equal

B. Hardware Set #2

Each door to have:

1-1/2 pr.	Butts	A5112 4-1/2 inches x 4-1/2 inches NRP
1 ea.	Lockset	4000-F81 (Door 408)
1 ea.	Panic Device	109 (Door 409)
1 ea.	Closer	C72061
1 ea.	Armor Plate	
1 ea.	Overhead Holder	C89551
1 ea.	Auto. Door Bottom	Pemko 434A x Door Width or equal
1 ea.	Weatherstrip	Pemko 305DR x Door Width or equal
2 ea.	Weatherstrip	Pemko 305DR x Door Height or equal

C. Hardware Set #3

Each door to have:

2 pr.	Butts	A5112 4-1/2 inches x 4-1/2 inches
1 ea.	Latchset	4000-F75
1 ea.	Closer	C72021
1 ea.	Kick Plate	
1 ea.	Wall Stop	L12101
3 ea.	Silencers	Quality 1337A or equal

D. Hardware Set #4

Each door to have:

2 pr.	Butts	A5133 4-1/2 inches x 4-1/2 inches
1 ea.	Privacy Set	4000-F76
1 ea.	Wall Stop	L12101
3 ea.	Silencers	Quality 1337A or equal

E. Hardware Set #5

Each door to have:

2 pr.	Butts	A5112 4-1/2 inches x 4-1/2 inches
1 ea.	Lockset	4000-F81
1 ea.	Closer	C72021
1 ea.	Kickplate	
1 ea.	Wall Stop	L12101
3 ea.	Silencers	Quality 1337A or equal

F. Hardware Set #6

Each door to have:

2 pr.	Butts	A5112 4-1/2 inches x 4-1/2 inches
1 ea.	Lockset	4000-F81
1 ea.	Closer	C72021
1 ea.	Armor Plate	
1 ea.	Floor Stop	L12161 (Door 405)
1 ea.	Wall Stop	L12101 (Door 301)
3 ea.	Silencers	Quality 1337A or equal

PART 3: EXECUTION

3-1 APPLICATION OF HARDWARE: NHBA "Recommended Locations for Builders' Hardware", and the following:

A. Kick plates: Install on the push side of single-acting doors.

B. Door-closing devices: Install and adjust in strict accordance with the manufacturer's printed templates and instructions.

3-2 ABBREVIATIONS AND SYMBOLS used in Hardware Sets are as listed in NBHA Handbook "Abbreviations and Symbols". Keying symbols and notes are as listed in ASAHC handbook "Terms and Nomenclature of Keying".

3-3 INSPECTION:

A. Check all closers for proper operation after they have been installed and make necessary adjustments to those closers which prove to be difficult to adjust upon the initial attempt. Verify the keying to insure proper location of locksets and correct faulty operations of any locks.

B. All Hardware: Inspected and checked by hardware supplier. Be responsible for proper installation for proper operating conditions. Inspection made by a qualified architectural hardware consultant; verify in writing to the Contracting Officer that all hardware specified and/or required herein is properly installed.

3-4 INSTRUCTION: Instruct Contracting Officer in the proper repair and adjustment of all finish hardware items, particularly door closers and locksets. Present to the Contracting Officer full complement of tools to be used in maintaining the finish hardware and explain to him the proper use of each.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 GENERAL DESCRIPTION: The work of this section consists of furnishing and installing all glazing as shown and as specified herein.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

A. Metal Doors and Frames, Section 08100

B. Aluminum Windows, Section 08525.

1-3 STANDARDS: Meet requirements and recommendations of the Flat Glass Marketing Association Glazing Manual and of the applicable portions of:

A. Federal Specifications (FS)

B. FS DD-G-001403 - Heat Strengthened and Tempered Glass. Safety Glass comply with ANSI Z97.1. Safety glass shall be marked with Safety Glass imprint.

C. FS DD-G-451 - Flat Glass for Glazing.

D. Regulations of Sealed Insulating Glass Manufacturers Association (SIGMA)

1-4 SUBMITTALS: Provide certificate of compliance for insulating glass to regulations of SIGMA.

PART 2: MATERIALS

2-1 GLASS:

A. Insulating Glass - two panes: 1/4 inch float glass, exterior pane clear; interior pane clear; total thickness 1 inch, unless otherwise noted.

B. Safety Glass: 1/4 inch tempered - clear.

C. Wire Glass: 1/4 inch polished - clear; wire horizontal and vertical.

2-2 GLAZING:

A. Glazing compound with stops at hollow metal frame windows.

B. Steel stops at all hollow metal windows.

C. Silicone rubber sealant, Dow Corning, or approved equal, clear.

D. Glazing Compound for Insulating Glass: As recommended compatible with insulating glass unit by SIGMA.

1. FS TTS-00-227 - 2 part polysulphide.

2. FS TTS-00-1543A - silicone rubber.

PART 3: EXECUTION

3-1 INSTALLATION OF GLASS:

A. Cut glass with smooth straight edge to fill size required by opening.

B. Vertical Edges: Ground smooth and sharp, corners eased slightly.

C. Maintain 1/4 inch clear at top, sides and edges of glass greater than 3 feet in width or height.

D. Set all glass with waves parallel to sill.

E. Remove all dirt and stains.

F. Glazing compound back and face beds shall be straight and smooth without finger marks. Remove excess glazing compound.

G. Clean, polish glass and restore to original condition all adjacent areas soiled during glazing operation.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing gypsum drywall. The installation and application of all materials shall be in accordance with the latest printed directions or specifications of the manufacturer.

1-2 QUALITY ASSURANCE: All catalog numbers and trade names used in this section are those of United States Gypsum, unless otherwise noted, and are to establish continuity and a standard of quality. Products of other manufacturers approved as equal may be substituted.

1-3 RELATED WORK SPECIFIED ELSEWHERE: Carpentry Work, Section 06097.

1-4 DELIVERY AND PROTECTION: Deliver all materials in their original unopened containers and store in an enclosed shelter providing protection from damage and exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

PART 2: MATERIALS

2-1 GYPSUM BOARD: 5/8 inch W/R Firecode, tapered edge gypsum board, 48 inches wide, lengths as long as practical to minimize the number of joints.

2-2 WOOD STUDS: See Carpentry Work, Section 06097.

2-3 CHANNELS: 1-1/2 inches cold-rolled and USG metal furring.

2-4 HANGER WIRE: #9 cold drawn galvanized steel wire.

2-5 TIE WIRE: 16 gauge or clips.

2-6 METAL TRIM: No. 200 series metal trim.

2-7 JOINT TREATMENT: Perf-A-Tape Joint System; joint compound all-purpose or ready-mixed joint compound all-purpose; Durabond 90.

2-8 FASTENERS: Type S and Type S-12 - ceiling; Type W - Partitions - length as required and 3/8 inch pan head or nails for wood stud partitions, obtain locally.

PART 3: EXECUTION

3-1 INSTALLATION:

A. Isolate ceiling from walls by use of #200 Series metal trim.

B. Provide sealant at edge of gypsum board where abutting walls.

C. End joints shall be staggered.

D. Screws shall be staggered on adjoining edges where ends occur on same framing members.

E. Drive screws home with the head slightly below surface in a dimple form by the crowned face of the driving tool.

F. Care shall be taken to avoid breaking the paper surface.

G. Apply fasteners as recommended by manufacturer.

H. Provide #200-A Series metal trim where all edges adjoin dissimilar material and elsewhere as indicated.

I. Finish all exposed joints and screw heads with Durabond 90 and Perf-A-Tape joint treatment.

J. The building shall be heated well in advance of, during, and following the application of wallboard, to maintain a uniform temperature in the range of 50°F with ventilation provided to eliminate excessive moisture.

K. Ceilings shall be constructed with single layer 5/8 inch W/R Firecode gypsum board secured to metal furring channels. Metal furring channels space at 24 inches on center, secured to 1-1/2 inches cold-rolled channels with 16 gauge tie wire or clips. 1-1/2 inches cold-rolled channels spaced at 4 feet center and supported at maximum 4 feet on center with No. 9 gauge wire.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing tile flooring and base.

1-2 STANDARDS: Federal Specifications (FS)

1-3 SUBMITTALS: Submit manufacturer's literature and samples in accordance with Section 01300. Submit samples of colors available.

PART 2: MATERIALS

2-1 FLOOR TILE: 12 inches by 12 inches by 1/8 inch thick vinyl asbestos tile, marbelized, meet requirements of FS SS-T-312, Type IV, through pattern tile, color and pattern shall be as GAF Thru-Chip 3565.

2.2 VINYL EDGING STRIP:

A. 1/8 inch thick standard width by length required; color shall match tile.

B. Exposed edge shall be round or beveled.

C. Material shall meet FS SS-W-40A, Type II, Class I.

2-3 BASE: Rubber 1/8 inch thick by 4 inches high; meet FS SS-W-40A, Type I, Style B, cove; color shall be as Burke 502-P, Dark Brown. Base shall be sufficiently flexible to conform to irregularities in walls, partitions, and floors. Premolded corners in matching size, shape, and color shall be provided for all right-angle external and internal corners.

2-4 APPLICATION MATERIAL:

A. General: Provide type and brands of adhesive as recommended by manufacturer of resilient tile, edge strip and base material for the conditions of the installation.

B. Primer: Type and brand recommended by floor covering manufacturer.

C. Crack Filler: Type and brand recomended by floor covering or base manufacturer.

D. Wax, Cleaner, or Other Finishing Material: As recommended by floor covering manufacturer for the particular type of flooring material.

2-5 REPAIR TILE: Provide 1 case of tile and 1/2 case of topset base more than that required to complete the work to be left at building for replacement use.

PART 3: EXECUTION

3-1 PREPARATION OF SURFACES:

A. Concrete Floor Surfaces: All ridges or other uneven surfaces shall be ground smooth. Cracks 1/16-inch or wider shall be cut out and filled with a crack filler as specified for this application. Latex underlayment shall be provided to fill the remaining holes, cracks, and depressions, and for smoothing, leveling, or feather edging the concrete. Chalky or dusty surfaces shall be primed with an approved primer, recommended by the flooring manufacturer after cleaning and removal of all loose particles.

B. Moisture Test for Concrete Floors: After concrete floor surfaces have been cleaned, small patches of adhesive to be used shall be spread in several locations in each room and allowed to dry or "set" overnight. If the "set" adhesive can be peeled easily from the floor surfaces, the floor is not sufficiently dry. The test shall be repeated until the adhesive adheres properly. When the adhesive adheres tightly to the floor surface, the tile shall be applied.

3-2 APPLICATION:

A. General: Installation shall be deferred until all other work that might cause damage to the flooring has been completed. Flooring and accessories shall be applied in accordance with the approved installation procedure. Work shall be performed by workmen thoroughly experienced in the application of such flooring. Adhesives shall be as specified for the specific application. Adhesives shall be applied in accordance with the adhesive manufacturer's printed directions. Flooring shall be applied in the patterns indicated, starting in the center of the room or area, and working from the center towards the edges. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edges shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied. Edging strips shall be provided where flooring terminates at points higher than the contiguous finished flooring, except at doorways where thresholds are provided. Plastic strips shall be secured with adhesive.

B. Application of Vinyl Asbestos Tile: Concrete slabs shall be primed with primer as recommended (2-4B). Primer shall be worked into the surface of the concrete, using the minimum quantity that will cover the surface completely with a nonabsorptive base. Primer shall be allowed to become thoroughly dry before adhesive is applied. Adhesive shall be applied to primed concrete floor surfaces. Tile shall be carefully laid in the pattern indicated and fitted so that each tile is in contact with the adjoining tiles, and all joints are tight and in alignment.

. Application of Rubber Wall Base: Wall base shall be applied after looring has been completed, and the wall surface to which the base is to be pplied is thoroughly dry. All cracks and voids in the wall shall be filled ith a crack filler as specified for this application. Irregular surfaces hall be brought to a smooth finish with a satisfactory smoothing compound. pecial base adhesive shall be applied to the back of the base with a notched rowel, leaving approximately 1/4-inch bare space along the top edge of base. he base shall immediately be pressed firmly against the wall and moved gently nto place, making sure that the toe is in contact with the floor surface and he wall. The entire surface of the base shall be rolled with a hand roller, nd then the toe of the base shall be pressed firmly against the wall with a traight piece of wood. Internal and external corners shall be formed with ase materials as specified herein.

-3 CLEANING: Immediately upon completion of the installation in a room or an rea, flooring and adjacent surfaces shall be dry-cleaned with an approved leaner to remove surplus adhesive. No sooner than 5 days after installation, looring shall be washed with an approved nonalkaline cleaning solution, rinsed horoughly with clear cold water, and given 2 coats of polish. After each olish coat, floors shall be buffed to an even luster with an electric olishing machine. Bases shall be cleaned but not polished.

-4 PROTECTION: From the time of laying until acceptance, flooring shall be rotected from damage. Defects which develop, such as damaged, loose, broken, r curled tiles, shall be removed and replaced (prior to final inspection).

ART 4: MEASUREMENT AND PAYMENT

.1 No separate measurement or payment will be made for this work. It will be onsidered a subsidiary obligation of the contract under other work to which it elates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of all labor and materials, equipment and supervision necessary for the installation of epoxy floor and base and wall coating to toilet room floors and base and shower walls as set forth in the Room Finish Schedule.

1-2 QUALITY CONTROL: Product applied shall meet performance requirements outlined in Part 2: Materials.

1-3 SUBMITTALS: In accordance with section 01300, submit certification of test results by a recognized test laboratory indicating conformance with Paragraph 2-2. Submit samples of colors available.

1-4 WARRANTY: The applicator shall warrant epoxy coating against film failure and deterioration due to defective material. The warranty shall include improper preparation of surfaces, poor workmanship and material for one (1) year from date of acceptance.

PART 2: MATERIALS

2-1 All materials shall be first quality and freshly compounded.

2-2 The materials installed under this Section must have the following:

A. Physical Properties:

	Floor & Base	Wall
Cured hardness shore D (air dry) 7 days at 77°F	68	68
Tensile strength (psi)	7,800	7,600
Tensile elongation (%)	3	6
Flexural strength (psi)	12,500	12,500
Adhesive strength (psi)	230	230
Conical madrel 1/8 inch 77°F	Pass	Pass
Izod impact (foot-pounds per inch notch)	0.40	0.40
Ambering - ASTM D-822 200 hrs.	No Change	No Change
FTMS 141 Abrasion Test Method 6192	97 mg	126.5 mg

B. Performance Properties:

1. Fire resistance - floor and wall; rated as self-extinguishing on asbestos board.

2. Combustibility - Floor and Wall:

Flame Spread	25
ASTM E84 Fuel Combination	5
Smoke Density (non-toxic)	10

3. Chemical Resistance - Floor and Wall: Effect ASTM D-1308-57, 24-hour immersion.

ITEM	EFFECT
Coffee	Nil
Sulfuric Acid 20%	Nil
Brake Fluid	Nil
Motor Oil	Nil
Gasoline	Nil
Water	Nil
Marks - Ink	Slight
Muratic Acid 10%	Slight

C. Epoxy shall be 100% resin solids, floor and base, 90% wall, reacted with suitable hardeners to produce a seamless, monolithic, plastic coating.

D. Aggregate for floor and base application shall be ceramic coated quartz to pass #28 mesh.

PART 3: EXECUTION

3-1 APPLICATION:

A. Material shall be applied by technically trained, factory approved mechanics, using equipment specifically designed for this purpose.

B. Mask off all areas not to receive epoxy coatings.

C. Apply epoxy coatings in accordance with the manufacturer's instructions and to the color and finish as selected.

D. Film thickness on floor and base shall be 80-100 mils.

E. Wall film (primer and finish) 4-6 mils.

F. The floor finish shall be solid color, non-slip. The wall finish shall be solid color, gloss.

G. Allow sufficient time to complete the coating application and at no time shall speed of project completion or unsuitable drying conditions be allowed to detrimentally speed up these operations.

H. All backings must be properly cured and dry.

I. Surface temperature is to be maintained at a minimum of 50°F during application and for a minimum of 48 hours thereafter.

J. Areas to be coated must be kept free of traffic and no other trade shall be allowed to work in the area during the application procedure.

Surface shall be cleaned; remove any dirt, grease, oil, wax or other leterious material.

Joints, cracks, pits, etc., shall be filled with epoxy caulking as commended by the manufacturer.

Concrete surfaces shall be acid etched or mechanically abraded so all rface laitance is removed, then thoroughly flushed.

Prime coat, flood coat, aggregate and finish coat(s) to be applied in quence and with drying time as recommended by the manufacturer.

Form minimum 1-1/2 inch radius cove base with 100% epoxy solids with athered edges.

RT 4: MEASUREMENT AND PAYMENT

1 No separate measurement or payment will be made for this work. It will be nsidered a subsidiary obligation of the Contract under other work to which it lates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing all materials, equipment, supplies, and accessories required and of performing all operations needed in connection with the painting of the various parts of the work.

No paint shall be applied to permanently finished equipment which is considered acceptable by the Contracting Officer.

1-2 QUALITY ASSURANCE: National Association of Corrosion Engineers (NACE); Steel Structures Painting Council (SSPC).

1-3 MATERIALS SUBMITTAL: The paints to be used on the various substrate materials shall be of the best quality commercial and industrial grades and shall be manufactured by nationally known and approved paint manufacturers. In accordance with Section 01300, submit a minimum of 6 copies of a Painting Schedule. This schedule shall give the information listed below for all the paints and stains he intends to use. This shall be done for substituted paints as well as those listed in the painting systems.

A. Name of the manufacturer of the paint;
B. Type of paint (chemical composition type such as alkyd, epoxy, vinyl, etc.);
C. Trade name and number of each specific paint;
D. Number of coats to be applied for each paint;
E. Dry film thickness to be achieved for each coat;
F. Spreading rate at which each coat will be applied;
G. Color name and number accompanied by color chart;

1-4 COLORS: The exact colors to be used on the various substrate materials will be confirmed by the Contracting Officer from color charts provided to him by the Contractor as a portion of the painting schedule. General colors to be submitted upon for use on the various materials are listed below.

Unless specifically instructed otherwise by the Contracting Officer, the following color code shall apply to all piping and equipment connected to it:

Waterlines	Color
Raw or Non Potable	Olive Green
Finished or Potable	Dark Blue

Chemical Lines

Alum	Orange
Carbon Slurry	Black
Chlorine (Gas and Solution)	Yellow
Lime Slurry	Light Green
Potassium Permanganate	Violet

Chemical Lines, except for Chlorine, need not be painted if all white PVC is used.

Waste Lines

Backwash Waste or Sludge	Brown
Sewer (Sanitary or Other)	Dark Gray

Other

Other Lines	Light Gray

1-5 PAINTING SCHEDULE

A tabular summary of the only items to be painted and stained under this contract are listed below. The color and painting system to be used is included in this table. The general painting systems are described in Section 2-2, (some of which may not be used).

	Item	Color	Painting System
1.	Paint all exterior ribbed concrete block walls	Clear	As specified in Section 04230
2.	Paint all interior concrete block walls	Oyster Shell (Tnemec)	A4
3.	Paint interior concrete walls on the chemical storage level	Oyster Shell (Tnemec)	A4
4.	Paint all interior drywall	Oyster Shell (Tnemec)	D1
5.	Paint concrete and block walls and ceiling in carbon feed room 409	Oyster Shell (Tnemec)	A4, D6
6.	Paint all exposed steel surfaces, both interior and exterior, including steel support bridges, platforms, stairs, doors, and frames	Dark Bronze (Tnemec)	B3
7.	Paint all steel surfaces submerged in water, including troughs, weirs, mixers, and steel support members	White	B2

Item	Color	Painting System
3. Paint all exposed steel piping	Piping Color Code	C1 (refer to B3)
9. Paint all exposed ductile and cast-iron piping in all facilities including vaults	Piping Color Code	C2c for bituminous coated (sand blast all non-coated items) C1 (refer to B3) for non-bituminous coated
10. Paint all ductile and cast-iron piping submerged in water	White	C2b for bituminous coated (sand blast all non-coated items C1 (refer to B2) for non-bituminous coated
11. Paint all exposed copper piping	Piping Color Code	C3
12. Paint all exposed PVC piping (See note under I-4)	Piping Color Code	C3
13. Paint all exposed fiberglass piping	Piping Color Code	C3
14. Paint all exposed galvanized piping	Piping Color Code	C1 (refer to B5)
15. Toilet-epoxy floor and base, and shower stall-epoxy floor and wall coatings	Tan	As specified in Section 09720
16. Paint all electrical conduit that is exposed		
A. P.V.C.	Match Wall	C3
B. Galvanized	Match Wall	C1 (refer to B5)
17. Paint exterior aluminum or steel hatches, scuttles	Suede Brown (Tnemec)	B3, B5 or E1
18. Paint vent pipes from tanks and vaults	Suede Brown (Tnemec)	C3 or as applicable

1-6 LABELS AND FLOW ARROWS: All exposed piping shall be labelled with black stencilled letters and flow direction arrows. Letters on major process piping shall be at least 2-inches high. On smaller piping letters shall be no more than 20-feet on center with shorter intervals as required to maintain visible continuity. Labelling and flow arrows shall be located at all wall penetrations.

PART 2: MATERIALS

2-1 DESCRIPTION: The following are the general painting systems. The Painting Schedule to be submitted by the contractor shall contain painting systems approved as equal to those listed below, for each substrate category.

2-2 PAINTING SYSTEMS:

A. Concrete, Concrete Block and Brick Masonry:

1. Exposed, Exterior Concrete Walls, Soffits and Eaves and Exterior Concrete Block Walls

Paint Type: Cementious Waterproofing

Surface Preparation: Substrate surface to be sound, clean and free of dirt, loose mortar, paint, films, protective coating, efflorescence, etc. All steel tie rods and reinforcement to be held or cut back to 3/4-inch from substrate surface and patched tightly with cementious patching material. Dampen surface immediately ahead of application as per manufacturer's directions.

Manufacturer: Standard Dry Wall Products Company

Paint Name and No.	Dry Mil Thickness	Spreading Rate
Coat No. 1 Thoroseal	80 (3/32 inch ±)	2 lb. Dry sq.yd.
Coat No. 2 Thoroseal	40 (1/32 inch ±)	1 lb. Dry sq.yd.

Use Acryl 60 and clean water for mixing liquid at rate of one part Acryl 60 to 3 parts clean water. A 50-pound bag of Thoroseal will require about 2 gallons of mixing liquid. (Two quarts Acryl 60 and 6 quarts clean water.)

2. Interior Concrete Block Walls, and Concrete Walls (Concrete Walls Only Where Designated to be Painted)

Paint Type: Cementious Waterproofing

Surface Preparation: Substrate surface to be sound, clean and free of dirt, loose mortar, paint, films, protective coatings, efflorescence, etc. All steel tie rods and reinforcement to be held or cut back to 3/4-inch from substrate surface and patched tight with cementious patching material. Dampen surface immediately ahead of application as per manufacturer's directions.

Manufacturer: Standard Dry Wall Products Company

Paint Name and No.	Dry Mil Thickness	Spreading Rate
Coat No. 1 Thoroseal	80 (3/32 inch ±)	2 lb.Dry/sq. yd.
Coat No. 2 Thorosheen Acrylic	3	200 sq.ft./gal.

For Thoroseal, use Acryl 60 and clean water for mixing liquid at a rate of one part Acryl 60 to three parts clean water. A 50-pound bag of Thoroseal will require about 2 gallons of mixing liquid. (Two quarts Acryl 60 and 6 quarts clean water.)

3. Interior/Exterior Concrete and Concrete Block

Paint Type: Acrylic Base Clear Sealer

Surface Preparation: Substrate surface to be sound, clean, free of dirt and stains, loose mortar, paint, film protective coatings, efflorescence, etc. and be dry. Apply coats as recommended by manufacturer.

Manufacturer: Process Solvents

Paint Name and No.	Dry Mil Thickness	Spreading Rate
Sure Clean Weather Seal 209	N/A (Penetrating)	120 sq.ft./gal.

4. Interior Concrete and Block walls.

Paint Type: Polyamide Epoxy

Surface Preparation: Substrate surface to be sound, clean and free of dirt, loose mortar, paint, insulation, insulation glue and mastic films, protective coating, efflorescence, etc. All steel tie rods and reinforcement to be held or cut back to 3/4-inch from substrate surface and patched tight with cementious patching material. Patch any other defects as directed. Prepare surfaces by etching with solution containing 1 part muriatic acid to 2 to 4 parts fresh water. Rinse with clean water under pressure while scrubbing with stiff brushes or brooms. Test with pH paper and continue rinsing until pH of 7 or higher is obtained. Remove excess water by brooms or squeegees and allow to dry thoroughly before coating.

Manufacturer: Tnemec

Paint Name and No.	Dry Mil Thickness	Spreading Rate
Coat No. 1 Hi-Build Epoxoline 66	5 plus or minus 1	175 sq.ft./gal.
Coat No. 2 Hi-Build Epoxoline 66	5 plus or minus 1	175 sq.ft./gal.

5. Interior Concrete Floors.

Paint Type: Polyamide Epoxy, Sanded

Surface Preparation: Remove oil or dirt. Allow concrete to cure a minimum of 28 days for complete curing and dryout. Prepare surfaces by etching with solution containing 1 part muriatic acid to 2 to 4 parts fresh water. Rinse with clean water under pressure while scrubbing with stiff brushes or brooms. Test with pH paper and continue rinsing until pH of 7 or higher is obtained. Remove excess water by brooms or squeegees and allow to dry thoroughly before coating.

Add 5 pounds of 50 mesh dry washed silica sand to each gallon of mixed material used for the top coat.

Manufacturer: Tnemec

Paint Name and No.	Dry Mill Thickness	Spreading Rate
Coat No. 1 Tneme Tread Series 67	2.5 plus or minus .5	360 sq.ft./gal.
Coat No. 2 Tneme Tread Series 67	2.5 plus or minus .5	360 sq.ft./gal.

B. Steel, Structural and Plate:

1. Interior/Exterior Steel - Submerged in Sewage

Paint Type: Coal Tar Epoxy

Surface Preparation: Remove all grease, oils, and contaminants. Remove all weld splatters and grind rough and sharp welds to smooth rounded contour and blast clean to near-white metal finish (NACE No. 2). Surface to be dry.

Manufacturer: Tnemec

Paint Name and No.	Dry Mil Thickness	Spreading Rate
Coat No. 1 37-77 Chem-Prime	2.5 plus 1 or minus 0.5	290 sq.ft./gal.
Coat No. 2 413 Tneme-Tar	9 plus or minus 1	125 sq.ft./gal.
Coat No. 3 413 Tneme-Tar	9 plus or minus 1	125 sq.ft./gal.

Note: Coat No. 1 shop prime may be eliminated for material which is surface prepared at job-site.

2. Interior/Exterior Steel - Submerged in Water (Potable Water Safe)

Paint Type: Polyamide Epoxy

Surface Preparation: Remove all grease, oils and contaminants. Remove all weld splatters and grind rough and sharp welds to smooth rounded contour and blast clean to near-white metal finish (NACE No. 2). Surface to be dry.

facturer: Tnemec

t Name and No.	Dry Mil Tnickness	Spreading Rate
No. 1 Pota-pox Primer 20-1255	4 plus or minus 1	215 sq.ft./gal.
No. 2 Pota-pox 20-2000	4 plus or minus 1	215 sq.ft./gal.
No. 3 Pota-pox 20-2000	4 plus or minus 1	215 sq.ft./gal.

Interior/Exterior Steel Railings, Doors, Miscellaneous Metalwork - Not erged but Exposed to Moist Atmosphere and/or Sunlight and Weather

t Type: Aliphatic Polyurethane semi gloss Enamel over polyamide epoxy.

ace Preparation: Remove all grease, oils and contaminants. Remove all splatters and grind rough and snarp welds to smooth rounded contour and st clean to near-white metal finish (NACE No. 2). Surface to be dry.

facturer: Tnemec

t Name and No.	Dry Mil Tnickness	Spreading Rate
No. 1 Hi-Build Epoxoline 56	5 plus or minus 1	175 sq.ft./gal.
No. 2 71-Color Endura-Shield	1.5 minimum plus 1.0	555 sq.ft./gal.

Interior/Exterior Steel - Not submerged, Very Mild Exposure

: Type: Semi-Gloss Alkyd Enamel

ace Preparation: Remove all grease, oils and contaminants. Remove all splatters and grind rough and sharp welds to smooth rounded contour and clean to near-white metal finish (NACE No. 2). Surface to be dry.

facturer: Tnemec

: Name and No.	Dry Mil Thickness	Spreading Rate
No. 1 37-77 Chem-Prime	2.5 plus 1 or minus 0.5	290 sq.ft./gal.
No. 2 23 Enduratone	2.5 plus 1 or minus 0.5	400 sq.ft./gal.
No. 3 23 Enduratone	2.5 plus 1 or minus 0.5	400 sq.ft./gal.

Interior/Exterior Galvanized Steel Surfaces

Type: Aliphatic Polyurethane semi-gloss enamel over Polyamide Epoxy

Surface Preparation: Remove all grease, oils and contaminants with solvents recommended by the specific paint manufacturer. Apply etching solution and flush off in accordance with specific paint manufacturer's recommendations. All surfaces to be dry.

Manufacturer: Tnemec

Paint Name and No.		Dry Mil Thickness	Spreading Rate
Coat No. 1	Hi-Build Epoxoline 66	5 plus or minus 1	175 sq.ft./gal.
Coat No. 2	71-Color Endurasnield	1.5 minimum plus 1.0	555 sq.ft./gal.

C. Piping:

1. Steel; and Ductile and Cast Iron without exterior Bituminous Coating: See painting systems B1 through B5.

2. Ductile and Cast Iron, Bituminous Coated:

a. Submerged in Sewage: Use painting system B1 but eliminate sandblasting. Sandblast all non-coated items.

b. Submerged in Water: Use painting system B2 but eliminate sandblasting. Sandblast all non-coated items.

c. Not submerged, but exposed to moist environment and/or sunlight: Use painting system B3 except eliminate sandblasting and use two 5 dry mil coats of Polyamide Epoxy (Hi-Build Epoxoline 66) and then one coat of Aliphatic Polyurethane. Sandblast all non-coated items.

3. Copper Piping, Plastic Piping and Fiberglass Piping (and small tanks): Do not paint when submerged. For other applications use:

Paint Type: Aliphatic Polyuretnane semi-gloss Enamel over Polyamide epoxy.

Surface preparation: Prepare according to manufacturers' recommendation for each specific application. Remove all grease, oils and contaminants. Surface to be dry.

Manufacturer: Tnemec

Paint Name and No.		Dry Mil Thickness	Spreading Rate
Coat No. 1	Hi-Build Epoxoline 66	5 plus or minus 1	175 sq.ft./gal.
Coat No. 2	71-Color Endura-shield	1.5 minimum plus 1.0	555 sq.ft./gal.

Wood and Drywall:

Interior/Exterior Wood and Drywall - Walls, Ceilings, Doors, Trim, etc. exposed to continually wet conditions:

int Type: Semi-gloss Alkyd Enamel

face Preparation: Remove all grease, oil, and contaminants. Putty all l holes. Sand smootn. Surface to be dry.

ufacturer: Tnemec

nt Name and No.	Dry Mil Thickness	Spreading Rate
Drywall:		
: No. 1 51-792 PVA Sealer	1.5 plus or minus 0.5	325 sq.ft./gal.
Wood:		
: No. 1 36-603 Undercoater	2.5 plus or minus 0.5	320 sq.ft./gal.
Both:		
. No. 2 Series 23 Enduratone	2 plus 1 or minus 0.5	400 sq.ft./gal.
. No. 3 Series 23 Enduratone	2 plus 1 or minus 0.5	400 sq.ft./gal.

Interior/Exterior Wood and Drywall - Walls and Ceilings not exposed to conditions. See 6 below for splash and continually wet condtions:

t Type: Flat Acrylic Latex

ace Preparation: Remove all grease, oil and contaminants. Putty all holes. Sand smootn. Surface to be dry.

facturer: Tnemec

t Name and No.	Dry Mil Thickness	Spreading Rate
No. 1 36-603 Undercoater Wood only:	2.5 plus or minus 0.5	320 sq.ft. gal.
No. 2 Series 6 Tneme-Cryl	2 plus or minus 1	265 sq.ft./gal.
No. 3 Series 6 Tneme-Cryl	2 plus or minus 1	265 sq.ft./gal.

Interior/Exterior Wood - Semi Transparent Stain:

in Type: Alkyd-Resin Stain

face Preparation: Remove all grease, oil and contaminants. Surface to ry.

Manufacturer: Olympic

Stain Name and No.		Spreading Rate
Coat No. 1	Olympic Semi-Transparent Stain	150 sq.ft./gal.
Coat No. 2	Olympic Semi-Transparent Stain	250 sq.ft./gal.

4. Interior/Exterior Wood - Heavy Bodied Stain:

Stain Type: Aklyd-Resin Stain

Surface Preparation: Remove all grease, oil and contaminants. Surface to be dry.

Manufacturer: Olympic

Stain Name and No.		Spreading Rate
Coat No. 1	Olympic Solid Color Stain	150 sq.ft./gal.
Coat No. 2	Olympic Solid Color Stain	250 sq.ft./gal.

5. Exterior Wood - Clear, Wood Preservative:

Paint Type: Pentachlorophenal Penetrating Resin

Surface Preparation: Remove all grease, oil and contaminants. Surface to be dry.

Manufacturer: Woodlife

Paint Name and No.		Spreading Rate
Coat No. 1	Woodlife	150 sq.ft./gal.
Coat No. 2	Woodlife	150 sq.ft./gal.

6. Interior Wood and Drywall exposed to splash and wet conditions:

Paint Type: Polyamide Epoxy

Surface Preparation: Remove all grease, oil, and contaminants. Putty all nail holes. Sand smooth. Surface to be dry.

Manufacturer: Tnemec

Paint Name and No.	Dry Mil Thickness	Spreading Rate
For Wood:		
Coat No. 1 Hi-Build Epoxyline 66	2.5 plus or minus 0.5	see mfg.
Coat No. 2 Hi-Build Epoxyline 66	2.5 plus or minus 0.5	see mfg.
For Drywall:		
Coat No. 1 51-792 PVA Sealer	1.5 plus or minus 0.5	325 sq.ft./gal.
Coat No. 2 Hi-Build Epoxoline 66	5 plus or minus 1	175 sq.ft./gal.
Coat No. 3 Hi-Build Exoxoline 66	5 plus or minus 1	175 sq.ft./gal.

E. Aluminum

1. Interior/Exterior Aluminum: Use painting system B5.

PART 3: EXECUTION

3-1 SURFACE PREPARATION: Surface preparation of each substrate material shall be as described in the painting systems breakdown and completed prior to beginning the painting operation.

All structural steel, metalwork, piping, and other metal surfaces to be painted shall be thoroughly cleaned of grease, oil, and contaminants by the use of solvents recommended by the manufacturer of the paint which will be applied. When blasting is required in the surface preparation of a painting system, the blasting shall be performed within conformance of the "Standard for Surfaces of New Steel Airblast Cleaned with Sand Abrasive" as written by the National Association of Corrosion Engineers, 2400 West Loop South, Houston, Texas.

Acceptance of final blasted steel surfaces will be made by the Contracting Officer utilizing the visual standards test method No. NACE TM-01-70 to visually compare the specified NACE surface with the steel actually being blasted. NACE standards of quality are called out for each painting system where blasing is required as a portion of the surface preparation. The Steel Structures Painting Council (SSPC) through its specifications recognizes several methods of surface preparation as being equivalent to the NACE standards. The NACE and SSPC standards referred to are:

NACE No. 1:	SSPC-SP-5	White Metal Blast
NACE No. 2:	SSPC-SP-10	Near-White Blast
NACE No. 3:	SSPC-SP-6	Commercial Blast
NACE No. 4:	SSPC-PS-7	Brush-Off Blast

The Contractor shall continue to blast the surface of the steel until such time as the Contracting Officer is satisfied that the steel being blasted is of a quality equal to the specified NACE grade.

All dust created by the blasting operation must be removed immediately after the blasting operation by vacuuming. The first coat of paint should be applied to the steel as soon as possible and always the same day that the blasting is done.

3-2 MANUFACTURER'S RECOMMENDATIONS: All paint and stain shall be mixed and applied with strict conformance to the paint manufacturer's directions, which will take precedence over this specification. Selection of paints to be applied to each specific substrate material shall be verified with the paint manufacturer and his approval obtained.

3-3 WRITTEN APPROVAL OF COATINGS MANUFACTURER: For all coatings to be applied to new and existintg concrete, concrete block, plaster and asbestos cement paneling, written approval shall be obtained from the coatings manufacturer for the items listed below. Six copies of this written approval shall be submitted to the Contracting Officer after the coatings manufacturer has personally inspected each of the following conditions:

A. Final surface preparation of all surfaces prior to coating application.

B. Sequencing of application of coatings as to when each surface of each wall and ceiling shall be coated.

This is intended to keep the coatings manufacturer informed of the status of the job at all times so that he can govern the application process to be assured that all coatings are applied within his recommendation.

3-4 SHOP APPLIED PRIME COAT: Any prime coat which shall be shop applied shall meet the requirements stated in this specification. The manufacturers of such items shall submit the information required in paragraph 1-3 of this section, for each manufactured item. The Contractor shall coordinate shop prime coat painting and finish coat painting to insure compatibility.

3-5 APPLICATION METHODS: Exterior painting shall not be done during damp or freezing weather. Paint manufacturer's directions for cold weather applications shall be followed explicitly. All fresh work shall be protected from damage. For interior work, the temperature shall not be allowed to fall below 60 degrees F. while paint is being applied, or while it is drying.

All paint shall be evenly applied in a uniform coat. The finished painting shall show no drops, runs, or sagging of materials.

In addition to preparatory sanding, each coat, except the last, shall be fine-sanded. Avoid cross scratches and swirls.

Each coat of paint shall be given at least 48 hours to dry before the next coat is applied, unless otherwise directed by the manufacturer's instructions.

Any walls that are to have dampproofing applied thereto, will be marked with chalk lines to the approval of the Contracting Officer to establish a clean-cut line at which the dampproofing stops.

All metalwork which has been shop-painted with rust-inhibitive prime coat shall be handled with care to preserve such coating. Before painting, the Contractor shall repaint all defective or damaged areas with an approved prime coat after cleaning and removing rust.

On metal surfaces, each coat of paint shall be applied at the rate specified to achieve the average dry mil thickness required. Allowable maximum variations from the average are given, however the average must be achieved. Deficiencies in the average or in the maximum variation must be corrected. On concrete and/or masonry, application rates will vary according to surface texture. However, in no case shall the stated spreading rate be exceeded. On porous surfaces, a protective and decorative finish shall be achieved. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint. Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times will be necessary. Additional coats of paint shall not be applied, nor shall units be returned to service until paints are thoroughly dry.

Where thinning is necessary, only the products of the manufacturer furnishing the paint, and for the particular purpose, shall be allowed, and all such thinning shall be done strictly in accordance with the manufacturer's instructions, as well as with the full knowledge and approval of the Contracting Officer. All coats will be of the same color except where specified differently.

Paint both faces and all edges of doors which require painting. Doors between rooms having different finishes shall have edges finished to match the room the door opens into.

Knife-putty nail holes upon the priming coat with putty tinted to color of finished work. Putty full and flush with surrounding surfaces; thumb-puttying will not be permitted. Permit to dry and harden before applying next coat.

3-6 CLEAN-UP/TOUCH-UP WORK: Upon completion, carefully remove all spatterings of paint material from adjoining work, glass, plumbing fixtures, trim and concrete surfaces. A detailed inspection of paint work shall be made and disfigured portions thereof shall be satisfactorily touched up or refinished to produce an acceptable job. All disused implements of service, rubbish and debris, resulting from the work shall be removed from the premises and the entire project left in a neat, clean, and acceptable condition.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing and installing toilet accessories as indicated and herein described.

1-2 STANDARDS: Meet the requirements and recommendations of the applicable portions of standards listed.

Federal Specification, FS WW-P-541/8A.

1-3 QUALITY CONTROL: Model numbers included for toilet room accessories and miscellaneous are items manufactured by Bobrick and are listed as a standard of quality. Products of other manufacturers may be used if approved by Contracting Officer.

1-4 SUBMITTALS: In accordance with Section 01300, provide catalog cuts of all items. These are to include functional description and installation requirements.

PART 2: MATERIALS

2-1 MATERIALS:

A. Stainless Steel: Type 302, No. 4 finish.

B. Brass: Cast or forged quality alloy conform to FS WW-P-541D/GEN.

C. Aluminum: Cast quality conform to FS WW-P-541D/GEN.

D. Mounting Devices: With bonderized finish.

2-2 ACCESSORIES:

A. Accessories shall be as manufactured by Bobrick or approved equal:

1. Paper towel dispenser and waste receptacle, Model No. B-369. (Located in rooms where indicated).

2. Toilet tissue dispenser, Model No. B-685. (One each toilet.)

3. Soap dispenser, Model No. B-823. (Locate where indicated.)

4. Mirror, Model No. B-165 2448.

5. Soap dish and grab bar, Model No. B-439.

6. Shower curtain rod, Model No. B-204.

7. Shower curtain hooks, Model No. B-204-1 (8 each per rod).

8. Clothes hook, Model No. B-222.

9. Shower curtain, Model No. B-204-2.

2-3 FABRICATION:

A. Fabricate recessed units with seamless one-piece flange on exposed face.

B. Locked dispensing units: Key alike for all accessories.

C. Weld corners, leaving no open miters.

D. All equipment except grab bars minimum 22 gauge.

PART 3: EXECUTION

3-1 INSPECTION:

A. Check opening schedule to receive recessed units for correct dimensions, plumbness of blocking or frames, preparation that would affect installation of accessories.

B. Check areas to receive surface mounted units for conditions that would affect quality and execution or work.

C. Do not begin installation of washroom accessories until openings and surfaces are acceptable.

3-2 INSTALLATION:

A. Drill holes to correct size and make application so that work to surface is concealed by item with 1/4" tolerance.

B. Mount recessed accessories into wall openings with wood screws through cabinet side into wood blocking, or sheet metal screws into metal frames.

C. Mount surface mounted accessories to conceal anchors.

3-3 ADJUST AND CLEAN

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surface

C. Deliver keys and instruction sheets to Contracting Officer.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing laboratory furniture and fixtures.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Interior Piping and Plumbing - Section 15203; Heating and Ventilation - Section 16350; General Electrical - Section 16010.

1-3 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM).

The laboratory furniture shall be approved equal to furniture manufactured by Hamilton.

PART 2: MATERIALS

2-1 WORKING SURFACES: Counter tops shall consist of a molded resin that shall be highly chemical and corrosion resistant, especially compounded, and cured to give optimum physical and chemical resistance properties required of heavy-duty laboratory equipment. Top shall be 1-1/4-inch thick. All joints shall be made with a highly chemical and corrosion resistant cement having the same properties as the base material. It shall be similar and equal to Hamilton Corrocast 20L122. Overall dimensions: 30 inches wide.

The counter tops shall have a 6-inch high continuous splash back curb. The curb shall be of the same material as the counter top.

The counter tops and cabinets shall be installed to provide an undercounter space 7-inches deep between the back of the cabinets and the walls. These spaces shall be utilized for the various service lines and fittings.

2-2 LABORATORY SERVICE FITTINGS: Water, fittings, where shown or specified, shall be furnished in accordance with this specification. Fitting bodies for plumbing services shall be of red brass with a minimum of 85 percent copper, and for gas or steam services shall be of high-grade brass forgings (SAE-88) with a minimum of 60 percent copper. Fittings shall be polished chrome plated.

All hot and cold water fixtures shall be of the manual operation type. Fixture design shall permit simple field conversions, and full interchangeability from manual to self-closing and self-closing to manual on all hot and cold water fixtures.

A. Water fittings shall be gooseneck type with replaceable cartridge, interior working unit. Cartridge housing shall be formed of non-metallic, non-corrosive 30 percent glass-filled NORYL plastic. Non-longitudinal shifting operating

stem shall be of red brass and sealed at the housing with a Buna-N "O" ring. Flow control valve shall consist of two polished, lapped, inert ceramic discs having shaped fluid ports for precise flow rate control through a 90 degree rotation. Lubricant shall be FDA approved. Slicing action of the discs shall cut the fluid instead of blocking it. Working unit shall be non-contaminating and be held in place with a cap nut and sealed to faucet body with two Buna-N "O" rings. All faucets shall have four arm type handles with snap-in, tamper-proof index buttons for permanent indentification of service.

All spout outlets shall have female 3/8-inch I.P.S. threads for the attachment of filter pumps, anti-splash spout ends or 3/4-inch hose connector. Each outlet shall have, as standard equipment, a removable hose connection with ten serrations.

Goosenecks shall provide a minimum clearance of 7-1/2 inches between outlet and table top, with two 90 degree bends to direct water flow vertically onto sinks for minimum splashing. A union type of connection employing two "O" ring seals and cap nut shall attach gooseneck to faucet body, permitting faucet and gooseneck to be installed in any fixed position, and shall permit field conversion to swinging type gooseneck with the removal of a washer. Gooseneck shall be 3/8-inch brass pipe, 0.090 wall thickness. Combination hot and cold water fitting shall have one piece cast body. Vacuum breakers shall be installed on all potable water fixtures in the laboratory.

B. Ground key cocks shall be of heavy construction with tapered body and plug hand lapped, ground sealed. A spring retainer, providing automatic take-up between plug and body, shall be provided. All cocks shall withstand a maximum pressure of 50 pounds per square inch without leakage, and be designed for one-quarter turn quick "ON" or "OFF" control. Tapered, integral long lever type, with snap-in, tamper-proof index buttons for permanent identification of service, color codes for the service used.

C. Sinks and trim shall be molded resin of the sizes specified and shall be complete with molded resin sink strainer, plug and tailpiece. The sink in Unit B shall be similar and equal to Hamilton Corrocast Sink 52L364. Overall dimensions: 18 inches long, 15 inches wide, 8 inches deep.

D. The safety eyewash shall be table top mounted. The eyewash shall include a hand held spray nozzle, a push down to activate valve and a vacuum breaker. The spray nozzle shall be rubber bound and shall have a soft stream flow. The spray shall be equipped with an eight-foot hose that retracts into the counter. The safety eyewash shall be similar and equal to Hamilton Model 32L346.

2-3 PEGBOARD: Pegboard shall be provided with no less than 23 pegs. Board proper shall be of Hamilcore finish all around. Pegs shall be of solid polypropylene of the following sizes: 1/2-inch by 7-5/8 inches, 3/8-inch by 6-1/8 inches and 3/8-inch by 4-5/8 inches. Base of peg shall be 1-1/2 inch diameter with two 5/8-inch long studs on backside which shall insert into the board. Pegs shall not be bonded into the board, but shall be held in by mechanical design. It shall be similar and equal to Hamilton Hamilcore 52L811. Overall dimensions: 24 inches wide, 30 inches high.

2-4 CABINET AND FURNISHINGS SCHEDULE: The item letters given in the schedule below refer to the cabinets and funishings as numbered on the drawings of the laboratory layout.

A. Combination Unit - 24 inches wide, one finished and one unfinished end, similar and equal to Hamilton 2W154.

B. Sink Base - 35-1/2 inches wide, unfinished ends, similar and equal to Hamilton 2W221.

C. Drawer Unit - 24 inches wide, unfinished ends, similar and equal to Hamilton 2W184.

D. Combination Unit - 35-1/2 inches wide, one finished and one unfinished end, similar and equal to Hamilton 2W245.

E. Combination Unit - 35-1/2-inches wide, unfinished ends, similar and equal to Hamilton 2W281.

F. Wall Case - 35-1/2 inches wide, 12 inches deep, framed glass hinged doors, finished ends, similar and equal to Hamilton 8W33.

PART 3: EXECUTION

3-1 WOOD CONSTRUCTION: The construction of the wooden cabinets, doors, drawers, etc. shall meet or exceed the minimum standards given below.

A. CONSTRUCTION MATERIALS: All solid woods shall be hardwood lumber, clean and free from defects, kiln dried at manufacturer's plant to moisture content of 5-1/2 percent. Exposed exterior wood to be Northern Hard Maple. Exposed interior wood to be hardwood as specified. Drawer sides, backs, solid hardwood, clear and sound, unselected for color.

Plywood shall be thickness specified, consisting of cross and face plys glued with water resistant resin glue.

Composition board shall be composed of wood fibers and resin binder formed under head and pressure, in thickness specified.

Welded fiber shall be sheets of wood fibers, pressed in heated hydraulic presses and bound with a lignin binder.

Glass shall be 1/8-inch thick double strength, of high quality without imperfections, with unmarred surfaces.

Glue shall be moisture resistant, with gluing done in modern gluing clamps.

B. CONSTRUCTION AND DESIGN: Square edge flush overlap to provide dust proof cabinet and case interiors with overlap all sides of drawer fronts and swinging doors. All joints mortise and tenon, glued and screwed, using jigs and clamps to insure square corners.

Unexposed ends 3/4-inch plywood with 1-inch by 3/4-inch maple facer. Exposed ends same as unexposed with 3/16-inch applied exterior panel of maple veneer.

Front top rail, L shaped of two pieces 3/4-inch hardwood, exposed piece maple, grooved and glued together, mortised, tenoned, glued and screwed to cabinet ends.

Back top rail hardwood 3/4-inch by 6-3/8-inch with groove for cabinet back mortised, tenoned, glued and screwed to cabinet ends.

Front bottom rail 1-inch x 3-3/8-inch backed up with 3/4-inch hardwood rail, both mortised, tenoned and glued to cabinet ends. Toe space 4 inches high by 2-1/2 inches deep. Toe space rail solid hardwood. Plywood not acceptable.

Cupboard bottoms 3/8-inch plywood, set flush, grooved into cabinet ends.

Cupboard backs removable, of 3/16-inch thick composition board.

Vertical divisions, 1-inch plywood with 1-inch x 3/4-inch maple facer, grooved and glued into top, back and bottom rails and to extend to floor.

Horizontal frames of maple below all drawers, blind mortised, tenoned, glued and screwed into vertical division panels and ends. 1/8-inch welded fiber in frames when keyed different locks specified.

Ends and back rails grooved for "Z" irons, holes for screws in front top rail.

Shelves 3/4-inch plywood with front edge hardwood faced, adjustable 2-inch centers on plated steel slips. Plastic clips not acceptable.

Drawers to have 5/8-inch sides, with 1/8-inch machined on side guide, 3/4-inch solid maple fronts and 1/2-inch back. Bottom 3/16-inch welded fiber grooved into all sides. In addition, drawer to have corrosion resistant plastic stop, and groove in front, sides and back for partition clips.

Drawer to have extruded aluminum pull with clear anodized finish. Two pulls and two hardwood center guides on drawers over 30 inches.

C. CASES, WALL UPPER AND TALL STORAGE: Unexposed ends 3/4-inch plywood with 1-inch x 3/4-inch maple facer.

Exposed ends same as unexposed with 3/16-inch applied panel of maple veneer.

Top rails 3/4-inch x 1-5/8 inch or 1-inch x 3-inch for sliding doors. Bottom rails upper cases 3/4-inch x 2-1/2 inch, tall storage cases 3/4-inch x 4-5/8-inch, all rails tongue and grooved ends. Bottom 3/8-inch plywood grooved into ends.

Backs 1/4-inch plywood, those over 48 inches wide reinforced with mullion. Grooved into top, bottom and ends.

Shelves 3/4-inch thick plywood, hardwood faced on top, bottom and front surfaces, adjustable 2-inch centers on steel supports.

). DOORS, SWINGING, SLIDING, SOLID OR GLAZED: Hinged doors to 36 inches high, two 2-inch hinges. Doors over 36 inches and to 48 inches, two 3-inch hinges. Doors over 48 inches, three 3-inch hinges. Left hinged door with ntegral astragal, overlapped by right door. Doors have extruded aluminum pulls with clear anodized finish, roller type and elbow catches.

Sliding doors operate in groove at top, nylon glide and resin track at bottom. Doors have recessed satin chrome pull.

Doors up to 36 inches high 25/32-inch thick 5 ply, composition core, cleated our edges. Those up to 58 inches high 1-inch thick, 34 inches high 1-1/4-nch thick, 5 ply floating core construction, consisting of core cleated with olid hardwood rails and stiles. Faces 3 ply maple, over hardwood crossband. oors exposing end grain of core on top edge, not acceptable.

ramed glass doors 1-inch or 1-1/4-inch solid maple, those 48 inches to 84 nches high have intermediate rail. All joints mortised, tenoned and keyed. etaining molding vinyl extrusion.

. TABLE FRAMES: Rails 1-inch x 4-1/2-inch maple, hardwood cross rails, rooved for "Z" irons and steel corner braces.

-2 INSTALLATION: All laboratory furniture shall be installed as shown on he drawings and shall result in a unified built-in look without gaps between ndividual units, or between the units and the walls of the laboratory, unless a gap is shown.

ART 4: MEASUREMENT AND PAYMENT

-1 No separate measurement or payment will be made for this work. It will e considered a subsidiary obligation of the Contract under other work to hich it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing two work benches.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201.

1-3 QUALITY ASSURANCE: The work bench approved similar and equal to Grainger's Catalog No. 7 W087.

PART 2: MATERIALS

2-1 GENERAL: The work bench shall be 72 inches wide, 36 inches deep, and 34 inches high. The legs shall have a flared T-section and shall be 14-gage steel with 1/2-inch punched base plates. The legs shall have an enamel finish. The bench top shall be manufactured of laminated wood with tempered top and bottom surfaces. The top shall be 1-1/2-inches thick and rated at 00 pounds per square foot. The bench shall be provided with a steel lower shelf and a 20-gage steel drawer.

PART 3: EXECUTION

3-1 HANDLING: Care shall be exercised to protect the work bench from damage during handling, storage and installation.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

ART 1: GENERAL

-1 DESCRIPTION: The work of this section consists of providing and nstalling pre-dimensioned dock bumpers as indicated.

-2 QUALITY CONTROL: Pawling Rubber Corporation laminated impact bumper XL-12 is given as a standard of quality and required function. Products of ther manufacturers may be used if approved as equal by Contracting Officer.

ART 2: MATERIALS

-1 BUMPERS: 4-1/2 inches x 12 inches in section of laminated rubberized ruck tire fabric.

-2 ANCHOR BOLTS: Cadmium plated, length as required to provide 3 inches inimum anchorage into concrete.

ART 3: EXECUTION

-1 INSTALLATION:

. Securely attach bumpers to face of concrete dock.

. Set anchor bolts by use of templates.

ART 4: MEASUREMENT AND PAYMENT

-1 No separate measurement or payment will be made for this work. It will be nsidered a subsidiary obligation of the Contract under other work to which it lates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of installation of the flexible impervious membrane and all related finish earth work in the raw water reservoir and backwash ponds.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Clearing and Grubbing - Section 02102; Demolition - Section 02110; Excavation and Backfill - Section 02221.

1-3 QUALITY ASSURANCE: Refer to American Society for Testing and Materials (ASTM), provide certified test results of the liner by an independent laboratory.

1-4 SUBMITTALS: Submit manufacturer's literature, samples and affidavit of compliance with ASTM standards for the liner. Provide shop drawings of all fasteners and liner boots. Provide data regarding manufacturer's recommendation for field fabrication.

1-5 PRODUCT HANDLING: Handle and protect liner according to manufacturer's recommendations and as directed by the Contracting Officer. Liner to be kept covered at all times and as additionally required by manufacturer to assure field fabrication.

PART 2: MATERIALS

2-1 FLEXIBLE MEMBRANE LINER:

A. Flexible liner shall be hypalon or approved equal chlorosulfonated polyethylene, warranted free of defects in materials and workmanship. Material shall carry 20 year warranty covering weathering.

B. Flexible liner and adhesive solvents shall be certified suitable for potable water contact by the EPA.

C. Thickness of the chlorosulfonated polyethylene shall be 30 mil nominal, 14 mil $\pm$ 1 mil on each side of the reinforcing fabric.

D. Tongue tear of finished fabric: 80 pounds, ASTM-D-751.

E. Fabric Strength: 200-pound warp, 200-pound fill ASTM D-751 grab method.

F. Ozone resistance: ASTM D1149, 3 ppm at 30 percent strain at 104°F. for 70 hours - no effect.

G. Reinforcement: Fabric reinforcement shall be minimum 10 x 10 x 1000 denier plain weave polyester scrim, tensile strength of fabric reinforcement shall be minimum 150 pounds warp and 150 pounds fill. ASTM D751, grab method.

2-2 SOLVENT, BONDING AGENTS, MASTICS: As recommended by the manufacturer of the liner.

2-3 CLAMPS, ANCHOR CLAMPING BARS AND MISCELLANEOUS HARDWARE: Clamping bars are to be stainless steel or annodized aluminum, bar stock to be minimum 1/4 inch by 1-1/2-inch.

Anchors to be minimum 1/2-inch diameter by sufficient length to anchor into 4 inches of competent concrete.

Clamps to be stainless steel and minimum width of 3/4-inch.

2-4 SUBGRADE MATERIAL UNDER LINER: One foot earth thickness under liner must be approved fine grained soil (sand, silty or clayey sand, or sandy clay) with no rocks, gravel, sharp or angular particles, or other objectionable material. The Contractor will process on excavated material from project or import sand. All material will be sampled, tested and approved to determine that there are no objectional characteristics due to wetting.

PART 3: EXECUTION

3-1 ROUGH GRADING: As indicated by the drawings, the site will be graded to receive the liner. Work will include all excavation, borrow material acquired from other project excavations and fill placement and compaction.

3-2 COMPACTION AND FINISH SURFACE:

A. Surface under flexible membrane: The top 1 foot of soil remaining after excavation shall be scarified and worked until the moisture content is within 6.0% plus or minus of optimum moisture content or to the moisture content required to allow compaction. The top 1 foot of soil shall then be compacted to at least 95% standard Proctor density (ASTM D698-70). Finish surface shall be free of stones, sticks, or other protuberances. Sand cushion over such protuberances will not be acceptable.

B. Side slopes: Side slopes shall be graded 3 horizontal to 1 vertical or flatter. Additional grading as may be required by the contractor to facilitate installation of the liner shall be submitted for approval.

3-3 APPURTENANCES: The contractor will carefully measure all structures, pipes and miscellaneous items which will require openings through the liner. From these measurements shop drawings will be provided showing the details and modifications necessary to those shown in the construction drawings. The Contracting Officer will review, modify, and approve these shop drawings before any fabrication takes place.

3-4 FLEXIBLE LINER PLACEMENT: The liner shall not be placed in contact with sticks, stones, or other objects capable of causing puncture or damage to the liner.

During installation of the liner a manufacturer's qualified representative will be provided.

3-5 FIELD SEAMS: Field seams shall be kept to a minimum. Field seaming shall be by solution adhesives. Seam strength shall exceed that of parent material when tested according to ASTM D-816, Method B.

3-6 LINER PROTECTION: Prior to installation the membrane must be properly shielded from light.

3-7 FACTORY SEAMS: Factory seams strength shall exceed that of parent material when tested according to ASTM D-816, Method B.

3-8 DAMAGE DURING INSTALLATION: Holes, tears, or other damage caused during installation shall be immediately repaired. Lining shall be protected from undue abuse during construction.

3-9 FILLING RESERVOIR: Contractor shall fill the reservoir as soon as possible after completion of lining operations.

3-10 LEAKAGE TOLERANCE: Leakage tolerance shall not exceed the tolerance as set by the following formula:

$$Q = \frac{A \quad H}{80}$$

Where A = area in thousands of sq.ft., H = maximum water depth in feet. Q = maximum leakage tolerance in gallons per minute.

The Contractor shall assist the Contracting Officer in completing a leakage test for a continuous 48 hour period. Until such time that satisfactory results are obtained, the Contractor will be responsible to find and correct leakages. Satisfactory results in no way relieve the Contractor of his Contract obligation and/or project guaranty.

PART 4: MEASUREMENT AND PAYMENT

4-1 RAW WATER RESERVOIR LINER: The unit of measurement for payment will the square yard. Measurement will be according to the actual square yard installed except that overlaps for seams, boots, anchoring trenches, appurtenances will not be measured. All demolition, disposal, excavati borrow, placement of fill, compaction, surface preparation, lining fi fabrication, appurtenances and all work and materials necessary to compl the liner will be included. Quantities so measured will be paid for at Contract unit price.

4-2 BACKWASH POND LINER: The unit of measurement for payment will be square yard. Measurement will be according to the actual square yardage stalled except that overlap for seams, boots, anchoring trenches, appurtenances will not be measured. All demolition, disposal, excavati borrow, placement of fill, compaction, surface preparation, lining, fi fabrication, appurtenances and all work and materials necessary to compl the liner will be included. Quantities so measured will be paid for at Contract unit price.

END

ART 1: GENERAL

-1 DESCRIPTION: The work of this section consists of reservoir structures ncluding the concrete inlet structure, outlet structure.

-2 RELATED TECHNICAL SPECIFICATIONS FOUND ELSEWHERE:

Excavation, Trenching and Backfill - Section 02221;
Waterstops - Section 03253;
Riprap and Lined Drain Swales - Section 02262;
Cast-in-Place Concrete - Section 03300;
Reservoir and Pond Lining - Section 13351;
General Mechanical Provisions - Section 15010;
Ductile Iron Pipe - Section 15062

ART 2: MATERIALS

-1 CONCRETE: Cast-in-Place - Section 03300

-2 DUCTILE IRON MECHANICAL JOINT PIPE: Class 50

-3 DUCTILE IRON FLANGED PIPE: Class 53

ART 3: EXECUTION:

-1 CONCRETE INLET STRUCTURE: The concrete inlet structure shall be cast-
-place around 10 inch ductile iron pipe reservoir inlet. Construct inlet
ron as shown on the reservoir inlet detail. The hypalon liner will overlap
e concrete splash pan and swale.

-2 OUTLET STRUCTURE: Outlet structure shall consist of a concrete base
st around a 10-inch 90 degree bend.

-3 SPILLWAY RIPRAP - Place riprap from the reservoir line to the riprap at
e road culvert as shown on the drawings and as directed.

RT 4: MEASUREMENT AND PAYMENT

1 No separate measurement or payment will be made for this work. It will
considered as subsidiary obligation of the Contract under other work to
ich it relates.

END

ART 1: GENERAL

-1 DESCRIPTION: This section is an extension of the General Requirements nd contains items of a common or administrative nature that pertain to all echanical work.

-2 WORK INCLUDED: The work consists of completely installing the mechani- al systems as shown on the drawing and specified in Division 15.

-3 QUALITY ASSURANCE:

. Requirements of Regulatory Agencies: Comply with all applicable codes, ules, and regulations.

References: Comply with referenced standards as listed in the ecifications. Latest revisions will apply unless otherwise noted.

Codes:

National Electrical Code (NEC)
Uniform Building Code (UBC)
Uniform Mechanical Code (UMC)
Uniform Plumbing Code (UPC)

Fees and Permits: Obtain required permits necessary to execute the work der this division.

All pressure vessels, safety devices and appurtenances shall comply with andards of and bear stamp of ASME.

All electrical devices and wiring shall comply with standards of NEC. l devices shall be UL listed and so identified.

4 DRAWINGS: Drawings are diagrammatic and show the general design, rangement and extent of the systems. Do not scale drawings for roughing-in asurements, nor use as shop drawings. Make field measurements and prepare op drawings as required. Coordinate work with shop drawings of other ecification divisions.

5 SUBMITTALS: In accordance with Section 01300.

Detailed submittal requirements are given in the individual sections. ntracting Officer may require additional submittals as he deems necessary.

Contractor shall investigate the capacity and space requirements of the oposed equipment before submitting shop drawings.

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. Contractor shall investigate the capacity and space requirements of the roposed equipment before submitting shop drawings.

1-6 PRODUCT HANDLING: Protect material, equipment, and apparatus provid under this section from damage, water and dust, both in storage and instal ed, until final acceptance. Provide temporary storage facilities for mat rial and equipment. Material, equipment, or apparatus damaged because of i proper storage or protection will be rejected.

1-7 JOB CONDITIONS:

A. Special Controls: Section 01560.

B. Special Requirements:

1. Maintain emergency and service entrances usable to pedestrian and vehic traffic at all times. Where trenches are cut, provide adequate bridging f traffic.

2. Coordinate shutdown of water and waste or heating systems.

3. Provide alignment gages as required by Contracting Officer. For exampl alignment gage for pump shafts shall be provided and left on the job.

4. Provide all plumbing equipment and tools at the job site necessary complete the work.

C. Schedule of Work: Arrange work to comply with schedule of constructio In scheduling, anticipate means of installing equipment through availab openings in structure.

D. Protection:

1. Completely cover motors and other moving machinery to protect from di and water during construction.

2. Cap all openings in pipe to protect against entry of foreign matter.

3. Protect premises and work of other divisions from damage arising out installation of work of this division.

4. Perform work in manner precluding unnecessary fire hazard.

E. Service Connections: Arrange and pay all costs for utilities require to facilitate all work of this division.

1-8 CLOSEOUT SUBMITTALS: In accordance with Section 01700. Provide eig complete sets of the following data in loose leaf, 1-1/2-inch ring binde with permanent covers, separators with index tabs, and transparent loose lea sheet protectors.

A. Manufacturers' Literature: Instructions for operation and maintenance of all mechanical equipment and specialties, including replacement parts lists and project record wiring diagrams, on 8-1/2-inch by 11-inch sheets, or catalogs, all suitable for side binding. Local representative of service companies for each piece of equipment shall be noted, listing address and telephone number. List system number, unit number, manufacturer's model number, and manufacturer's drawing number.

. Brief description of each system and its service and basic operational features.

. Maintenance Instructions: Typewritten instruction for maintenance of each system, in itemized form and with time schedule for maintenance work, listing each item of mechanical equipment requiring inspection, lubrication, and service, and describing the performance of such maintenance; listing all types of bearings for each piece of equipment; the type of lubricant required and frequency of lubrication; sequence and flow diagrams for each of the systems, emergency procedures; normal starting, operating and shutdown procedures, and when applicable, winter shutdown procedures. The operation personnel shall be instructed in the care of the system in accordance with the approved instructions.

1-9 SPECIAL TOOLS: At completion of project, provide one set of special tools required to operate, adjust, dismantle, or repair any equipment of this division. Special tools mean those not normally found in possession of mechanics or maintenance personnel.

1-10 MINOR MAINTENANCE PARTS: At completion of project, provide maintenance parts such as seals, bushings, packing materials, taping and other items normally recommended by manufacturer.

PART 2: MATERIALS

2-1 The materials required for Division 15 are specified in the individual sections.

PART 3: EXECUTION

3-1 GENERAL: All equipment shall be installed in accordance with manufacturer's recommendations unless specifically directed otherwise.

3-2 SLEEVES AND INSERTS: Contractor shall be responsible for locating and installing sleeves, inserts, and supports as required during the stages of construction.

3-3 Contractor shall be responsible for making minor changes in the piping and equipment locations due to structural obstructions and conflicts with work specified in other divisions.

3-4 Contractor shall provide experienced plumbers among his staff on the job. The Contracting Officer may require proof of experience and references. If the Contracting Officer is not satisfied, he may postpone work until the Contractor obtains the services of an experienced plumber. In such a case, no delay or extra charge will be given to the Contractor.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered as subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL:

1-1 DESCRIPTION: The work of this section consists of the disinfection of all portions of the water system, including interior and buried piping, valves and stops, and any portion of the existing connecting system that might have become contaminated during construction activities.

1-1 SUBMITTALS: In accordance with Section 01300. Submit plan for gathering, transport and disposal of chlorine solutions and surplus materials after use.

PART 2: MATERIALS

2-1 CALCIUM HYPOCHLORITE: HTH, by Olin Chemicals, Olin Corporation, 120 Long Ridge Road, Stamford, Connecticut 06902, or similar commercial product having approximately 65 percent available chlorine.

2-2 MIXTURE: A 5 percent solution shall be made by mixing 8.0 percent of powder with 92.0 percent water, by weight, first into a paste, then thinning to slurry by the addition of water.

PART 3: EXECUTION

3-1 DOSAGE: Place enough disinfecting material in the system to insure a chlorine dosage of 50 parts per million. This is equivalent to 11 ounces of commercial hypochlorite powder to each 1,000 gallons of water.

3-2 FILLING SYSTEM: Fill entire system with the chlorine solution. Open all taps and valves and leave open until a strong odor of chlorine is noticeable in the water coming from the outlets, after which close the taps and valves.

3-3 TEST PERIOD: Allow chlorinated water to remain in the system a minimum of 24 hours, then thoroughly flush the system. During retention period, operate all valves, stops, and other appurtenances to assist this disinfection.

3-4 BACTERIOLOGICAL EXAMINATION: After the system has been thoroughly flushed, take samples from representative points in the system, in sterile bottles, and submit to proper authorities as directed for bacteriological examination. If the report is unsatisfactory, repeat the disinfection procedure until satisfactory results are obtained.

3-5 DISPOSAL OF SOLUTION: This shall be the Contractor's responsibility. He shall notify and obtain the approval of the Contracting Officer.

Solution shall not be dumped into any lake or stream or drainage flowing into a lake or stream or into the sewage system.

PART 4: MEASUREMENT AND PAYMENT: No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION:

A. The work of this section consists of leak testing gravity sewer lines, gravity sewer manholes, water lines, force mains, inverted siphons, and related valves and fittings. Rejected work shall be retested.

B. Testing Methods: Gravity sewer lines - air or water test manholes - water level drop test; water lines, force main, inverted siphons - nigh pressure water test.

1-2 QUALITY ASSURANCE:

A. Flow meters shall record the actual volume plus or minus 2 percent.

B. Air test gauges shall be ANSI/ANSI B40.1, Grade 3A (plus or minus 0.25 percent of full scale accuracy), 15 psi dial range.

C. Water test gauges shall be ANSI/ANSI B40.1, Grade 2A (plus or minus 0.5 percent of full scale accuracy), dial range approximately twice the required test pressure.

1-3 SUBMITTALS: In accordance with Section 01300.

A. Accuracy certification by approved independent testing laboratories for flow meters and test gauges. Certifications shall be dated no more than 90 days prior to actual system testing.

B. Prior to testing, provide the following information:

All Tests: Describe precautions that will be taken to protect system equipment that might be damaged under test pressures.

Air Test: Describe safety devices on air test equipment, and personnel safety precautions during air tests.

High Pressure Water Test: Describe the proposed method for disposal of water used in line testing.

1-4 JOB CONDITIONS:

A. Testing shall not be performed until each system has been flushed or thoroughly cleaned in accordance with procedures in the sections that describe water and sewer line installation.

B. Test potable water lines before disinfecting.

C. Water for flushing and testing is available from park supplies at the existing distribution system.

Do not create a cross connection situation.

1-5 CONTRACTOR'S OPTION: Water leakage test described in this section may be used in lieu of air test for sewer lines.

PART 2: MATERIALS: None.

PART 3: EXECUTION

3-1 GENERAL:

A. Perform testing in the Contracting Officer's presence after backfill and proper compaction of trenches. Where lines are installed under roadways and parking areas, perform tests after completion of final subgrade preparation and prior to application of surface courses. Notify Contracting Officer at least 48 hours prior to testing.

B. Provide test equipment including test pumps, gages, instruments, and other equipment required.

C. Prior to testing, remove from systems all equipment which would be damaged by test pressure. Replace removed equipment after testing. Systems may be tested in sections as work progresses; however, any previously tested portion shall become a part of any later test of composite system. Using approved methods, correct leaks by remaking joints with new material. Test time will be accrued only while full test pressure is on system. Prepare and brace the pipeline in accordance with manufacturer's instructions.

3-2 GRAVITY SEWER SYSTEMS:

A. Test manholes first. Plug inlet and outlet pipes and fill manhole with water to lid seat ring inside the metal frame. Let water stand for 1 hour to allow maximum absorption by manhole materials. Refill to the reference point. Run a drop test for 15 minutes. Add a measured volume of water to bring the level back to the reference point, and record the amount for each manhole. Two gallons is the maximum allowed for each manhole.

B. Air Test: Test lines between manholes with low pressure air. Safety requires a regulator or relief valve on pressurizing equipment, set at 8 psig. No one will be allowed in manholes while there is air pressure against test plugs.

1. Plug all pipe outlets to resist test pressure. Give special attention to laterals.

2. Plug all other pipes in both upstream and downstream manholes and fill manholes with clear water to just above the line plugged for testing. Any bubbles appearing during the test indicate leakage past a plug or in part of the test equipment.

3. Compute the test pressure by multiplying 0.43 times the elevation difference (in feet) of the upstream manhole rim and the invert of the line under test at the downstream manhole. The result is in psig and may be rounded to the nearest half psig. The test pressure shall be not less than 3.5 psig, nor more than 6.0 psig. Total line length included in any test section shall not exceed 400 feet.

4. Supply air into the line until test pressure is attained. Allow at least 5 minutes for air temperature in the test section to stabilize.

5. Reestablish the test pressure, and start a stop watch. Determine the time required for pressure to drop 0.5 psig.

6. If the pressure does not drop during the stabilization period, and no additional air has been added, the section undergoing test will have passed without further testing.

7. The pipe section will also have passed if the time observed for the pressure to drop 0.5 psig is greater than that determined by using the following table:

PIPE SIZE, INCHES	TIME
4	4 min. 2 sec.
6	6 min. 0 sec.
8	7 min. 37 sec.
10	9 min. 8 sec.
12	10 min. 58 sec.
14	12 min. 30 sec.
16	14 min. 32 sec.

When a combination of more than one pipe size is under test, the calculated time for the larger pipe shall apply.

C. Water Test: After manholes have passed the leak test, perform line leakage tests. Plug all lines entering the upstream manhole and the line to be tested in the downstream manhole. Fill the line and the upstream manhole with water to the lid seat ring. Laterals entering the main line between manholes shall be tested also, making sure all air is evacuated where test plugs are inserted. During the 2 hour test period, measured quantities of

water shall be added to maintain the test level within 1 inch of the reference point. Maximum allowable gallons of makeup water for pipeline leakage shall be determined by multiplying the nominal pipe diameter in inches by 1.0 gallons per inch, by the number of linear feet of pipe in the test section, and dividing the product by 1,000. The line will pass the test if the volume of makeup water during the 2 hour period does not exceed the sum of the actual manhole loss and the allowable line loss. This volume is 8 times the 15 minute manhole loss, recorded earlier, plus the calculated allowable leakage for main and lateral lines being tested.

3-3 WATER LINES, FORCE MAINS, INVERTED SIPHONS:

A. Fill line with water; eliminate all air. Allow a minimum standing time of 2 hours for materials to absorb water.

B. Raise the internal pressure by pumping in water to 50 psig above the maximum anticipated service pressure at the point of test gauge attachment.

Do not exceed the pipe rating pressure.

C. Maintain the test pressure within 5 psig for 2 hours by pumping in metered quantities of makeup water.

D. The line section will have passed the test if the metered makeup water does not exceed that determined by the following formula: Leakage in gallons equals 0.00002 times the nominal diameter of pipe in inches times the length of the test section in feet times the square root of the test pressure in psig.

E. Do not use paints, asphalts, tars, or other types of pipe compounds to eliminate leaks.

F. Replace leaking fittings, nipples, or lengths of pipe.

PART 4: MEASUREMENT AND PAYMENT

4-1 TESTING OF WATER AND SEWER LINES: No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under the other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing utility marking and warning tape capable of being detected electronically. Also, in non-pavement areas, additional marking by use of treated timber utility line markers shall be provided.

1-2 SUBMITTALS: In accordance with Section 01300.

A. Samples: Submit three 24-inch long sections of tape for approval.

B. Certificate: Furnish three copies of certification from manufacturer or supplier certifying that the materials used in the tape fabrication meet the requirements of these specifications.

1-3 TIMBER UTILITY LINE MARKER QUALITY ASSURANCE: Reference, Federal Specifications (FS).

1-4 PRODUCT HANDLING: Carefully handle timber posts after treatment to prevent damage to surfaces.

PART 2: MATERIALS

2-1 MARKING TAPE:

A. Construction: Metallic foil laminated between two layers of polyester film not less than 3 inches wide. The adhesive shall be colored and be compatible with the foil and film.

B. Film: Thermoplastic polyester, polyethylene terephthalate, commonly known as mylar, trademark of E.I. DuPont de Nemours and Co., Inc., or approved equal. Each film layer shall not be less than 0.0005 inches thick (1/2 mil).

C. Metallic: Not less than 0.0005 inches thick (1/2 mil).

D. Imprint: 3/4-inch black bold letters.

E. Legend: Imprinted with the identification of the buried utility line such as: "Caution: Potable Water Main Below," "Caution: Potable Service Line Below," "Caution: Sewer Main Below," "Caution: Irrigation Lateral Below," "Caution: Electrical Line Below," "Caution: Raw Water Transmission Line Below." Repeat at approximately 24-inch intervals.

F. Detectable, marking and warning tape shall be as manufactured by Lineguard, Inc., Allen Systems, Inc., Paul Potter Associates--all of Wheaton, Illinois, or Griffolyn Company, Inc., Houston, Texas; or approved equal.

2-2 TIMBER POSTS:

A. Pine, Douglas Fir or Western Red Cedar, S4S stock, construction grade, seasoned. Sizes, as shown.

B. Pressure treat timber posts with creosote or pentachlorophenol to a minimum net retention meeting requirements of FS TT-W-571. Remove excess treatment material at plant.

PART 3: EXECUTION

3-1 TAPE:

A. Install tape in backfill directly over buried utility line, 15 inches below finished grade.

B. Where utilities are buried in a common trench identify each line by a separate warning tape. When crossing over existing utility install separate warning tape for that utility.

3-2 TIMBER POSTS:

A. Location: Install timber posts in non-pavement areas at all changes in horizontal direction or intervals not to exceed 400 feet of sight distance.

B. Excavation and Backfill: Section 02221.

C. Installation: Install in a true vertical plane to lines and dimensions directly over or immediately adjacent to the utilities to which they relate.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing ductile iron pressure pipe and fittings.

1-2 RELATED WORK SPECIFIED ELSEWHERE:
Excavating, trenching, and backfilling - Section 02221;
Concrete - Section 03300;
Insulation - Section 07216;
Disinfection - Section 15041;
Testing - Section 15042;
Utility line marking - Section 15058.

.-3 QUALITY ASSURANCE: References

American National Standards Institute (ANSI),
American Water Works Association (AWWA),
Federal Specifications (FS),
and manufacturers' printed recommendations.

-4 SUBMITTALS: In accordance with Section 01300. Submit certificates of ompliance and manufacturers literature.

-5 PRODUCT HANDLING:

. Handle pipe carefully to insure delivery in a sound, undamaged condition ith pipe coating uninjured. Contracting Officer will reject damaged pipe on ite. Contractor shall replace damaged pipe at no additional expense to the overnment.

. Storage: Do not store materials directly on ground.

-6 JOB CONDITIONS:

. Do not lay pipe in water or when trenches or weather conditions are nsuitable for such work.

. When work is not in progress, securely close open ends of pipe and fit- ings.

ART 2: MATERIALS

2-1 BURIED DUCTILE IRON PIPELINE:

. Pipe: ANSI A21.51 (AWWA C151) Class 50 for 6-, 8-, 10-, 12-, 14-, and 4-inch and Class 52 for 4-inch except where called for differently.

B. Joints: ANSI 21.11 (AWWA C111) Rubber Gasket Joints.

C. Fittings: ANSI A21.10 (AWWA C110) and equipment.

D. TIE RODS AND FIXTURES: Shall be zinc plated per ASTM A-164. The tie rods shall be 3/4-inch diameter ASTM A-36 Steel. Tie bolts, nuts and rod couplings shall be approved equal to Star and able to withstand 7,000 pounds tension each. Retainer clamps and washers shall be approved equal to Star and able to withstand a 7,000-pound force in each tie rod.

2-2 PIPING IN VAULTS:

A. Pipe: ANSI A21.51 (AWWA C151) and ANSI A21.15 (AWWA C115) Ductile Class 53 except where called for differently.

B. Flanges: ANSI A21.15 (AWWA C115) Ductile or Cast depending on fitting material, Class 125 or Class 250 as called out.

C. General: All fittings and equipment to be adequate for a 250 psi working pressure.

2-3 FITTINGS: Size, grade, joint type, and lining to match pipe.

Wherever a pipeline passes through the concrete wall or a tank designed to contain water or other liquid at such an elevation that the pipe outside the tank is above ground level or exposed within a building, the Contractor shall install a wall fitting or shall have brazed around the pipe at the center of the wall a continuous fin or collar at least 1/4-inch thick and 2 inches deep, to prevent leakage around the pipe. The wall fitting or pipe with fin shall be poured in place.

Wherever pressurized lines pass through walls and are shown with wall pieces, or where removable equipment exists along the pipeline, pieces with integrally cast (not brazed on) seep rings will be installed with adequate reinforcement steel on both sides of the seep ring to transfer thrust either way into the concrete wall. Approved alternative restraint systems may be used.

2-4 CONCRETE FOR THRUST BLOCKS: Proportioned, mixed, and placed as specified in Section 03300. Minimum compressive strength of concrete, 2,000 psi at 28 days.

2-5 CEMENT MORTAR LINING: ANSI A21.4 (AWWA C104). For pipe and fittings, minimum 1/16 inch thick.

PART 3: EXECUTION

3-1 GENERAL: Sizes as shown. Lay to the grades and lines shown in accordance with pipe manufacturer's specifications. Rest each section upon the pipe bed for full length of the barrel with recesses excavated to accommodate joints. Take up and re-lay any length that has had its line, grade, or joint disturbed after laying. Thoroughly clean pipe interiors of foreign matter before lowering into trench. Replace with new pipe any laid section of pipe found damaged or defective.

3-2 PIPE CUTTING: Cutting for closure or other reasons shall be done neatly by methods which will not damage pipe, lining, or coating.

3-3 CLEANING: Immediately prior to installation, draw cloth swab saturated with clean water through each length of pipe. Swabs may be kept in the pipe and pulled forward past each joint after jointing completion.

3-4 INSPECTION: Inspect pipe for defects and ring with a light hammer while suspended before lowering into the trench. Defective, damaged, or unsound pipe will be rejected.

3-5 LAYING: Lay pipe with bells facing in direction of laying except as approved. On appreciable slopes bells shall face upgrade, and where making connection with other lines, bells may face as needed.

3-6 DEFLECTION AT JOINTS:

A. Type II and III Joints: Deflections from a straight line or grade measured between extended centerlines of the connecting pipe shall not exceed the following.

Size of Pipe in inches	Deflection per Linear Foot in inches	
	Type II	Type III
4	1	1-1/2
8, 10, 12	1	1
14,	5/8	3/4
24	5/8	1/2

B. If the required alignment necessitates deflection in excess of that specified above, either provide special bends or a sufficient number of shorter lengths of pipe to effect angular deflections within the limits specified.

3-7 CONCRETE THRUST BLOCKS: Install thrust blocks at all tees, elbows, bends, crosses, reducers, and dead ends. Size of blocks, as shown or as recommended by pipe manufacturer.

3-8 PIPE ENDS: For future connections, valve, plug, or cap as shown.

3-9 TYPE II PUSH-ON JOINTS: Clean gasket, gasket seat inside of bell, and plain end of pipe to be socketed of foreign matter prior to joint assembly. Effect joint assembly, after proper alignment of pipe, by force of fork tool, crowbar, space dug in dirt at end of entering pipe, or by hand for pipe 8 inches or smaller. For pipe larger than 8 inches, use a jack type tool. Improper positioning of gasket, indicated by need of excessive force to assemble joint, requires disassembly, inspection for defects, and proper reassembly of joint. Prepare plain ends of field cut pipe for joint assembly by grinding or coarse filing outside cut end of pipe 1/8 inch back to 30 degree angle with pipe centerline. Use specially designed locking type end plugs or caps to close off dead ends.

3-10 TYPE III MECHANICAL JOINTS: Clean and brush with soapy water the gasket and surfaces which will contact gasket. Carefully center spigot in bell and position gasket evenly in seat. Tighten bolts alternately to an even normal torque. Ineffective sealing, indicating improper cleaning, uneven torque, or improper positioning of parts or materials, requires disassembly, inspection for defects, and proper reassembly of joint.

3-11 FLANGED PIPE: Not to be buried. Install as indicated. Provide supports as required to prevent strain on flanges.

3-12 RESTRAINED JOINTS: Shall be Type III mechanical joints with four (for 10-inch and larger) or two (for 8-inch and smaller) diametrically opposed tie bolts bolted through the flanged bell and gland. The tie rods are then bolted through the tie bolt ring and to a similar bolt or restraining clamp on the next joint. The nuts are then tightened until tension is obtained.

If restraining clamps are used, they must be behind the push on bell to insure positive restraint. Tie rods installed on horizontal bends shall be diametrically opposed on the horizontal plane and on vertical bends in the vertical plane. The pipe and tie rods shall be wrapped with polyethylene tube ANSI A21.5 (AWWA C105).

3-13 TESTING: In accordance with Section 15042, make tests upon completion of the system, or any reasonable length of the system and after thorough flushing of the portion to be tested.

3-14 BACKFILL AND RESTORATION OF SURFACE CONDITIONS: Section 02221. Backfill after acceptance of tests by Contracting Officer.

3-15 DISINFECTION OF WATER LINES: After completion of testing and prior to placing in service, the water system shall be treated in accordance with Section 15041.

3-16 INSULATION: At culvert crossings and as directed by the Contracting Officer insulate completely around pipe. See Section 07216. Payment shall be separate.

PART 4: MEASUREMENT AND PAYMENT

4-1 DUCTILE IRON PIPE (DIP) IN PAVEMENT: The unit of measurement for payment will be the linear foot. Measurement will be the actual horizontal projected distance along the centerline of the pipe of given size, furnished and installed, between the following termini, as applicable: ends of pipe; center of couplings or connections at junctions; a point 5 feet from the exterior face of all structures, including concrete valve boxes. No deductions will be made for valves, fittings, or other appurtenances between these termini. The work will include: exploration for utilities; demolition or abandonment of existing lines, fittings, valves and other items indicated on the drawings; all excavation, trench bottom preparation, and bedding;

pipe; all fittings except gate valves and connections to the existing system; stream crossings and concrete encasement where shown; thrust blocks; backfill; compaction; marking tape; and restoration including aggregate base course, and repair of any structures. Quantities so measured will be paid for at the Contract unit price for each size ductile iron pipe. Asphalt paving will be installed by the Government.

4-2 DUCTILE IRON PIPE (DIP): As described in 4-1 except in areas where paving is not to be installed. It will include top soil removal and reseeding.

4-3 DUCTILE IRON PIPE IN CONCRETE VAULTS: No measurement will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing copper pipe and fittings, principally for service connections.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavating, trenching and backfilling - Section 02221
Concrete - Section 03300;
Disinfection - Section 15041;
Testing - Section 15042;
Utility Line Marking - Section 15058.

1-3 QUALITY ASSURANCE: References

American Water Works Association (AWWA),
American National Standards Institute (ANSI),
American Society for Testing and Materials (ASTM),
and manufacturers' printed recommendations.

1-4 SUBMITTALS: In accordance with Section 01300. Submit certificates of compliance and manufacturers' literature.

1-5 PRODUCT HANDLING:

A. Delivery: Handle pipe carefully to insure delivery in a sound, undamaged condition. Contracting Officer will reject damaged pipe on-site. Contractor shall replace damaged pipe at no additional expense to the Government.

B. Storage: Do not store material directly on the ground. Adequately support piping.

1-6 JOB CONDITIONS:

A. Do not lay pipe in water or when trenches or weather conditions are unsuitable for such work.

B. When work is not in progress, securely close open ends of pipe and fittings.

PART 2: MATERIALS

2-1 PIPE: Type K copper, soft drawn. In accordance with ASTM B88.

2-2 FITTINGS: Use flared fittings to match pipe such as Mueller H-15400 or Ford C22 or approved equal. Use bends such as Mueller H-15525 or Ford L22 or approved equal.

2-3 CONNECTIONS TO STEEL PIPE: Provide dielectric fittings.

PART 3: EXECUTION

3-1 GENERAL: Size as shown, lay to grades and lines in accordance with pipe manufacturer's specifications. Thoroughly clean pipe interiors of foreign matter before placing into trench. Replace with new pipe any laid section of pipe found damaged or defective.

3-2 PIPE CUTTING: Cutting shall be done neatly by methods which will not damage pipe.

3-3 CLEANING: Flush lines before connection with service.

3-4 TESTING: With all connections made and backfill placed except at fittings, pressurize system. Repair any leaks observed. Leave joints exposed and inspect joints for no leakage for a 24-hour period.

3-5 BACKFILL AND RESTORATION OF SURFACE CONDITIONS AND STRUCTURES: Section 02221. Backfill after acceptance of tests by Contracting Officer.

PART 4: MEASUREMENT AND PAYMENT

4-1 COPPER PIPE: The unit of measurement for payment will be the linear foot. Measurement will be the actual horizontal projected distance along the centerline of the pipe, furnished and installed, between the following termini, as applicable: ends of pipe; center of couplings or connections at junction; a point 5 feet from the exterior face of all structures, including concrete valve boxes. No deductions will be made for valves, fittings, or other appurtenances between these termini. The work will include sod stripping, topsoil removal, exploration for utilities, all excavation, trench bottom preparation, any bedding, pipe, all fittings except gate valves, thrust blocks, backfill, compaction, marking tape and restoration including reseeding, sodding, base course and repair of any structures. Quantities so measured will be paid for at the contract unit price for each size copper pipe.

4-2 COPPER PIPE IN CONCRETE VAULTS AND BUILDINGS: No measurement will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing ductile iron drain pipe and fittings.

1-2 RELATED WORK SPECIFIED ELSEWHERE:
Excavating, trenching, and backfilling - Section 02221;
Riprap and lined drain swales - Section 02262;
Utility line marking - Section 15058.

1-3 QUALITY ASSURANCE: References,
American Society for Testing and Materials (ASTM).
Cast Iron Pipe Research Association (CIPRA)
American National Standards Insititute (ANSI)
and manufacturers' printed recommendations.

1-4 PRODUCT HANDLING:

A. Delivery: Handle pipe and fittings carefully to insure delivery in a sound, undamaged condition. Contracting Officer will reject damaged pipe on site. Contractor shall replace damaged pipe at no additional expense to the Government.

B. Storage: Do not store materials directly on the ground. Cover all screened ends and flap valves.

1-5 JOB CONDITIONS:

A. Do not lay pipe in water or when trenches or weather conditions are unsuitable for such work.

B. When work is not in progress, securely close open ends of pipe and fittings.

1-6 SUBMITTALS: In accordance with Section 01300. Submit shop drawings and manufacturer's literature for flap valves.

PART 2: MATERIALS

2-1 DRAIN PIPE AND FITTINGS: ANSI Class 50 with standard joints and rubber gaskets, except use Class 53 where less than 3 feet of cover or where flanges are to be used. Flanged pieces must be 15 feet minimum in length.

2-2 FLAP VALVES:

A. FLAP VALVE: Use a Traverse City (Industrial Mat's Co.) A-43 Flap Valve or approved equal with flanged end, aluminum disc, with bronze face ring, bronze mounted iron body, with heavy bronze hinge pin and nut. Flap valve shall open under low head.

B. PIPE: On last joint of pipe use minimum 15-foot piece of Class 53 ductile with threaded end for flange.

PART 3: EXECUTION

3-1 GENERAL: Lay to the grades and lines shown in accordance with pipe manufacturer's specifications. Rest each section upon the pipe bed for full length of barrel with recesses excavated to accommodate joints. Take up and re-lay any length of pipe that has had its line, grade, or joint disturbed after laying. Thoroughly clean pipe interiors of foreign matter before lowering into trench. Replace with new pipe any laid section of pipe found damaged or defective. Pipe to be laid at minimum 0.5 percent grade in straight horizontal alignment until invert of pipe is 1 foot above invert of surface drain swale or as shown on the drawings.

3-2 EXCAVATION AND TRENCHING: Section 02221.

3-3 INSTALLATION: See Section 15062, however, no concrete thrust blocks are required.

3-4 FLAP VALVE: Where called for install flap valve securely. Install on Class 53 ductile. Level last section of pipe such that valve is well seated under no head conditions yet will easily open to allow pipe to drain. Make adjustments as called for by the manufacturer. Place 1/2 cubic yard riprap as described in Section 02262. Additional riprap, if required, will be paid for separately.

3-5 TESTING: In accordance with Section 15042. Make tests upon completion of the system, or any reasonable length of system. Do not test as a pressure line but test as a gravity line.

PART 4: MEASUREMENT AND PAYMENT

4-1 DUCTILE IRON (DI) DRAIN PIPE: The unit of measurement for payment will be the linear foot. Measurement will be the actual horizontal projected distance along the centerline of the pipe of given size, furnished and installed, between the following termini, as applicable: ends of pipe; center of couplings or connections at junctions; a point 5 feet from the exterior face of all structures. No deductions will be made for fittings, or other appurtenances between these termini. The work will include:

exploration for utilities; demolition or abandonment of existing lines, fittings, and other items indicated on the drawings; all excavation, trench bottom preparation, and bedding; pipe; all fittings and connections to the existing system; backfill; compaction; marking tape; and restoration including aggregate base course, repair of any structures, topsoil stripping and replacement, reseeding and mulching. Quantities so measured will be paid for at the Contract unit price for each size drain pipe.

-2 DUCTILE IRON DRAIN PIPE IN CONCRETE VAULTS: No measurement will be made for this work. It will be considered a subsidiary obligation of the Contract nder other work to which it relates.

-3 DRAIN PIPE FLAP VALVE: The unit of measurement for payment will be ach. Measurement will be the number and size of flap valves including rock iprap. Use of flanged Class 53 DIP (15-foot minimum length) is included. uantities so measured will be paid for at the Contract unit price for each ize flap valve.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of installing gate valves equipped with Buffalo type service boxes.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavating, Trenching and Backfilling - Section 02221.

1-3 QUALITY ASSURANCE: American Water Works Association (AWWA)

1-4 SUBMITTALS: In accordance with Section 01300. Supply certificates of compliance and manufacturer's literature.

PART 2: MATERIALS

2-1 VALVES:

A. GATE VALVES: Iron-bodied, fully bronze mounted, double disc, parallel seat, non-rising stem. Valves shall open counterclockwise and shall conform to AWWA C500. All buried valves shall have a 2-inch square operating nut and shall also have an extension stem with guide to bring operating nut within 1 foot of surface. Provide MJ or push-on joints as appropriate for buried installations and flanged in vaults and buildings.

B. POST INDICATOR VALVES: Gate valves as previously specified shall be fitted with a bonnet flange to which the indicator post bolts.

2-2 SERVICE BOXES FOR VALVES:

A. Buffalo-type cast iron box, not less than 5-1/4-inch shaft, with extension stem adjustable for elevation, and with cover marked "water" or "W". The specific style of box, stem and cover shall be as indicated, as called for elsewhere in these Specifications, or as directed. Service box shall be of sufficient length to reach from the pipe to at least 1-inch above the final ground surface elevation.

B. INDICATOR POST: Fire service post indicator valves shall be installed with an indicator post. The post shall have a target window showing "SHUT" when the valve is closed and "OPEN" when the valve is open. The lettered plate shall be cast with raised letters. The post shall be equipped with an operating lever which can be locked in position. The indicator post shall be similar and equal to Clow F-5750 indicator post.

2-3 SPECIAL WRENCHES AND KEYS: All tools needed to operate valve and to open valve box lid - a minimum of one of each type as required for each style and size of box and lid - shall be furnished by the Contractor. Key lengths shall be approved by Contracting Officer.

PART 3: EXECUTION

3-1 GATE VALVES: Install in the lines as indicated on the drawings, unless otherwise directed, and set plumb on a firm base. All foreign matter shall be removed from the interior prior to installation.

3-2 SERVICE BOXES: Install over the gate valves as indicated on the drawings, unless otherwise directed, with base section centered over valve and resting on well-compacted backfill. Top section shall be so set as to allow equal movement above and below finished grade, final elevation to be 1 inch below finished grade unless otherwise directed. Top of base section shall be approximately on line with nut at top of valve stem, and the entire assembly shall be plumb.

3-3 TESTS: Gate valve tests shall be with and part of the tests on the companion water lines.

3-4 DISINFECTION: Gate valve disinfection shall be with and part of the disinfection of the companion water line.

PART 4: MEASUREMENT AND PAYMENT

4-1 GATE VALVE WITH VALVE BOX: The unit of measure for payment will be each. Measurement will be the actual number of gate valves each with cast iron service box including all excavating, backfilling, service box cover, opening and operating tools, and other appurtenances as specified and installed. Quantities so measured will be paid for at the Contract unit price for each size gate valve.

4-2 GATE VALVES IN CONCRETE VAULTS AND BUILDINGS: No measurement will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

4-3 POST INDICATOR VALVE: The unit of measure for payment will be each. Measurement will be the actual number of post indicator valves each with indicator post including all excavating, backfilling, and compaction and appurtenances as specified and required to complete the unit. Quantities so measured will be paid for at the contract unit price for each size post indicator valve.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of the furnishing and installing of all corporation and curb stops with cast iron service boxes.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavating, Trenching and Backfilling - Section 02221; Disinfection - Section 15041.

1-3 SUBMITTALS: Manufacturers' literature in accordance with Section 01300.

PART 2: MATERIALS

2-1 CORPORATION STOPS: Use AWWA taper thread. Use Mueller Co. H-15000 or approved equal.

2-2 TAPPING SADDLES: Use an AWWA taper thread. Use a Mueller Co. H-10522 for 4-inch DIP, H-10526 for 6-inch DIP, H-10530 for 8-inch DIP, and H-10533 for 10-inch DIP or approved equal. Use tapping saddles for all corporation stops. Thoroughly coat all metallic surfaces to be in contact with mainline with hot tar.

2-3 CURB STOPS: Use Mueller H-15201 Oriseal having teflon coated plug and O seals or Ford Ball Valve, or approved equal for 3/4 to 2-inch copper service lines.

2-4 SERVICE BOXES: Approved, standard design, cast iron extension type Minneapolis pattern base, arch pattern base, or Buffalo type (2-1/2 or 3-inch shaft) curb box. Service box shall be of sufficient length, when properly installed, to permit adjustment to at least 3 inches above the final ground surface elevation. Service boxes shall be of proper size for the required curb stops and equipped with lid, extension pieces, and such springs, bases, base plates, and other appurtenances as are required to complete each box. Lids shall be clearly marked "water" or "W". Provide each with a stationary operating rod, attached to the tee head and suitable guide ring for rod. Top of rod should be within 1 foot of surface.

2-5 TOOLS: Furnish corporation and curb box keys, shut-off rods, or other tools to operate corporation or curb stops and open the top of service boxes. A minimum of one of each such tool shall be furnished for each style and size installed.

PART 3: EXECUTION

3-1 CORPORATION AND CURB STOPS: Install as indicated on the drawings; set plumb on a firm base using bricks. All foreign matter shall be removed from the interior prior to installation.

3-2 SERVICE BOXES: Install over the curb stops as indicated on the drawings with base section firmly screwed to stop or resting on cast iron foot piece, and brick as directed. Set top section to allow equal movement above and below finished grade. Final elevation to be as directed.

3-3 TESTS: Corporation and curb stop tests shall be with and part of the tests on the companion water line.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of the connection of service lines including tapping saddle, corporation stop, curb stop and box, and connection fittings.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavating, Trenching and Backfilling - Section 02221;
Copper Pipe - Section 15063;
Corporation and Curb Stops with Cast-Iron Service Box - Section 15108.

1-3 SUBMITTALS: Manufacturers' literature in accordance with Section 01300.

PART 2: MATERIALS

2-1 SADDLE, CORPORATION STOP, CURB STOP AND BOX: See Section 15108.

2-2 TYPE 1 FITTINGS FOR NEW COPPER TO EXISTING LINES: Provide insulating fitting to prevent dielectric action between existing service line and copper service line such as a Epco Model EA or approved equal.

A. New copper to existing galvanized: For 1/2 to 2 inch sizes, use Ford C28 flare to thread coupling, insulating fitting, and Ford C35 pack joint, or approved equal system.

B. New copper to existing copper: for 1/2 to 2 inch sizes use Mueller H-15400 fitting or Ford C22 fitting or approved equal flared fitting.

C. Copper to copper 90° bends: For 1/2 to 2 inch sizes use Mueller H-15525 or Ford L-22 or an approved equal flared fitting.

2-3 TYPE 2 FITTINGS FOR PUMPOUT DRAINS: Provide all fittings and materials necessary to provide above grade connections.

A. Buried Insulation: See Section 07216

B. Copper Pipe: See Section 15063

C. Curb Stop: Mueller Type H15201 or H10291 having a teflon coated plug and O rings or Ford Ball Valve or approved equal.

D. Bend: Male Iron Pipe Thread by Flare; Mueller H-15530 or approved equal.

E. Service Line Connection Fittings: Use Mueller 15450 flare by female iron pipe thread coupling, compatible insulated bushing (Ford) and galvanized nipple with threaded cap. Except for 2-inch coupling, increase by one size on threaded end so that inside of bushing is same as service.

2-4 1-1/2-INCH HYDRANT: Eclipse 2A by Kupferle Foundry Co. fire hydrant or approved equal. Hydrant shall be of a dry barrel, automatic draining type with rubber valve washer and, in general, of a frost proof design. Provide 4 cubic feet of clean gravel.

B. Fittings: Compatible with service line and hydrant.

PART 3: EXECUTION

3-1 GENERAL: Pipe fittings, sizes and installation as indicated on the drawings. Match existing sizes or as directed by the Contracting Officer. Install service saddle, corporation stop, curb stop and box, and fittings to connect to existing services.

3-2 TYPE 1 SERVICE CONNECTIONS: These connections are for conventional services to structures. Wherever practical make connection to existing service line inside structure. If not practical because of concealed or inaccessible interior piping make connection on exterior of building. Use caution with respect to electrical grounding. As necessary provide new ground rod. Contractor to be compensated where required.

3-3 TYPE 2 PUMPOUT DRAIN: These are services for above grade connection points to allow draining the mainline by pumping.

The curb stop will be located as directed by the Contracting Officer and may be moved to a location near the actual hookup. The various fittings, pipe and buried insulation will be installed as shown on the drawing. A concrete pad will be placed around the top of the curb stop valve box (where appropriate) and the connection fitting.

For pumpout drains tap bottom of main.

3-4 1-1/2-INCH HYDRANT: Install connection to main, curb valve, connection fittings, gravel, thrust block and other items as recommended by manufacturer and directed by Contracting Officer.

3-5 TESTING: Service connections shall be tested with companion water line.

PART 4: MEASUREMENT AND PAYMENT

4-1 TYPE 1 SERVICE CONNECTION: The unit of measurement for payment will be each. Measurement shall be actual number of service connections required including service saddle, corporation stop, curb stop and box, all fittings materials and work necessary to reconnect existing services. Payment will be at the applicable unit prices bid for each size and type of service connection as listed in the Contract Bid Schedule.

4-2 TYPE 2 PUMPOUT DRAIN: The unit of measurement will be each. Measurement shall be the actual number of service connections required and shall include service saddles, corporation stop, fittings, pipe below concrete pad, curbstop, bend, couplings, insulating fittings, cap and plug, insulation, concrete and restoration. Payment will be made at the contract unit price.

4-3 1-1/2-INCH YARD HYDRANT: The unit of measurement will be each. Measurement shall be the actual number installed and shall include excavation, connection to main line, curb valve with box, gravel, hydrant and all related work except for 2-inch copper pipe. Payment will be made at the contract unit price.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of connections from existing mainlines and appurtenances to existing fire sprinkler system and to the new mainline and appurtenances. These connections are shown on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavating, Trenching, and Backfilling - Section 02221.

1-3 SUBMITTALS: In accordance with Section 01300. Submit manufacturer's literature on fittings.

PART 2: MATERIALS

2-1 PIPE AND FITTINGS: Section 15062 for Ductile Iron Pipe.

2-2 COUPLINGS: Rockwell 433 transition coupling or approved equal. Must be adequate for a 250 psi working pressure.

2-3 TIEBARS: Provide as necessary to restrain connection fittings. See Section 15062.

PART 3: EXECUTION

3-1 GENERAL: Pipe, fittings, sizes, and installation indicated on the Drawings. Contractor to align new pipe and fittings to minimize additional bends and connective piping and as approved by Contracting Officer.

3-2 EXPOSURE OF CONNECTION POINTS: Contractor is to carefully expose connecting points to existing system and measure and locate piping. Order fittings and equipment accordingly. The Contracting Officer may require additional exploration along existing lines.

All new pipeline work will have a minimum depth of cover of 7 feet, thus downward deflection bends may be required to complete these connections.

3-3 CONNECTION: After new mainline system is approved and tested, the Contractor will make the connections noted on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 CES XX: No measurement of quantities will be made for this work. Each connection from the existing distribution mainlines to the new mainlines (CES) shall be identified by number, and payment for all work related to that connection shall be at the Contract lump sum price. These costs shall include clearing and grubbing; exploration; removal of obstructions; pavement and structures; disconnection and plugging of any related piping; concrete;

fittings; pipe restrainment; couplings; cutting into existing lines, including all work between cuts in existing lines and related work while maintaining service as approved by the Contracting Officer; and all related work. The only work not included is new piping along the mainline and any valving.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work covered by this section consists of constructing a pressure reducing valve vault, including all valves and fittings installed therein.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavation, Trenching, and Backfilling - Section 02221;
Ductile Iron Pipe - Section 15062;
Ductile Iron Drain Pipe - Section 15074;
Cast-in-Place Concrete - Section 03300;
Painting - Section 09900;
General Mechanical Provisions - Section 15010;
Disinfection of Water Lines - Section 15041;
Testing of Water Lines - Section 15042;
Interior Piping and Plumbing - Section 15203.

1-3 SUBMITTALS: In accordance with Section 01300 submit shop drawings for reinforcing steel. Submit manufacturer's literature and data for all parts and equipment, including valves, fittings, pressure reducing valve, meter, steps, hatch, air release valve, gages, and floor drain.

1-4 PRODUCT HANDLING: All components will be carefully handled to prevent damage, will be stored under structural cover and wrapped in heavy plastic.

PART 2: MATERIALS

2-1 CAST-IN-PLACE CONCRETE: Refer to Section 03300.

2-2 PIPE AND FITTINGS: Refer to appropriate Section of Division 15.

2-3 LADDER OR STEPS: See ladder specified under Section 15179. Alternative provides cast-in-place extruded aluminum steps similar or equal to Neenah R-1982W.

2-4 HATCHES: Shall be approved equal to Bilco Type J. The hatches shall be aluminum. They shall be flush mounted. The frames shall be 1/4-inch galvanized steel. The door leaves shall be 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners as required to withstand a live load of 300 pounds per square foot. Hinges and anchor straps shall be cast steel. The hinges shall be bolted to the underside of the door leaves and shall pivot on torsion bars to counterbalance the doors. A device shall be provided to automatically hold the doors in the open position. A neoprene cushion shall be provided between the frame and the door leaves. The doors shall be provided with a removable handle on the top side and an inside handle below the door. All hardware shall be cadmium plated. A locking hasp shall be installed at the factory.

2-5 FLOOR DRAIN: Use Neenah R4953 or approved equal.

2-6 4-INCH GATE VALVES: Iron body, fully bronze mounted, double disc, parallel seat, rising stem, heavy duty handwheel, flanged, conforming to AWWA C500. See Section 15101.

2-7 4-INCH PRESSURE REDUCING VALVE: A G.A. Industries Inc., Figure 4500-D or approved equal valve.

A. Description: The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is of a greater area than the underside of the piston.

The valve piston shall be guided on its O.D. by the long stroke Vee Ports which shall be downstream of the seating surface to minimize the consequences of severe throttling. Throttling shall be done by the valve Vee Ports and not by the valve seating surfaces.

The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no springs to assist the valve operation.

The pilot control valve shall be of the single seated design type globe body pattern. It shall be diaphragm operated and spring loaded permitting adjustment over a range of 30 to 300 psi.

Downstream pressure shall be factory set at 30 psi.

The valve body, piston chambers, pilot lines, pilot valves and accessories containing water will have drain cocks that will allow easy draining without taking plumbing and fitting apart.

B. Construction: The valve body shall be of cast iron ASTM A-126 Class B with flanges conforming to the latest ANSI standards. The valve shall be extra heavy construction throughout. The interior wearing surfaces shall be bronze ASTM B-62, as well as the main valve piston.

The valve seals shall be easily renewable.

All controls and piping shall be of non-corrosive construction.

A visual valve position indicator shall be provided for observing the valve piston position at any time.

2-8 4-INCH METER: Use Rockwell single register compound meters or approved equal. Low flow meter shall be of the positive displacement type and high flow meter shall be of the turbine type. Provide registration in gallons and flanged connections. Features included will be single register, sealed coordinator, hard rubber roller bearings, magnetic suspension of turbine shaft, enclosed intermediate gear train, swing action valve that prevents flow through the turbine meter when below its accuracy range and limits flow through the displacement meter when the turbine is measuring flow, bronze body and stainless trim.

2-9 PRESSURE GAUGES: The gauges shall be style (AA) AO-30771, cast-iron case, brass ring, with 4-1/2-dial, as manufactured by Crosby Valve and Gauge Co., or approved equal. A style 216.1 level handle shut-off shall be provided with each gauge. The gauge pressure connection shall be 1/4-inch. The gauge shall have a 0 to 300 psi range and be accurate within 1/2 of 1 percent.

For pipeline connection use a 1/2-inch corporation thence to 1/4-inch copper pipe.

2-10 1-INCH AIR RELIEF VALVE: Shall be similar or equal to APCO Model No. 143-C 1-inch combination air release valve. The valve shall be of a type comprising a special float enclosed in the valve body with attached lever for opening and closing the air intake or discharge port and capable of functioning as an air vent valve or as a vacuum breaker. Access to the ball float and interior vent seat shall be provided by means of a bolted flange top. The diameter of the valve will be 1-inch and will be suitable for pressures of 150 psi. The assembly shall not leak nor shall the valve stick under service conditions. All working parts of the valve shall be made of a non-corrosive material.

2-11 1-INCH PRESSURE REDUCING VALVE AND STRAINER: Use Mueller H-9300 regulator No. 2 or approved equal with adjustable outlet setting of 25-84 psi range. Bronze body, stainless steel seat ring, composition washer and diaphragm. Set downstream pressure at 30 psi. Drain provisions will be the same as paragraph 2-7.

2-12 1-INCH GATE VALVES: Bronze body, bronze wedge disc, rising stem, heavy duty handwheel, threaded Crane No. 423 or approved equal.

2-13 COUPLINGS FOR DUCTILE IRON PIPE: Rockwell Type 431 or approved equal cast couplings.

2-14 RESTRAINMENT: All pipe will be restrained from movement, particularly when meter or other equipment is removed. See Section 15062 for cast wall pieces for thrust restraint.

Ductile and cast-iron system will use the rods which are 3/4-inch diameter ASTM A-36 steel. The bolts, nuts and rod couplings shall be STAR or approved equal. All parts will be zinc plated per ASTM A-164.

2-15 EQUIPMENT SUPPORTS: See Section 15203.

PART 3: EXECUTION

3-1 GENERAL: Construct and install equipment as shown on the drawings. Keep all equipment and piping free of dust and debris at all times.

Leave existing service in use until new facility is ready for service. When ready and approved by the Contracting Officer, connect the new facility.

Meter, valve testing and disinfection per sections 15041 and 15042.

PART 4: MEASUREMENT AND PAYMENT

4-1 PRESSURE REDUCING VALVE VAULT: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price and will include all work including pipelines within 5 feet of the outside face of the structure and all excavation, backfill and restoration.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of the construction of concrete meter vaults and the installation of flow metering and control valves within, as well as modification of existing meter vaults and installation of meters within existing structures.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavating, Trenching, and Backfilling - Section 02221
Cast-in-Place Concrete - Section 03300
Insulation - Section 07216
Painting - Section 09900
Disinfection of Water lines - Section 15041
Testing - Section 15042
Ductile Iron Pipe - Section 15062
Copper Pipe - Section 15063
Corporation and Curb Stops with
Cast-Iron Service Box - Section 15108
Gate Valves - Section 15101
Service Connections - Section 15109
Connections to Existing Distribution - Section 15110
Air Relief Valve - Section 15130

.-3 SUBMITTALS: In accordance with Section 01300. Submit shop drawings for manholes, shop drawing of plumbing layouts and manufacturer's literature for meters, check valves, restrainment, frames and covers, gate valves, service clamps, corporation stops, curb stops, boxes, couplings, meter yokes, and insulation.

PART 2: MATERIALS

-1 CAST-IN-PLACE CONCRETE: Section 03300

-2 MORTAR: ASTM C270, Type M or 1 part Portland Cement Type 11 or better and 3 parts sand.

-3 GROUT: Grout for pipes through walls and other openings shall be "5-TAR" or approved equal non-shrink and non-ferric.

-4 SIX FOOT AND FOUR FOOT I.D. MANHOLE SECTIONS: Generally use precast components meeting ASTM C478; and AASHTO M199, suitable for HS20 Highway loading.

. Manhole Top Slab: A flat reinforced concrete top slab section will be provided with a 24-inch opening having extra reinforcing and with a 3/4-inch

stainless eye bolt located over meters 3 inches (and larger) and major pieces of equipment. The eye will be welded closed. The eye will bolt through a 1/4-inch by 6-inch square plate on top of the slab.

B. Manhole Bottom Slab: A flat reinforced concrete bottom slab will be provided. The slab will be sufficiently wide to prevent uplift of the manhole. In locations where dry conditions are encountered a 6-inch minimum diameter hole will be completed, for drainage purposes a 1-foot wide by 1-foot deep pit will be excavated below the slab and filled with clean 3/4-inch gravel.

C. Preformed Gasket: Shall be approved equal to RubrNek Butyl Rubber preformed gasket.

D. Grade Rings: The precast rings should not be less than 6-inches wide and furnished in heights to allow for 1-inch adjustment.

E. Steps: Shall be extruded aluminum approved equal to Neenah R-1982.

F. Frame and Cover: Shall be approved equal to frostproof Neenah R-1758F, 24-inches inside diameter. Additional insulation is required on the inner lid.

2-5 INSULATION: See Section 07216. Use Dow FB on exterior curved surface of pit and Dow SM on flat surfaces or inner lid; or approved equal.

2-6 POSITIVE DISPLACEMENT METERS (3/4 through 2-inch): Use Rockwell SR meters or approved equal. Provide registration in gallons and threaded connections. Features provided will include heat treated glass, sealed register, register retainer, magnetic drive, magnetic shield, internal strainer, bronze body and stainless trim. Meters shall meet AWWA requirements and, have an accuracy of 100 percent $\pm$ 1.5 percent.

2-7 COMPOUND METERS (3 through 6-inch): Use Rockwell single register compound meters or approved equal. Low flow meter shall be of the positive displacement type and high flow meter shall be of the turbine type. Provide registration in gallons and flanged connections. Features included will be single register, sealed coordinator, hard rubber roller bearings, magnetic suspension of turbine shaft, enclosed intermediate gear train, swing action valve that prevents flow through the turbine meter when below its accuracy range and limits flow through the displacement meter when the turbine is measuring flow, bronze body and stainless trim.

2-8 CHECK VALVES: The 6-inch check valves shall be butterfly type, similar and equal to Technocheck short form SF, for installation between pipe flanges.

2-9 PIPING: See Sections 15062, 15063,15203 . For ductile iron pipe use Class 53, for copper use Type K copper, soft drawn, and for galvanized use schedule 40. Use dielectric fittings between copper and galvanized pipe.

2-10 COUPLINGS FOR DUCTILE IRON PIPE: Rockwell Type 431 or approved equal cast couplings. Rockwell Type 912 for flanged adapter couplings.

2-11 GATE VALVES, 3-INCH AND LARGER: Iron body, fully bronze mounted, double disc, parallel seat, rising stem, heavy duty hand wheel, flanged, conforming to AWWA C500.

2-12 GATE VALVES, 2-INCH AND SMALLER: Bronze body, bronze wedge disc, rising stem, heavy duty handwheel, threaded Crane No. 423 or approved equal.

2-13 RESTRAINMENT: All pipe will be restrained from movement, particularly when meter or other equipment is removed.

Ductile iron system will use tie rods which are 3/4-inch diameter ASTM A-36 steel. Tie bolts, nuts and rod couplings shall be STAR or approved equal. All parts will be zinc plated per ASTM A-164. Restraining brace angles used outside manholes and structures shall be minimum 1/4 by 3 by 3-inch by 2-feet long. Use approved preservative coating on all exterior components.

2-14 EQUIPMENT SUPPORTS: For ductile iron pipe use Adjustable Pipe Saddle Support Fig. 264 as manufactured by I.T.T. Grinnel, Inc., or approved equal. Attach to threaded steel pipe which is in turn attached to floor flange.

2-15 MINOR FITTINGS:

A. Brass fittings. See Sections 15063 and 15109.

B. Galvanized pipe fittings. Schedule 40 and as approved by the Contracting Officer.

2-16 FITTINGS FOR 3/4-INCH AND 1-INCH METER INSTALLATION:

Yoke: Ford Linesetter or approved equal. Provide "Valve Type", series V-21 flare connections to service line), with brace pipe, and fittings to allow 3/4 or 1-inch meter.

2-17 INDOOR METER INSTALLATIONS:

A. 1-inch and smaller: Use cast iron straight meter yokes with ball valve by Ford or teflon plug and O seal curb valve by Mueller or approved equal.

B. 1-1/2 inch and larger; Use brass body and wedge disc gate valve and galvanized malleable iron unions as required to remove meters, PRV's and gate valves.

2-18 FLOOR DRAIN: Where applicable use Neenah R4953 or approved equal.

2-19 AIR RELEASE VALVE: APCO Model 143-C 1. See Section 15130.

2-20 BACKFLOW PREVENTER: See Section 15203 paragraph 2-9 Backflow Preventor.

PART 3: EXECUTION

3-1 INSTALLATION: Install as indicated on the drawings and in accordance with the applicable provisons of the related sections. Locations and sizes are indicated on the drawings.

Leave existing service in use until new meter facility is ready for service. When ready and approved by the Contracting Officer connect the new meter and service. Cut and plug all lines to be abandoned, and remove any equipment in existing vaults to be abandoned as indicated by drawings and Contracting Officer as part of this work.

3-2 DISINFECTION: Meter and valve testing and disinfection shall be performed concurrently with the companion water lines.

3-3 GENERAL DESCRIPTION OF METERS: The following table identifies each meter installation's basic components and any special work included.

METERS - CANYON PHASE II

METER NO	FACILITY SERVED	BASIC COMPONENTS AND SPECIAL WORK
1	Winterkeeper's Residence	3/4-inch meter, yoke with valve
2	Stable and Bunkhouse	2-inch meter, 2-inch bypass, valves connective piping and fittings.
3	Residence, Government Area	3/4-inch meter, yoke with valve.
4	Apartment #2 Government Area	2-inch meter, 2-inch bypass, valves, connective piping and fittings.
5	Apartment #1 Government Area	2-inch meter, 2-inch bypass, valves, connective piping and fittings.
6	Apartment #3 Government Area	2-inch meter, 2-inch bypass, valves, connective piping and fittings Two 2-1/2-inch by 2-inch reducers)
7	Ranger House, Government Area	3/4-inch meter, yoke with valve.

METER NO	FACILITY SERVED	BASIC COMPONENTS AND SPECIAL WORK
8	Sewage Lift Station, Government Area	2-inch meter, 2-inch bypass, valves connective piping and fittings. Install backflow preventer in lift station as directed.
9	Dorm, Government Area	2-inch meter, 2-inch bypass, valves connective piping and fittings.
10	Mess Hall, Government Area	2-inch meter, 2-inch bypass, valves, connective piping and fittings.
11	Men's Dorm, Government Area	2-inch meter, 2-inch bypass, valves, connective piping and fittings.
12	Utility Building, Government Area	2-inch meter, valves, connective piping and fittings for two feed points downstream of meter.
13	Trailers, Government Area	6-inch compound meter, 2 interior 6-inch gate valves; 2-inch bypass, valve, exterior connective piping and fittings.
14	Cabin Area	6-inch compound meter, 2 interior 6-inch gate valves, 6-inch check valve.
15	Visitors Center	4-inch compound meter, 2-inch bypass, valves connective piping and fittings.
16	Power Bldg. Government Area	2-inch meter, 2-inch bypass, valves, connecting pipe and fittings.
17	Temporary WTP Bldg.	1-1/2-inch meter, bypass, valves, connecting pipe and fittings.
18	Hamilton Dorm	2-inch meter, 2-inch bypass, valves, connecting pipe and fittings.
19	Lower Campground	6-inch compound meter, 6-inch check valve 2-inch bypass, valves, connecting pipe and fittings to existing line.
20	Lower Campground	6-inch compound meter, 6-inch check valve, 2-inch bypass, valves, connecting pipe and fittings to existing line.
21	Lower Campground	4-inch compound meter, 4-inch check valve, 2-inch bypass, valves, connecting pipe and-5

METER NO	FACILITY SERVED	BASIC COMPONENTS AND SPECIAL WORK
22	Lower Campground	4-inch compound meter, 4-inch check valve, 2-inch bypass, valves, connection pipe and fittings to existing line.
23	Upper Campground	4-inch compound meter, 2-inch bypass, valves, connecting pipe and fittings to existing line.
24	Hamilton Store	2-compound meter, 2-inch bypass, valves, connecting pipe and fitting.
25	Sewage Treatment Plant	2-inch meter with bypass, valves and connecting pipe and fittings.

Note:

For meter serving Lower Falls, Upper Falls and Uncle Tom's view areas, see Pressure Reducing Valve Vault - Section 15130.

PART 4: MEASUREMENT AND PAYMENT

4-1 METER XX: No measurement of quantities will be made for this work. Each meter facility shall be identified by number. Payment for all work related to that facility will be at the contract lump sum price. The costs shall include clearing and grubbing, removal of obstructions, pavements, structures; disconnection and plugging of any related piping and meter vaults; concrete; manholes; meter pits; insulation; gravel; brick; meters; valves; check valves; ARV's; pressure reducing valves and strainers; fittings; restrainment; clamps; saddles; corp stops; curb valves and boxes; bypass piping, valves and fittings; connections to existing service lines, couplings and fittings to connect into existing main lines and all restoration; and all other work and appurtenances required to complete the facility. The only work not included will be piping 5 feet outside the facility or structure; gate valves larger than 3-inch outside the face of the facility or structure; and normal service line piping, curb valves and boxes, and service line connections labeled on the drawings.

END

PART 1: GENERAL

.-1 DESCRIPTION: The work of this section consists of the connection of the nsulation of the existing meter vaults and painting of all interior piping.

-2 RELATED WORK SPECIFIED ELSEWHERE:

Insulation - Section 07216;
Painting - Section 09900;
Meter Installations - Section 15170.

-3 QUALITY ASSURANCE: Standards, American Society for Testing and Materials ASTM) and Federal Specifications (FS).

ART 2: MATERIALS

-1 INSULATION: See Section 07216.

-2 PAINTING: See Section 09900.

ART 3: EXECUTION

-1 INSULATION: See Section 07216.

-2 PAINTING: See Section 09900.

ART 4: MEASUREMENT AND PAYMENT

-1 REFURBISH MOTOR LODGE METER VAULTS: No measurement of quantities will be ade for this work. Each meter facility shall be identified and payment for ll work related to that facility will be at the contract lump sum price.

END

PART 1: GENERAL

1-1 DESCRIPTION: the work of this section consists of constructing a 750,000 gallon buried reinforced concrete storage tank and appurtenances.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavation, Trenching and Backfilling	Section 02221
Concrete Formwork	Section 03101
Reinforcing Steel	Section 03210
Post-Tension Tendons	Section 03230
Waterstops	Section 03253
Cast-in-Place Concrete	Section 03300
Disinfection and Testing, Reservoir	Section 03700
Below Grade Insulation	Section 07216
Painting	Section 09900
General Mechanical Provisions	Section 15010
Disinfection of Water Lines	Section 15041
Testing of Water Lines	Section 15042
Ductile Iron Drain Pipe	Section 15074
Interior Piping and Plumbing	Section 15203
Butterfly Valves	Section 15273
General Electrical Provision	Section 16010
Basic Materials and Methods	Section 16100
Electrical Service	Section 16410
Grounding	Section 16450
Controls	Section 16900

1-3 SUBMITTALS: In accordance with Section 01300. Submit complete shop drawings for reservoir, plumbing, electrical, ladder, hatch, safety system, layouts and manufacturer's literature for all components.

1-4 INSTRUCTION, OPERATION AND MAINTENANCE MANUALS: Provide manuals and instruction period with electrical personnel and control system representative for a three-day period. If equipment not fully operable or instruction period is not satisfactory as determined by the Contracting Officer, additional instruction may be required.

PART 2: MATERIALS

2-1 CAST-IN-PLACE CONCRETE: See Section 03300.

2-2 PIPE AND FITTINGS: Refer to the appropriate Section of Division 15.

2-3 TANK HATCH: Shall be approved equal to Bilco Type SS-40, 4-feet by 4-feet. The hatches shall have an aluminum cover, insulated and reinforced for a 150 psf live load. The curb will be galvanized, insulated, and fully

enclosed. There will be an exterior padlock hasp. Install with 1/2-inch thick neoprene or approved equal strip seal, safe for potable water. Anchor with 3/8-inch diameter by 4-inch stainless steel expansion bolts. Verify with hatch fabricator holes and anchoring system to provide approved sanitary seal.

2-4 LADDERS:

A. Ladder: Provide ALAD Series 560 (Box 630, Pomona, California, 91769, (714) 623-2134, represented through Ted Green Company, 2701 Alcott, Denver, Colorado 80211, (303) 433-7105 or approved equal. All components will be aluminum, high strength 6061-T6, and will be anodized after fabricatrion, 0.0007-inch minimum thickness. Rungs will be non-slip serrated, 1-1/8-inch minimum outside diameter, with 3,600-pound shear strength. Rung to side rail connectors shall have a minimum of 4 rivets per each side.

Rungs will be drilled to release air and water.

Mounting brackets to wall shall be 1/2-inch minimum thickness by 3-inch width and shall have a 2-inch diameter hole for one 3/4-inch bolt. A 1/4-inch thick by 3-inch diameter washer shall be provided. The brackets will be fastened securely to the side rail of the ladder with a compatible system capable of 3,600 pound shear strength. Brackets will be provided every 6-feet maximum. Finished width of the ladder shall be 20-1/4 inches maximum. Side rail section shall be an ALAD "U2" side rail or approved equal, having a channel type section 2-13/16 inch by 1-1/16 inch by 0.064 inch thick with thickened edges and corners.

Ladder shall rest firmly on the bottom of the tank. Coordinate cast iron threaded insert with fastening bracket dimensions or approved shop drawings (ALAD shows a dimension of 24-3/4 inches between bracket hole center but this should be confirmed).

B. Bolts for Fastening Ladder to Tank: 3/4-inch diameter stainless steel. Do not use expansion anchors except in the storage control vault. Bolts, mounting brackets for ladder, and cast iron threaded wall inserts are to be coordinated.

C. Safety Rail and Appurtenances: On the tank ladder, provide a safety rail and compatible antifall devices: Use SAF-T-CLIMB fall prevention system or approved equal. Rail is to be of fiberglass or stainless steel such that it does not need painting. Rail to ladder connections will be rustproof or painted and suitable for potable water. Provide two belts compatible with system and provide storage hooks to be located in top of near by storage control vault for easy access.

Safety rail will be provided with a removable extension section that will allow the user to easily affix the safety sleeve before climbing onto the ladder. The extension in position will rise 4-foot minimum above the hatch opening. Two storage mandrels will be provided within the control vault so that the extension can be securely stored and the hatches closed.

2-5 TANK PERIMETER UNDERDRAIN: Provide SDR 32.5 4-inch P.V.C. suitable for load with 2 rows of 1/4-inch perforations, 120° apart on bottom of pipe, every 6-inches along length of pipe to be made prior to installation. For gravel filter around pipe, provide a 6-inch thick envelope of size 57 concrete aggregate according to ASTM C-33 or equivalent washed rock meeting the following gradation:

100%	passing	1-1/2-inch	Standard Sieve
95-100%	passing	1-inch	Standard Sieve
25- 60%	passing	1/2-inch	Standard Sieve
0- 10%	passing	#4	Sieve
0- 5%	passing	#8	Sieve

In place of gravel filter, may use Polyfilter X produced by Carthage Mills, Inc.; 123 West 66th Street; Cincinnati, Ohio or approved equal wrapped around pipe and surrounded by 6-inch thick envelope of 3/4-inch uniform, washed rock. Rock in any case must be round, not angular or crushed.

2-6 STORAGE CONTROL VAULT:

A. Hatch: Shall be approved equal to Bilco Type J. The hatches shall be aluminum. They shall be flush mounted. The frames shall be 1/4-inch galvanized steel. The door leaves shall be 1/4-inch aluminum diamond plate reinforced with aluminum stiffeners as required to withstand a live load of 300 pounds per square foot. Hinges and anchor straps shall be cast steel. The hinges shall be bolted to the underside of the door leaves and shall pivot on torsion bars to counterbalance the doors. A device shall be provided to automatically hold the doors in the open position. A neoprene cushion shall be provided between the frame and the door leaves. The doors shall be provided with a removable handle on the top side and an inside handle below the door. All hardware shall be cadmium plated. A locking hasp shall be installed at the factory.

B. Floor Drain: For sump use 15-inch RCP with Neenah R4040 grate or other approved 15-inch grate.

C. Flap Valve: Use a Traverse City (Industrial Materials Co., Denver) A-43 flap valve or approved equal with flanged end, aluminum disc, with bronze face ring, bronze mounted iron body, with heavy bronze hinge pin and nut. Flap valve shall open under low head. Refer to Section 15074.

D. 6-Inch and 12-Inch Butterfly Valves: See Section 15273. Provide handwheel operated for 12-inch and lever operated for 6-inch.

E. 1-Inch Air Vacuum Relief Valve: Shall be approved equal to APCO Model No. 143-C 1-inch combination air release valve. The valve shall be of a type comprising a special float enclosed in the valve body with attached lever for opening and closing the air intake or discharge port and capable of functioning as an air vent valve or as a vacuum breaker. Access to the ball float and interior vent seat shall be provided by means of a bolted flange top. The diameter of the valve will be 1-inch and will be suitable for

pressures of 150 psi. The assembly shall not leak nor shall the valve stick under service conditions. All working parts of the valve shall be made of a non-corrosive material.

PART 3: EXECUTION

3-1 GENERAL: Provide all materials, equipment and construct tank and appurtenances as shown on drawings and described in the related technical specifications.

3-2 SITE CLEARING AND SOILS TESTING: As directed by the Contracting Officer clear and grub the site of the excavation, adjoining area and at additional locations as directed for soils testing. Grade access roads to allow complete soils testing of site. Assist with all measures to complete soils testing program. Once a final site location is determined the Contractor will excavate for, construct and backfill the tank at no additional expense provided the center of the tank does not move more than one tank diameter from the center shown on the drawings to the final constructed location; and with no time extension so long as no more than 45 days expire from the time the soils testing begins until the final tank location is selected.

PART 4: MEASUREMENT AND PAYMENT

4-1 750,000 GALLON STORAGE TANK: No measurement will be made for this work. Payment for all work included will be at the contract lump sum price. Work will include clearing, grubbing, soils tank coordination, earth excavation, tank site adjustment as specified herein, the storage tank, the storage control vault, all appurtenances to 5 feet outside tank and the relocation of the existing storage control transmitter to the new storage control vault. It will include the excavation and backfill for the tank and the hauling away of all excess material to be used at the new water treatment plant site or disposal. The increase in excavation costs for rock excavation will be paid for as specified in Section 02221.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing equipment for the Water Treatment Plant. This includes furnishing and supplying all lubricants and any equipment which is needed to place equipment, supplied under all other sections into working condition, all fees of any type, all information and manuals for equipment operation and equipment needed to maintain the equipment supplied under other sections.

The compliance of the general requirements of this section will be required unless modified by a section for a specific piece of equipment.

1-2 EQUIPMENT DESIGN: The major items of equipment shall be products of a well-known reputable national manufacturer with local representation. Each major component of the equipment shall have the manufacturer's name, address, and model number on a plate securely affixed in a conspicuous place.

Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and other rotating parts located so that a person could come into contact therewith, shall be fully enclosed or properly guarded.

To facilitate maintenance of the equipment, the Contractor will be required to furnish all equipment with the same type of pressure-gun grease fittings, and a separate pressure-gun for each type of grease required. All grease guns shall be of the lever-operated type.

All auxiliary material such as grease, oil, etc., required to properly place all equipment in operation shall be provided by the Contractor at no additional cost to the Government.

All equipment must have the specified capacities and efficiencies at elevation 7,900 feet above sea level datum.

1-3 PURCHASING AND GUARANTEES: Whenever in the specification any piece of equipment is defined by describing the particular equipment manufactured by a particularly-named manufacturer, or is defined by using a trade name, the term "or equal", if not inserted, shall be implied. The specific article, material, or equipment mentioned shall be understood as indicating the type, function, minimum standard of design, efficiency, and quality required for the proper functioning of the treatment plant as designed.

1-4 RELATED WORK SPECIFIED ELSEWHERE:

Cast-in-Place Concrete	Section 03300
Utility Mortar and Grout	Section 04100
Miscellaneous Metalwork	Section 05500
Painting	Section 09900
Laboratory Furniture	Section 11610
Dock Bumpers	Section 11875
General Mechanical Provisions	Section 15010
Interior Piping and Plumbing	Section 15203
Plumbing Fixtures	Section 15204
Treated Water Pumps	Section 15222
Setting Tank Sludge Pumps	Section 15223
Sludge Waste and Decant Pumps	Section 15224
Metering Pumps	Section 15225
Sump Pump	Section 15226
Rapid Mix Agitator	Section 15231
Flocculator Agitators	Section 15232
Static Mixers	Section 15233
Tube Settlers	Section 15234
Flow Meters	Section 15235
Filter Media	Section 15251
Filter Underdrain	Section 15252
Filter Surface Wash Agitators	Section 15253
Filter Control Consoles	Section 15254
Turbidimeters	Section 15255
Loss of Head Gages	Section 15256
Lime Feeder	Section 15260
Alum Feeder	Section 15261
Powdered Activated Carbon Feeder	Section 15262
Potassium Permanganate Feeder	Section 15263
Polymer Feeder	Section 15264
Chlorination Equipment	Section 15265
Modulating Float Valve	Section 15271
Pressure Reducing Valve	Section 15272
Butterfly Valves	Section 15273
Check Valves	Section 15274
Plug Valves	Section 15275
Ball Valves	Section 15276
Solenoid Valves	Section 15277
Shear Gates	Section 15278
Pump Control Valves	Section 15279
Surge Relief Valve	Section 15280
Globe Valves	Section 15281
Trolley Hoist	Section 15282
General Heating and Ventilation	Section 15801
General Electrical Provisions	Section 16010
Controls	Section 16900

1-5 SUBMITTALS:

A. General: In accordance with Section 01300. The Contractor shall procure from each manufacturer of the respective equipment such data and information required to substantiate fact that such equipment meets the requirements set forth in the corresponding section. Any approval by the Contracting Officer of said data submitted shall in no way be construed as relieving the Contractor of the responsibility of supplying equipment properly designed and manufactured to produce the quality, efficiency, and capacity specified or implied. He will provide complete shop drawings reflecting and coordinating all piping, equipment and accessories.

B. Pumps

The Contractor, when requesting approval of pumps shall submit a complete dimensional information and descriptive matter, including guaranteed performance curves. The performance curve must be based on the stated operating conditions showing overall efficiencies. The curve must show the capacity range from 0 to 125 percent for the design capacity.

In addition, the Contractor will be required to furnish the below indicated information:

Number of stages
Motor horsepower for maximum load condition
Shaft size
Power factor, design load
Shut-off head, feet
Wire to water efficiency, design load
Motor efficiency, design load

Note that the pumps are to be located at an elevation of approximately 7,900 feet above sea level and all data submitted must be computed on that basis.

Pump efficiency will be given prime consideration in determining the suitability of the pump selected by the Contractor, other conditions being equal.

C. Bearings

Bearing rating calculations shall be submitted at the request of the Contracting Officer.

D. Operation and Maintenance Manual: Complete operation and maintenance information shall be provided by the equipment manufacturer. The Contractor shall be responsible for gathering this information and submitting it to the Contracting Officer. Refer to Section 01700.

The Contractor shall assist the Contracting Officer in preparation of an Operations and Maintenance (O&M) Manual. The Contractor shall provide the Contracting Officer the following:

1. A completed Maintenance Schedule for each item of equipment.

2. Eight complete copies of required manufacturer's data.

A Maintenance Schedule equal to the form on the next page, shall be completed by the appropriate equipment manufacturer, and shall be submitted by the Contractor at the time other data is submitted for approval. Data to be provided by the manufacturer shall include but is not limited to the following:

Manufacturer's Data
Lubricant Summary
Maintenance Requirements and Frequency
Special Requirements for the Particular Item of Equipment

Each Manufacturer supplying data on a Maintenance Schedule shall specify lubricants thereon. All lubricants shall be products of a national corporation with local representation. At least one alternative supplier shall also be provided. The lubricant shall be described by name and specification number of each supplier.

The Contractor shall furnish eight complete sets of Manufacturer's Data, properly marked to indicate the specific equipment furnished. Serial numbers shall be included whenever applicable. The data shall be placed in binders. Submittals of data for approval do not necessarily meet requirements of this paragraph. Field modifications shall be indicated on the data. All data submitted shall be completely legible, clean, and in an undamaged condition.

PART 2: MATERIALS

2-1 MOTORS: Unless otherwise modified in the specific equipment sections, all motors shall meet the following requirements:

Electric motors furnished under this contract shall be designed to meet load and operating conditions under which they will be used. Fractional horsepower motors shall have a service factor of 1.25; motors of one-horsepower or more shall have a service factor of 1.15.

Motor nameplate voltage shall be in accordance with voltages specified on drawings and stated in the specifications and shall be designed to operate successfully at a rated load with a voltage variation of 10 percent plus or minus.

Motors shall be designed to operate successfully carrying rated loads when supplied rated voltage at a frequency of 60 cycles plus or minus 5 percent.

Motors shall be designed for continuous duty as defined by NEMA MG-1 unless otherwise specified.

EQUIPMENT MAINTENANCE SCHEDULE

Equipment Item (Descriptive Name): _____

Location in Plant: _____

Specification Reference: _____

Supplier - Name _____

Address _____ Telephone _____

_____

_____

Equipment Items

_____

_____

Manufacturer _____

Model _____

Size _____

Type _____

Serial No. _____

Lubricants -
Capacity
Summer
Winter

_____

Daily Maintenance Requirements

_____

Weekly Maintenance Requirements

_____

Monthly Maintenance Requirements

_____

Annual Maintenance Requirements

_____

Remarks

Observable motor temperatures shall not exceed those specified in NEMA standard MG 1-12.42. Motors shall be designed to operate in an ambient temperature of 40 degrees C.

Motors shall operate satisfactorily at the specified altitude, and shall be designed for an increased temperature rise over that experienced at sea level under the same load conditions. Motors furnished under this Contract shall be of such rating that temperatures specified by NEMA MG 1-12.42 will not be exceeded.

The Contractor shall provide energy efficient motors, where available.

Pump motors shall not become overloaded whenever the pump operates at any point on the pump performance curve.

Motors shall be high efficiency type, complying with ASHRAE 90-75 minimum power factor requirement, where such motors are available through the equipment manufacturer. Submittals shall indicate compliance with this requirement. Motors shall be sized closely to the full load point.

2-2 CONCRETE FOUNDATIONS: All concrete foundations for mechanical equipment shall be provided as required for the equipment being furnished. Foundations shall be level unless otherwise noted on the drawings.

PART 3: EXECUTION

3-1 INSTALLATION: All equipment specified in this section shall be furnished and installed by the Contractor at the locations shown on the drawings in accordance with the manufacturer's drawings and instructions, and in compliance with standard construction codes. Manufacturer's details and instructions shall be followed in the installation. Before bases are constructed the Contractor shall check that the size and height of the base is suitable for the equipment being mounted.

The equipment shown on the drawings corresponds to equipment specified. Dimensions, sizes, location of connecting piping, and other details have been established for equipment specified. In the event that different equipment is approved and furnished, the Contractor shall be responsible for all changes in piping, bases, location revisions, and any other detail that may be changed by approval of such equipment. If equipment furnished does not fit the bases piping, and other features, the Contractor, at no additional cost, shall make the necessary changes.

No field changes to the equipment assemblies will be allowed without prior approval of the manufacturer in writing. Any changes made will be done under the direction of the equipment manufacturer and any damage to protective coatings due to changes shall be repaired to the original condition of the equipment as delivered.

All changes must be approved by the Contracting Officer.

3-2 MANUFACTURER'S SUPERVISION: It wold advantageous for the Contractor to provide the services of a qualified manufacturer's representative to thoroughly check the installation, to adjust and to test operate all major pieces of equipment.

3-3 MOTOR TESTS: Motors shall be operated with anticipated loads and ampere readings shall be recorded on each line leg. If the nameplate rating is exceeded, corrective action shall be taken. Check motor overload rating to be sized properly.

3-4 LEAKAGE TESTING: All water bearing equipment shall be hydrostatically tested separately after being installed. After this test all pressure pipeline and connective fitting shall be tested per Section 15203.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates. (See Section 01150).

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing all interior piping, piping under structures and buried piping within 5 feet of any building exterior wall. Included with the interior piping will be pressure gages, small valves, hose bibbs, water heater, hydropneumatic tank, floor drains, and all other work, equipment or materials needed to complete the piping systems as shown on the drawings.

The mechanical details on the drawings are diagrammatic in character; and exact locations of the elements of the system, the measurements for cutting and installing pipe, and dimensions of the equipment, shall be determined from the structure and from the equipment. Space requirements and locations of connections of equipment the Contractor proposes to furnish shall be investigated by him prior to ordering. The Contractor shall not scale off the drawings to cut pipe or make connections to equipment selected. Equipment which will not enter the openings or which will not fit the assigned space will not be acceptable. All drawings relating to the construction, including architectural, structural, electrical, plumbing, piping, heating, and ventilating, together with these specifications shall be considered collectively.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Disinfection of Waterlines - Section 15041;
Miscellaneous Metalwork - Sectionm 05500;
Sealants - Section 07951;
Utility Mortar and Grout - Section 04100.

1-3 QUALITY ASSURANCE: American Water Works Association (AWWA).

1-4 SHOP DRAWINGS: Submit in accordance with Section 01300. Shop drawings of piping and equipment with installation details shall be submitted to the Contracting Officer. Shop drawings shall be approved prior to installation of the components.

PART 2: MATERIALS

2-1 CAST-IRON FITTINGS: All cast-iron fittings shall conform to ANSI Specification A21.10 or B16.1. All flanges on cast-iron pipe and on cast-iron fittings shall be faced and drilled to a 125 pound template. All push-on or mechanical joints shall conform to ANSI Specification A21.11. The exterior surfaces of all fittings shall be foundry-coated with a bituminous coating (except those inside the plant which may be provided without a bituminous coating) and the interior shall be Portland cement lined in accordance with ANSI Specification A21.4. Exposed pipe shall be provided with flanges and buried pipe, shall be provided with mechanical joints unless indicated otherwise on the drawings. With the approval of the Contracting Officer cast-iron fittings as specified above can be substituted for ductile iron fittings as specified below.

Joints in flanged pipe shall contain red rubber ring gaskets, full flange diameter and not less than 1/8-inch thickness. Cast-iron soil pipe for floor drains and at locations shown on the drawings shall conform to Federal Specification WW-P-401 for extra heavy weight.

2-2 DUCTILE-IRON PIPE AND FITTINGS: All ductile-iron pipe shall comply to ASA A21.51 and shall be Class 53. Pipes below slabs shall be polyethylene wrapped. Pipe shall have cement lining. Fittings and gaskets shall be as specified for cast-iron pipe.

2-3 PIPE COUPLINGS: Pipe couplings for cast-iron and ductile-iron pipe shall be mechanical sleeve type with iron body. The gasket shall be a general purpose compound suitable for use with potable water. Bolts and nuts shall be corrosion resistant high strength, meeting requirements of Specification ANSI A21.11 (AWWA C111). Pipe couplings shall be approved equal to Rockwell Type 431 or 913.

2-4 RESTRAINING SYSTEM: The materials of the tie rod systems used in interior piping shall meet the requirements of Section 15062 - Ductile Iron Pipe - Part 2.

All pressure pipe passing through concrete walls shall have integrally cast seep rings capable of restraining pipe from movement under the test pressure. Brazed on seep rings will not be adequate unless the Contractor uses an approved alternative restraint system. The restraint system will allow removal of equipment with the adjacent line pressurized.

2-5 SMALL PIPE AND FITTINGS:

A. Water supply: Seamless copper tube, type K, rigid, conform to ASTM B42. Use with cast-bronze or wrought copper solder fittings and 95-5 tin antimony solder. Wrap hot water supply lines with fiberglass insulation. Insulation shall be approved equal to J-M Micro-Lok with AP jacket.

B. Gage piping: Seamless "regular" red brass conforming to ASTM Specification B43. Use brass threaded fittings.

C. Steel piping: Standard weight, schedule 40, galvanized, wrought steel conform to ASTM A-120. Use malleable iron fittings, threaded, Class 150. Conform to ANSI B16.3 and Federal Specification WW-P-521.

D. Plastic piping: Polyvinyl chloride (PVC) conforming to ASTM D 1785 for schedule 80 pipe. Use threaded fittings for schedule 80.

E. Dissimilar pipe connections: Supply dielectric coupling EPCO Model HA or EA when connecting pipes of different metals to provide electrical insulation.

2-6 SMALL WATER PIPING VALVES: In general, small piping valves shall be suitable for use with liquid being transported. Water piping valves under 3 inches shall be bronze complying with ASTM B62 with screwed end connections.

A. Gate valves shall be of rising stem solid wedge disc type. Stuffing box repackable while under pressure, 125-pound rating. Gate valves shall be similar and equal to Crane No. 428. Valve Nos. 39, 40, 41, 55 and 56 are 1-1/2-inch; Valve No. 50 is a 2-inch.

B. Globe valves shall be of bronze disc type with 125-pound rating and repackable while under pressure, and shall be similar and equal to Crane No. 1.

C. Check valves shall be bronze swing check disc type with integral disc and hinge, and 125-pound rating. Use Crane No. 34, or approved equal. Valve Nos. 9 and 10 are 2-inch size, 30 gpm design flow.

D. Hose bibbs shall be 3/4-inch, and shall have a nickle-plated body, red bronze valve seat, Buna-N disc, stainless steel disc screw, an aluminum handwheel, graphite impregnated packing, and standard thread garden hose connection. Use Nibco Fig. No. 63-LS/Frost Proof No. 62-LS or other approved equal.

E. Corporation stops to be all bronze with tapered inlet threads and iron-pipe outlet threads; both inlet and outlet shall be male nipples; stops shall be approved equal to Mueller Co. H-10003. Saddles will be required in all A-C and PVC pipe. Saddles will be required on ductile iron pipe in accordance with the standards established by the Ductile Iron Pipe Research Association.

F. Air Release Valves: Cast-iron body with bronze internal parts and type 304 stainless steel float. Valve to have 1/2 inch-threaded female connections. Valve and Prime Co. No. 55 (APCO) or approved equal.

2-7 SMALL CHEMICAL PIPING VALVES:

A. Chemical line valves shall be thermoplastic ball valves, made with Polyvinyl Chloride (PVC), type 1, grade 1, conforming to ASTM D-1784. All valves to have union connections on both sides, threaded for schedule 80 socket type for schedule 40. Celanese TU Series, or approved equal.

B. Check valves to be thermoplastic ball type. Supply all plastic valves with Viton seals and supply ball valves with Teflon seats. Celanese BC Series, or approved equal.

2-8 PRESSURE GAGES: Each gage installation shall include the gage, a shut-off valve, a snubber and a ball valve on PVC pipelines or a corporation stop on cast-iron or ductile-iron pipelines. On pipelines containing sludge or impure water there shall also be a liquid filled chemical seal to insulate the gage from the pipeline liquid. Gages shall be mounted vertically.

All pressure gages shall have aluminum cases, back flanged with screwed ring cover, 4-1/2-inch dial, nonreflecting white face, bronze socket and tube, 1/4-inch NPT bottom connection.

The shut-off valve shall be 1/4-inch brass with a "T" handle. The snubber shall be 1/4-inch brass threaded connection. The liquid seal shall be bronze, 1/4-inch connections, maximum pressure of 1,000 psi with a glycerin fill liquid. All gages and accessories shall be supplied by the same manufacturer. Gages shall read in both pounds per square inch (psi) and feet of water. Pressure ranges for the gages shall be as follows:

PLANT WATER SUPPLY	0 - 100 psi, 230 feet
BACKWASH SUPPLY	0 - 15 psi, 35 feet
SURFACE WASH SUPPLY	0 - 100 psi, 230 feet
CHLORINATION WATER	0 - 100 psi, 230 feet
TREATED WATER PUMP DISCHARGE (3)	0 - 130 psi, 300 feet
SLUDGE RECYCLE PUMP DISCHARGE	0 - 15 psi, 35 feet
DECANT PIPING	0 - 25 psi, 60 feet
SLUDGE WASTE AND DECANT PUMPS (2)	0 - 15 psi, 35 feet

Gages shall be approved equal to those manufactured by Crosby Valve and Gage Co.

2-9 BACKFLOW PREVENTER: The backflow preventer shall be of the reduced pressure type. It shall consist of two independently acting check valves separated by a zone containing an automatic pressure differential relief valve. It shall provide protection against back pressure and back siphonage. It shall conform to the requirements of AWWA Standard C506. The body shall be manufactured of cast-iron, with bronze working parts and stainless steel springs. The valve discs shall be neoprene, and the diaphragm shall be neoprene-coated cotton duck. Use Beeco Model 6-C (Hersey-Sparling), or approved equal. Valve No. 30 is included in this Specification (2-inch, 100 gpm).

2-10 FLOOR DRAINS: Drains shall have cast-iron body (ASTM Specification A-48) and a bronze strainer. They shall be sized to fit drain piping as shown on the drawings. Drains with strainer shall be approved equal to Model No. 30,000 A as manufactured by Josam.

2-11 BACKWATER FLOOR DRAINS: Drains which connect to the 4-inch ductile-iron drain pipe which drains the lower level of the water treatment plant and the backwash pond pumphouse shall be approved equal to Series No. 30650A Type 8A, with integral trap, adjustable strainer and ball type backwater valve as manufactured by Josam.

2-12 WATER HEATER: The water heater shall be supplied at the location shown on the drawings. The water heater shall have a 30-gallon capacity with a single heating element run on 1500-Watt, 230-volt, single-phase power source.

The water heater shall have a glass-lined tank with fiberglass insulation, automatic temperature control thermostat, and over-temperature protector, and an anode rod. The water heater shall be approved equal to Model KEN-30 as manufactured by A.O. Smith Corp.

2-13 ROTAMETERS: For the purpose of regulating flows to the chemical feeders and chemical solution dilution lines, there shall be installed rotameters. Each rotameter shall be 1/2-inch diameter and 10-inches long with a flow range of 0-3 gpm. Each rotameter shall be equipped with an identification tag. The required rotameters are as follows:

Alum feeder water supply
Lime feeder water supply
Polymer transport #1
Polymer transport #2
PAC feeder water supply
PAC transport #1
PAC transport #2
Potassium Permanganate Feeder water supply

Rotameters shall be Fisher and Porter Series 10A3000 or approved equal.

2-13 PRESSURE REDUCING VALVES: On the float valve pilot control system, the chlorinator, and the backwash pond pumphouse water seal supply line, pressure reducing valves shall be installed. The pressure reducing valves shall be approved equal to the Mueller H-9300 No. 2.

2-14 NEEDLE VALVES: A needle valve shall be supplied with each rotometer. It shall be a bronze body union bonnet needle type as manufactured by Stockham, or approved equal. It shall have an aluminum handle, brass bonnet, and copper-silicon alloy stem.

2-15 SLUDGE QUICK COUPLING: A guide coupling for the sludge discharge line at the backwash pond pumphouse shall be provided. It shall be bronze Model 633-AD Adapter by Kam Lock, OPW, or approved equal.

PART 3: EXECUTION

3-1 GENERAL PIPE INSTALLATION: Due to the small scale of the drawings, it is not possible to indicate all of the piping systems nor to show all offsets, fittings, etc., which may be required.

All piping shall be installed as closely as possible to walls, ceilings, columns, beams and equipment (consistent with proper space requirements for maintenance and operational appurtenances) so as to occupy the minimum of space. All offsets, fittings, etc. required to accomplish this must be furnished.

Provisions for maximum flexibility are not always shown and the Contractor may add flexible joints where required, and approved, by the Contracting Officer. All piping shall be installed plumb and square.

Exposed pipe shall be run parallel with or at right angles to the adjacent walls and floors.

Piping shall be run in a straight grade between elevations shown on the plans, except when not possible due to conflict with other facilities. Pipelines carrying liquid shall be installed without high points that could trap gases or air and shall be kept below the static water level in the items to which they connect.

All pipe, fittings, and valves delivered to the work site shall be clearly marked to identify the material, class, and thickness. All material shall be new and free of blemishes.

3-2 PIPES THROUGH CONCRETE WALLS: Unless otherwise specifically detailed on the plans, when a pipe (except copper or wrought steel) passes from concrete to earth or from earth to concrete, a bell and spigot, ringtite, wedgelock,

or other flexible-type joint or coupling shall be installed. Particular care shall be taken to secure full support of the pipe in the earth. Where pipes terminate in or pass through concrete sections below finished grade, they may be set in place or block out opening may be made in the concrete. Location of the openings shall be accurately determined, and they shall be of sufficient size to permit passage of flanges and bells to allow satisfactory caulking of the opening. Block out openings may not be used in tank walls, floors, or areas where liquid is contained or where ferrous pipes from earth to concrete allow possible groundwater entry.

After installation of the pipe, the openings around the pipe shall be closed by pouring with non-shrink grout in accordance with the manufacturer's instructions.

Where grout is placed in openings through vertical walls, a "spout" 6 inches above the highest point in the opening shall be provided and filled with grout to assure filling the entire opening. The grout shall be thoroughly mixed and shall be poured in place immediately after mixing.

On exposed external surfaces, the finished surface of the grout shall be left not less than 3/4-inch below the adjacent surfaces and a 3/4-inch coat of 3:1 Portland cement plaster applied after the grout has set. The exterior face of the grouted opening and the joint between the grouting and the wall shall be painted with 3 coats of emulsified asphalt.

Whenever the pipelines extend through structural walls or through successive walls, or through a roof slab and adjacent wall, the Contractor shall provide a sufficient number of unions, flanges, or similar couplings to permit the dismantling of sections of pipelines within the structure without disturbing adjacent lines or portions within the concrete.

Wherever a pipeline passes through the concrete wall or a tank designed to contain water or other liquid at such an elevation that the pipe outside the tank is above ground level or exposed within a building, the Contractor shall install a wall fitting or shall have brazed around the pipe at the center of the wall a continuous fin or collar at least 1/4-inch thick and 2 inches deep, to prevent leakage around the pipe. The wall fitting or pipe with fin shall be poured in place.

Wherever pressurized lines pass through walls and are shown with wall pieces, or where removable equipment exists along the pipeline, pieces with integrally cast (not brazed on) seep rings will be installed with adequate reinforcement steel on both sides of the seep ring to transfer thrust either way into the concrete wall. Approved alternative restraint systems may be used.

3-3 ALLOWANCES FOR EXPANSION: All hot water lines, and other lines subject to temperature variations shall be so installed as to allow free movement to take care of expansion and contraction. Where expansion is taken up by bends in pipelines, the Contractor shall so install the line that adequate room is available for movement of the pipelines. Anchorages shall be provided at the proper joints to prevent creeping.

3-4 CHASES, SLEEVES, AND WALL PIPES: Galvanized iron or cast-iron pipe sleeves shall be provided for pipes passing through floors, ceilings, and partitions at the time such are being constructed. Where the pipes run through footings, iron pipe sleeves shall be in place before the concrete is placed. Where pipes pass under footings, the holes shall be grouted with concrete. Pipe runs encased in concrete shall be properly supported so that they will not be disturbed during concrete placement operations. The Contractor shall supervise the installation of all chases, and recesses which are installed for the installation of piping, plumbing, ventilation ducts, and heating pipes.

Cutting for the installation of the mechanical work shall be done at times most suitable for other crafts and as directed by the Contracting Officer. Coordination of this work shall be the responsibility of the Contractor. Where necessary to cut chases in walls, they shall be reinforced as directed. After the work is installed, all holes shall be patched to match the finish of the adjacent surface.

3-5 SMALL PIPE INSTALLATION: All threads on steel pipes shall be cut with sharp dies to standard depth, left clean-cut, and tapered. All screwed pipe joints shall be properly sealed with a potable water safe approved joint paste or teflon tape applied on the male threads only. Expansion joints shall be provided as required.

All copper piping shall have solder-type fittings. The joints in the copper pipe shall be properly cleaned, flux applied, and then soldered, all applied in accordance with the manufacturer's directions. All parts to be soldered shall be thoroughly cleaned before the flux is applied. All copper piping where the pipe is in direct contact with the pipe hangers or other metal supports shall be protected with a copper saddle soldered to the underside of the pipe. Saddles may be made of split copper pipe.

All schedule 80 PVC pipe shall have flanged or threaded connections and schedule 40 shall have solvent weld joints. Threads shall be cut with proper tools and connections shall be sealed correctly and completely with teflon tape.

For small size piping in those structures not holding water, sleeves shall be provided for pipes passing through floors, ceilings, and partitions at the time the structure is being constructed. After installation, all sleeves shall be caulked with approved appropriate material; see Section 07951.

In all small piping, unions must be installed at all equipment so that the equipment can be removed without dismantling the piping.

At each piece of equipment using water, valves must be installed in the water supply line, or lines, whether shown or not.

All piping shall be reamed and cleaned of all dirt and scale before being installed. All concealed piping shall be tested in the presence of the Contracting Officer before being concealed. Changes in direction shall be made with fittings. Pipe showing kinks or wrinkles will not be accepted. All joints shall be made watertight or airtight, depending on their use.

3-6 LARGE PIPE INSTALLATION: All pipe fittings to be embedded in concrete shall be accurately located and shall be securely held in place to prevent displacement when concrete is placed. Such embedded items shall be thoroughly cleaned of rust, grease, dirt and other foreign materials that will destroy concrete bond.

All pipe and valves shall be carefully aligned and shall be installed in a neat manner. The bolts in the flange joints shall be drawn up uniformly and tightly around the flange without overstraining the flanges. All joints must be made watertight. If any joint, pipe, fittings, and valve is found defective upon testing, it shall be immediately repaired or replaced by the Contractor at no additional cost to the Government. Make-up piping and closure pieces shall be sized and measured after equipment selection has been completed and located, and all permanent parts of the structure are in place. Couplings may be used when locations are approved by the Contracting Officer. In general, the location of the piping has been fixed on the drawing, but variations will be permitted to suit the type or make of approved equipment purchased by the Contractor. However, the general plan of fittings and connections is expected to be followed unless variations are approved by the Contracting Officer.

3-7 FLEXIBILITY IN PIPING: The drawings show the location of pipe couplings in piping. All mechanical joints or pipe couplings shall be restrained by the use of tie rod systems whether or not shown on the drawings.

Unless otherwise shown, four 3/4-inch diameter rods shall be installed to restrain flexibility joints in piping.

The rods shall be diametrically opposed. When restraining pipe couplings, the rods shall be bolted between adjacent flanges.

The use of mechanical joint connections at interior sides of wall pipes will be accepted instead of flanged joint at the Contractor's discretion. Additional pipe couplings with tie rod restraint can be used, however, coupling location must be approved by the Contracting Officer. Restraint shall be sufficient for the test pressure of the system.

3-8 CLEANUP: After each of the systems has been installed, the Contractor shall thoroughly clean all parts of the installation. All equipment, piping, valves, and fittings shall be cleaned of grease, metal cuttings, and other debris. Any stoppage, discoloration, or other damage to any of the work due to the Contractor's failure to properly install or to properly clean the systems shall be repaired without additional cost to the Government.

3-9 TESTING: Following the cleaning, each system shall be completely tested in the presence of the Contracting Officer. All piping that will be subjected to internal pressures for transporting liquids or gases shall be tested for leaks in accordance with the instructions of the Contracting Officer. In general, tests shall comply with the Uniform Plumbing Code. In the absence of a specific Code test, the lines shall be capable of witnstanding and holding without leakage a pressure equal to 150 percent of the

working pressure for that particular line, except that no test pressure shall be in excess of 200 psi. In the event the line tested should fail, repairs shall be made and the line retested until it does comply.

3-10 DISINFECTION: All potable water lines shall be disinfected. Refer to Section 15041.

3-11 PLUMBING FIXTURES INSTALLATION: All plumbing fixtures and equipment described in this section shall be installed in strict conformance with the manufacturer's recommendations.

3-12 DRAINS: Provide drain hose bibs or approved system for draining low points.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing plumbing fixtures in the Water Treatment Plant.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Interior Piping and Plumbing - Section 15203; Toilet Accessories - Section 10800.

PART 2: MATERIALS

2-1 GENERAL: The water closet shall be the Norwall vitreous china wall hung model. Bolt caps shall be included. The water closet seat shall be white and solid plastic.

The faucet shall be self-closing. The lavatory shall have 4 holes with 1 hole for the soap dispenser. The strainer shall have an open grid. The shower valve shall be of the pressure balancing type. The mop sink shall be molded. The service faucet shall have a vacuum breaker.

The items specified in this section shall be approved equal to those manufactured by American Standard, Church, Chicago or Powers Fiat.

2-2 ITEMS:

Water closet	American Standard No. F2090-11
Water closet seat	Church No. 5334.016
Lavatory	American Standard No. 0493.015
Lavatory Faucet	Chicago No. 802-335-E2805
Strainer	American Standard No. 2411.015
P-trap	American Standard No. 4401.014
Shower	American Standard No. 1361.062
Mop sink	Powers Fiat No. MSB 3624
Service faucet	Powers Fiat No. 830-AA
Hose and hose bracket	Powers Fiat No. 832-AA
Mop hanger	Powers Fiat No. 889-CC

PART 3: EXECUTION

3-1 HANDLING: Care shall be exercised to protect the plumbing fixtures during shipment, storage and installation.

3-2 INSTALLATION: The plumbing fixtures shall be installed as shown on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing three treated water pumps at the locations indicated on the drawings. The pumps shall be end suction centrifugal, close coupled and shall be designed for operation at continuous or intermittent service.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Interior Piping and Plumbing - Section 15203; Filter Control Console - Section 15254.

1-3 QUALITY ASSURANCE: American National Standards Institute (ANSI).

1-4 DESIGN CONDITIONS:

Number of Units		3
Condition #1	Capacity, gpm	290
	Total Head, ft	220
	Efficiency, percent	73
Condition #2	Capacity, gpm	230
	Total Head, ft	240
	Efficiency, percent	70
Maximum Rotational Speed, rpm		3550
Motor, hp		25

Normal operating flow will be 250 gpm

PART 2: MATERIALS

2-1 PUMP: The pump body shall be ductile iron with flanged connections faced and drilled to an ANSI B16.1 125-pound template. The suction connection shall be 3-inch and the discharge shall be 2-inch. The impeller shall be manufactured of Type 316 stainless steel and shall be statically and dynamically balanced. It shall be of the enclosed type and shall be keyed to the shaft. The shaft sleeve shall be manufactured of Type 316 stainless steel finished to 32 micro inches. The pump shall have a stuffing box with asbestos packing, teflon seal cage, and a Type 316 stainless steel split gland.

The treated water pumps shall be approved equal to Model D-1021 as manufactured by Worthington.

2-2 MOTOR: The motor shall be an open drip-proof type with a 1.15 service factor, designed for 460-volt, 3-phase, 60-cycle service.

PART 3: EXECUTION

3-1 HANDLING: The pump shall be protected from the elements during shipment and installation.

3-2 INSTALLATION: The treated water pumps shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall be strictly followed.

Installation shall include all lubrication and oil as recommended by the manufacturer to provide a unit complete and ready for operation.

At no time shall the pumps be supported by the connecting piping, nor shall the connecting piping be supported by the pumps.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing two settling tank sludge pumps. Each pump will be used to either recycle or waste sludge from the settling tanks.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment Section 15201; Interior Piping and Plumbing - Section 15203.

1-3 QUALITY ASSURANCE: American National Standards Institute (ANSI).

1-4 DESIGN CONDITIONS:

Number of Units	2
Condition #1 Capacity, gpm	30
Total head, ft.	16
Condition #2 Capacity, gpm	20
Total head, ft.	18
Pump speed, rpm	1730
Motor speed, rpm	1750
Motor hp	0.5

PART 2: MATERIALS

2-1 PUMP: The pumps shall be centrifugal, and close coupled. The pumps shall be designed for operation at continuous or intermittent service. The pump casing shall be 316 stainless steel. The inlet and discharge connections shall be 1-1/2-inch and 1-inch, minimum. It shall have a Type 316 stainless steel impeller. The pump will be supplied with a mechanical seal constructed of Carbon verses ceramic faces, 316 stainless steel and metal parts, Viton bellows and a 316 stainless steel sleeve.

The pump shall be removable from the rear without disturbing discharge or suction piping.

The settling tank sludge pumps shall be approved equal to Model D-520 as manufactured by Worthington.

2-2 MOTOR: The motor shall be an open drip-proof type with a 1.15 service factor, designed for 460 volt, 3-phase, 60-cycle service. The motor shaft shall be 416 stainless steel.

PART 3: EXECUTION

3-1 HANDLING: The pump shall be protected from the elements during shipment and installation.

3-2 INSTALLATION: The sludge pumps shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall strictly followed.

Installation shall include all lubrication and oil as recommended by the manufacturer to provide a unit complete and ready for operation.

At no time shall the pumps be supported by the connecting piping, nor shall the connecting piping be supported by the pumps.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work with which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing two pumps in the Backwash Pond Pump House. One pump shall be used to decant water from the backwash ponds to the rapid mix tank at the water treatment plant. The other pump shall be used to transfer sludge from the backwash ponds to the sewage treatment plant or to a tank truck.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Interior Piping and Plumbing - Section 15203.

1-3 QUALITY ASSURANCE: American National Standards Institute (ANSI).

1-4 DESIGN CONDITIONS:

Number of Units	2
Condition #1 Capacity, gpm	100
Total head, ft.	28
Condition #2 Capacity, gpm	120
Total head, ft.	25
Pump speed, rpm	1150
Maximum solids diameter inches	1-7/8
Motor speed, rpm	1760
Motor hp	5

PART 2: MATERIALS

2-1 PUMP: The pumps shall be a centrifugal non-clogging solids pump with a recessed-type impeller. It shall be belt driven, with adjustable sheaves. The pumps shall be designed for operation at continuous or intermittent service. The pump construction shall be cast Ni-Hard iron for both casing and impeller with a minimum of 1/2-inch thickness. Casings shall be two-piece, split vertically to allow access to the impeller without dismantling the pump discharge casing. The impeller shall be mounted such that there is no interference to the flow. Flow suction shall be directed to the center of the impeller. Impeller shaft shall be direct hardened carbon steel conforming to ASTM A-108. The shaft sleeve through the packing length shall be stainless or high-chrome steel. Shaft bearings shall be heavy duty antifriction-type enclosed in an oil bath with an oil reservoir at each end to prevent entrance of foreign matter. Thrust bearings shall be ball bearings in an angular contact plate.

The pump shall have a water seal packing gland.

Standard ANSI B16.1 125 pound flanges are to be furnished at both the pump suction and discharge, the suction connection being 2-inch and the discharge connection being 2-inch.

The volute shall be manufactured with a drain.

A temperature sensor shall be mounted on the pump volute, at the drain.

The sludge waste and decant pumps shall be similar and equal to Model C as manufactured by WEMCO.

2-2 PUMP MOTOR AND DRIVE: Each pump shall be belt driven as shown on the drawings. Power supply for the motor is 460-volts, 3-phase, 60-cycle. The motor shall be an open, drip-proof type with a 1.15 service factor.

PART 3: EXECUTION

3-1 HANDLING: The pump shall be protected from the elements during shipment and installation.

3-2 INSTALLATION: The sludge pumps shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall be strictly followed, including belt tension.

Installation shall include all lubrication and oil as recommended by the manufacturer to provide a unit complete and ready for operation.

At no time shall the pumps be supported by the connecting piping, nor shall the connecting piping be supported by the pumps.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing one polymer solution feed pump and one powdered activated carbon slurry pump. The pumps shall be mechanical diaphragm type pumps.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Interior Piping and Plumbing - Section 15203.

1-3 DESIGN CONDITIONS:

A. Polymer Pump

Number of Units	1
Type	Dual Head
Capacity per head, gph	0-18.0
Pumping rate, strokes per minute	0-105
Motor hp	1/4
Material to be pumped	Polymer, 1/4 percent solution

B. Powdered Activated Carbon Pump:

Number of Units	1
Type	Dual Head
Capacity per head, gph	0-11.0
Pumping rate, strokes per minute	0-69
Motor, hp	1/4
Material to be pumped	PAC, 0.2 lbs./gal.

PART 2: MATERIALS

2-1 GENERAL: The polymer pump shall be approved equal to BIF 1271-21-9211. The powdered activated carbon slurry pump shall be approved equal to BIF 1212-26-9412 with a slurry head.

The pump housing shall be cast-iron or aluminum. The diaphragm shall be a molded elastomer of nylon reinforced Hypalon. It shall have a back-up disc to assure consistency and long diaphragm life. The diaphragm shall isolate the process fluid from the push rods and all other mechanical equipment in the pump. The pump head shall be clear plastic or Tyril or PVC.

The seals shall be of Hypalon. The pipe connectors shall be screwed type PVC. The check valves shall be Hypalon. The pump shall be supplied with a pressure sustaining (anti-syphon) valve on the pump discharge. The pump discharge shall be controlled by a dial operated micrometer having an in-motion capacity adjustment from 0 to 100 percent. The motor shall be suitable for 115-volt, 1-phase, 60-cycle service.

2-2 POLYMER FEED PUMP: The polymer feed pump shall have a dual head designed to transfer equal quantities of polyelectrolyte solution from the polymer mix tank to 2 dilution lines, which in turn will inject the diluted solution into the 2 filter influent pipelines.

2-3 PAC PUMP: The powdered activated carbon (PAC) slurry pump shall have a dual head designed to pump equal quantities of slurry from the powdered activated carbon feeder solution tank to the 2 filter influent pipelines.

PART 3: EXECUTION

3-1 HANDLING: Care shall be exercised during shipment and on-site storage to prevent any damage.

3-2 INSTALLATION: The polymer metering pump shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall be strictly followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing three sump sumps. One shall be installed at the water treatment plant, one shall be installed at the backwash pond pumphouse, and one shall be a spare pump equal to the pumps installed.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Interior Piping and Plumbing - Section 15203.

1-3 DESIGN CONDITONS:

Number of units	3
Capacity, gpm	10
Total head, feet	24
Motor, hp	1/3

PART 2: MATERIALS

2-1 GENERAL: The pumps shall be the submersible type with a centrifugal, non-clogging, bronze, impeller. The pump case shall be heavy bronze casting with 3 support legs, all bronze and a baffle to block large objects from the impeller. Bearings shall be the ball bearing type. The shaft shall be stainless steel a minimum of 5/8-inch diameter. The motor case shall be bronze with rubber seal and stainless steel screws or bolts or other connections. The motor shall be suitable for continuous or intermittent duty, and 115-volt, 1-phase, 60-cycle, electric service. A 10-foot electric cord with three-prong plug and pump lifting handle shall be provided.

Pump operation shall be controlled by a diaphragm type pressure switch isolated from damage by objects in the sump and set to start the pump at a depth of 8-12 inches.

The sump pump shall be approved equal to Model OSB33AB-1 as manufactured by Hydr-O-Matic Pump Division of Wylain, Inc.

PART 3: EXECUTION

3-1 HANDLING: Care shall be exercised to protect the pumps during shipping and storage.

3-2 INSTALLATION: The sump pumps shall be installed as shown on the drawings. All manufacturer's procedures and tolerances for installation shall be strictly followed. Installation shall include all lubrication and oil as recommended by the manufacturer to provide a unit complete and ready for operation.

The spare pump shall be delivered to the water treatment plant for storage.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a turbine type agitator in the rapid mix basin. The agitator consists of a motor and motor bracket, high speed coupling, right angle speed reducer, low speed coupling, impeller shaft, turbine impeller and mechanism support.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201.

1-3 QUALITY ASSURANCE: American Gear Manufacturer's Association (AGMA).

1-4 DESIGN CONDITIONS:

Number of Units	1
Desired Minimum Velocity Gradient, sec.$^{-1}$	G=500
Impeller speed, rpm	84
Motor, hp	2
Motor speed, rpm	1750
Basin surface area, square-feet	16
Basin sidewater depth, feet	14
Maximum flow, gpm	500

PART 2: MATERIALS

2-1 DRIVE MOTOR: The drive motor shall be of the totally enclosed fan cooled type designed for outdoor service with windings impregnated with a special moisture resistant compound. The motor shall have a service factor of 1.15 for operation on 460-volt, 3-phase, 60-cycle current. It shall be of the horizontal foot mounted type with normal starting torque.

2-2 HIGH SPEED COUPLING: The connection between the motor and the reducer unit shall be made by means of a flexible coupling, approved equal to a T. B. Woods Sureflex, Falk Steelflex. A coupling guard shall be provided to prevent any contact with moving parts.

2-3 SPEED REDUCER:

a. Case: The speed reducers shall be a right angle design and constructed of fabricated steel or cast iron. Lifting lugs shall be provided.

b. Gears: All internal gears shall be of helical and spiral type.

Worm gears will not be permitted. Helical gears shall be through hardened. No case hardened gears will be allowed.

Gears shall be lubricated by means of an oil bath with gears running in oil to insure constant lubrication to all surfaces. The reducer output shaft shall be provided with an oil dam to prevent lubricant leakage along the shaft. It shall be equipped with readily accessible lubricant fill and drain openings, and a visible indicator for checking the oil level.

C. Bearings: All bearings shall be tapered roller bearings, approved equal to those manufactured by Timkin for high thrust and load capacity. No ball bearings will be permitted in the reducer. Bearings must have a B-10 life greater than 30,000 hours. No sealed-for-life bearings will be accepted. Grease lubricated bearings shall have easily accessible fittings.

D. General Design: The speed reducer must be designed and rated in accordance with AGMA practice.

(1) Service Factor: Suitable for 24-hour/day load as recommended by AGMA. The speed reducer shall have a minimum surface factor of 1.25 based on motor horsepower.

(2) Shaft Horsepower: Approximately 85 percent of full load.

(3) AGMA Thermal Rating: Must exceed mechanical rating of drive.

(4) Impeller Speed: Reducer shall step down 1,750 rpm motor speed to approximately 84 rpm at reducer output.

2-4 LOW SPEED COUPLING: A low speed all welded rigid flanged coupling shall be provided for the maintenance and replacement of the impeller shaft.

The low speed coupling halves must be attached when shipped, one to the low speed reducer output shaft and the other to the impeller shaft to avoid unnecessary field installation and insure a proper fit.

2-5 IMPELLER SHAFT: The impeller shaft shall be carbon steel. It shall be constructed and supported so that the shaft deflection caused by operating loads do not affect the alignment of the anti-friction bearings or cause misalignment of the gearing during mixer operation. When turned by hand, the impeller shaft runout or deflection shall not exceed 1/4-inch per 10 feet of length. The shaft and bearing assembly shall be designed to operate at or below 0.65 of the natural frequency of the system. Operation up to 0.80 of the natural frequency will be allowed, provided proper stabilizing devices are used. The impeller shaft shall be mounted on no more than 2 rolling, anti-friction type bearings. The impeller shaft bearings must be at least 24 inches away from the liquid level to eliminate possible malfunction due to bearing lubricant contamination. The shaft shall be extended through the impeller hub and transmit the torque through a hooked key and keyway to insure a positive trouble-free connection for transmitting the torque, and to prevent disconnection of the impellers under operating conditions.

2-6 TURBINE IMPELLER: The rapid mix agitator shall be provided with two impellers approximately 25 inches in diameter. The impellers shall be manufactured of carbon steel.

Impellers shall be of the pitched, 4-blade type, bolted or welded to the impeller hub.

The impellers shall be removable from the shaft for repositioning or replacement and shall be located as shown on the drawings.

Impellers requiring dynamic balancing will not be permitted.

The unit shall be approved equal to the Chemineer Model 1 HTD 2 with 2 26-inch diameter type B impellers.

PART 3: EXECUTION

3-1 HANDLING: Prior to shipment, a protective coating must be applied to the exposed metal parts of the unit for rust prevention.

The interior parts of the reducer must be sprayed with a rust preventative lubricant which provides for normal indoor storage conditions.

3-2 INSTALLATION: Agitator shall be installed in a vertical position with propellers located at the elevations shown on the drawings.

All manufacturer's procedures and tolerances for installation will be strictly followed.

Installation shall include all lubrication and oil as recommended by the manufacturer to provide a unit complete and ready for operation.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a turbine type agitator for each of the two flocculator basins. The agitators shall consist of a motor and motor bracket, high speed coupling, right angle speed reducer, low speed coupling, impeller shaft, turbine impeller and mechanism support.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201

1-3 QUALITY ASSURANCE: American Gear Manufacturer's Association (AGMA)

1-4 DESIGN CONDITIONS:

Number of Units	2
Impeller speed, rpm	25
Desired Velocity Gradient Range, sec.-1	G= 20-150
Motor, hp	3
Motor speed, rpm	1750
Basin area, square feet	81
Basin sidewater depth, feet	14.5
Maximum flow, gpm	500

PART 2: MATERIALS

2-1 DRIVE MOTOR: The drive motor shall be of the direct current variable speed type complete with variable speed controller. The drive motor shall consist of a standard C-face DC motor coupled through a non-corrosive, non-fretting flexible coupling to a single parallel reduction unit supplying the necessary low speed input to the reducer. The unit shall be designed to receive a 230 volt, 1-phase, 60-cycle power supply at the controller.

The motor shall be a totally enclosed not ventilated type, suitable for outdoor service with windings impregnated with special moisture resistance compounds.

The controller shall accomplish speed regulations between 10 and 100 percent of rated speed with a maximum allowable error of 0.5 rpm. The direct current system shall be complete with current limiting and IR compensation and will be suitable for mounting on the hand rail adjacent to the motor. The system shall be in a NEMA 1 enclosure complete with speed adjusting potentiometer, start-stop rocker switch and AC circuit breaker. A set of contacts shall be provided for a running light and running time meters to be located at the office control panel.

2-2 HIGH SPEED COUPLING: The connection between the motor and the reducer unit shall be made by means of a flexible coupling, approved equal to a T. B. Woods Sureflex or Falk Steelflex. A coupling guard shall be provided to prevent any contact with moving parts.

2-3 SPEED REDUCER:

A. Case: The speed reducer shall be a right angle design and constructed of fabricated steel or cast-iron. Lifting lugs shall be provided.

B. Gears: All internal gears shall be of helical and spiral type. Worm gears will not be permitted. Helical gears shall be through hardened. No case hardened gears will be allowed.

Gears shall be lubricated by means of an oil bath with gears running in oil to insure constant lubrication to all surfaces. The reducer output shaft shall be provided with an oil dam to prevent lubricant leakage along the shaft. It shall be equipped with readily accessible lubricant fill and drain openings, and a visible indicator for checking the oil level.

C. Bearings: All bearings shall be tapered roller bearings similar and equal to those manufactured by Timkin for high thrust and load capacity. No ball bearings will be permitted in the reducer. Bearings must have a B-10 life greater than 30,000 hours. No sealed-for-life bearings will be accepted. Grease lubricated bearings shall have easily accessible fittings.

D. General Design: The speed reducer must be designed and rated in accordance with AGMA practice.

(1) Service Factor: Suitable for 24 hour/day load as recommended by AGMA. Minimum of 1.25 based on motor horsepower.

(2) Shaft Horsepower: Approximately 85 percent of full load.

(3) AGMA Thermal Rating: Must exceed mechanical rating of drive.

(4) Impeller Speed: Reducer shall step down 1,750 rpm motor speed to approximately 25 rpm at reducer output.

2-4 LOW SPEED COUPLING: A low speed all welded rigid flanged coupling shall be provided for the maintenance and replacement of the impeller shaft.

The low speed coupling halves must be attached when shipped, one to the low speed reducer output shaft and the other to the impeller shaft to avoid unnecessary field installation and insure a proper fit.

2-5 IMPELLER SHAFT: The impeller shaft shall be carbon steel. It shall be constructed and supported so that the shaft deflection caused by operating loads do not affect the alignment of the anti-friction bearings or cause

misalignment of the gearing during mixer operation. When turned by hand, the impeller shaft runout or deflection shall not exceed 1/4-inch per 10 feet of length. The shaft and bearing assembly shall be designed to operate at or below 0.65 of the natural frequency of the system. Operation up to 0.80 of the natural frequency will be allowed, provided proper stabilizing devices are used. The impeller shaft shall be mounted on no more than two rolling, anti-friction type bearings. The impeller shaft bearings must be at least 24 inches away from the liquid level to eliminate possible malfunction due to bearing lubricant contamination. The shaft shall be extended through the impeller hub and transmit the torque through a hooked key and keyway to insure a positive trouble-free connection for transmitting the torque, and to prevent disconnection of the impellers under operating conditions. The minimum shaft diameter shall be 3 inches.

2-6 TURBINE IMPELLER: The flocculator shall be provided with a carbon steel impeller approximately 68 inches in diameter, by 16 inches wide.

The impeller shall be of the pitched, 4-blade type, bolted or welded to the impeller hub.

The impeller shall be removable from the shaft for repositioning or replacement and shall be located as shown on the drawings.

Impellers requiring dynamic balancing will not be permitted.

The flocculator shall be approved equal to Chemineer Model 3 HTD 3.

PART 3: EXECUTION

3-1 HANDLING: Prior to shipment, a protective coating must be applied to the exposed metal parts of the unit for rust prevention.

The interior parts of the reducer must be sprayed with a rust preventative lubricant which provides for normal indoor storage conditions.

3-2 INSTALLATION: Agitator will be installed in a vertical position with propellers located at the elevation shown on the drawings.

All manufacturer's procedures and tolerances for installation will be strictly followed.

Installation shall include all lubrication and oil as recommended by the manufacturer to provide a unit complete and ready for operation.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing four in-line static mixers. Two 8-inch diameter units are required, one in each filter influent pipeline. Two 1-inch diameter units are required, one in each polymer solution pipeline.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Interior Piping and Plumbing - Section 15203.

1-3 DESIGN CONDITIONS:

A. 8-inch Units	
Process Water Flow, gpm	250
Chemical Flow, gpm	
PAC (0.01 lbs/gal.)	5
Polymer (0.004 lbs/gal.)	1
Maximum headloss, ft.	0.8
B. 1-inch Units	
Transport Water Flow, gpm	1
Polymer (0.02 lbs/gal.), gpm	0.2
Maximum head loss, ft.	10

PART 2: MATERIALS

2-1 GENERAL: The units shall be approved equal to those made by the Kenics Corporation, North Andover, Massachusetts.

2-2 8-INCH STATIC MIXER: These two mixers shall be of the in-line, continuous mixing process type having no moving parts and requiring no external power. Each unit shall consist of fixed right-hand and left-hand helical elements enclosed within a tubular housing. The mixing elements shall be permanently and continually bonded to the pipe wall.

The static mixers shall be constructed of fiberglass reinforced polyester. The units shall have a working pressure of at least 100 psi at 60°F. The units shall have flanged ends faced and drilled to an ANSI B16.1 125-pound template. The overall length of each unit shall not exceed 4 feet. The units shall provide thorough mixing of the entering stream.

2-3 1-INCH STATIC MIXERS: The construction of these two units shall be similar to that of the 8-inch units. The units shall be provided with the fittings required to connect them into 3/4-inch, Schedule 80 polyvinyl chloride pipe lines.

PART 3: EXECUTION

3-1 HANDLING: The units shall be protected from damage during shipment and storage. They shall be protected from direct sunlight.

3-2 INSTALLATION: The 8-inch units shall be placed in the filter influent line and the 1-inch units in the 3/4-inch polymer feed lines as shown on the drawings. All manufacturer instructions and recommendations on installation procedures, bolt torques and mixer support shall be followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing tube settler modules in the settling tanks as shown on the Drawings. These modules shall consist of an array of tube-like channels inclined at an angle of 60 degrees to the horizontal, each not exceeding 4 square inches in cross sectional area.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Miscellaneous Metalwork - Section 05500.

1-3 DESIGN CONDITIONS:

No. of Basins	2
Surface area per basin, square feet	117
Maximum flow per basin, gpm	250
Surface application rate, gpm/square feet	2.14

PART 2: MATERIALS

2-1 GENERAL: The material of construction shall be rigid, chemically resistant plastic, approved for use with potable water. Each module shall be capable of supporting its own weight plus a 200 pound load concentrated on a 2-foot square area at the center of the module. The module shall be able to support these loads while spanning the maximum distance required in the settling tank. If the modules are unable to support these loads, the manufacturer shall provide whatever additional structural support necessary to meet these conditions.

The tube settler modules shall be approved equal to those manufactured by Keystone Engineering and Products Co., Inc., Seattle, Washington, or Neptune Microfloc, Inc., Corvallis, Oregon.

2-2 SUPPORT SYSTEM: The Contractor shall furnish and install the support system as shown on the drawings and conforming to the requirements of the tube settler manufacturer. Prior to fabrication and installation of the support system, complete and detailed shop drawings shall be submitted to the tube settler manufacturer for approval.

PART 3: EXECUTION

3-1 HANDLING: Care shall be exercised in loading, transporting, unloading, and placing of the tube settler modules. Any modules which are damaged with regard to performance, structural or aesthetic integrity shall not be accepted.

3-2 INSTALLATION: Installation shall be according to the manufacturer's requirements and recommendations. The supplier of the tube settler modules shall provide on-site services of a manufacturer's representative during installation.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing two propeller type flow meters, three venturi type flow meters, and one turbine meter. One tube type propeller meter shall be used to measure the backwash supply flow, and one to measure the flow of treated water. Each of these meters shall have a local indicator and a remote indicator/ totalizer to be located in the filter control console. The discharge piping from each of the three treated water pumps shall have a venturi type meter. These three meters will have a single common flow indicator. A turbine type meter shall be installed on the plant water system supply line where it enters the plant.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201, Interior Piping and Plumbing - Section 15203, Filter Control Console - Section 15254.

1-3 QUALITY ASSURANCE: American National Standards Institute (ANSI).

1-4 DESIGN CONDITIONS:

A. Propeller Type Meters:

	Backwash Supply	Treated Water
Number of units	1	1
Size, inches	10	8
Capacity, gpm	0-1500	0-750
Accuracy, percent	±2	±2
Maximum Working Pressure,psi	150	150

B. Venturi Type Meters:

Number of units	3
Size, inches	4
Capacity, gpm	150-400
Accuracy, percent	±1
Maximum Working Pressure, psi	150

C. Turbine Type Meter:

Number of units	1
Size, inches	2
Capacity, gpm	4-160
Accuracy, percent	±1.5
Maximum Working Pressure, psi	125

PART 2: MATERIALS

2-1 PROPELLER TYPE METERS: The meter tube shall be manufactured of close grain, high-tensile strength cast-iron. The connections shall be flanges faced and drilled to a standard ANSI B16.1 125-pound template. The meterhead is to be connected to the tube by means of a flanged connection. The meterhead cover plate shall be cast-iron. The propeller shall be of a corrosion resistant polyethylene plastic. Rotation of the propeller shall be transmitted by means of a worm and worm gear. The meter shall have a local direct reading flow indicator, a transmitter, and a remote indicator/totalizer at the filter control console. The indicator and totalizer shall be calibrated in gallons per minute and gallons, respectively. Connective wiring and related accessories shall be included with the remote unit.

The backwash supply, treated water, and raw water flow meters shall each be approved equal to Model FM112 as manufactured by Sparling. Each shall have a panel mounted indicator/totalizer similar and equal to Model 221-M as manufactured by Sparling. The indicator/totalizers shall be mounted on the filter control console.

2-2 VENTURI TYPE METERS: The venturi tube shall be fabricated of thermosetting polyester resin, reinforced with not less than 25 percent glass fiber, by weight. It shall be designed for butt mounting between standard ANSI B16.1 126 pound flanges with 1/8-inch thick neoprene gaskets. The pressure connections shall be lined with Type 316 stainless steel. There shall be a single pressure connection at the inlet and at the throat. The inlet section shall be cylindrical with an inside diameter equal to the inside diameter of the pipe preceeding it. It shall incorporate a hydraulic slope employing at least two vena contractae to condition the flow profile before it enters the throat section. The laying length of the throat shall be at least 0.5 times the throat diameter. The outlet cone shall be truncated having an included angle of 10 degrees.

A single local flow indicator shall be provided with a manifold connecting to each pair of pressure taps from the venturi tubes. Three sets of solenoid valves shall be operated from a single selector switch. The selector switch shall have four positions: Pump No. 1, Pump No. 2, Standby Pump, and Off.

The selector switch, manifold, solenoid valves, and indicator shall be housed in a NEMA 12 enclosure.

The flow indicator shall consist of dual rupture proof stainless steel bellows with integral temperature compensation. The bellows shall be liquid filled, and motion transmission shall be by a hermetically sealed torque tube. The indicating mechanism shall consist of a precision jewelled rotary movement that multiplies the rotation of the torque tube through a gear and pinion to the indicating pointer. It shall have micrometer screws for zero and range adjustment. The indicator shall be housed in a 6-inch case fabricated from die-cast aluminum. The pointer shall travel through a 270 degree arc. Square root gradations shall indicate flow from 0 to 420 GPM, corresponding to 0 to 150 inches of differential. It shall be accurate to within $\pm$0.5 percent of full scale differential pressure. The indicator shall be suitable for flush panel mounting.

The venturi tubes shall be approved equal to Model 0132-04-2231 "B" throat as manufactured by B.I.F.

The flow indicator shall be approved equal to Model 200 Differential Pressure Flow Rate Indicator as manufactured by Barton.

2-3 TURBINE TYPE METER: The meter body shall be cast bronze with a stainless steel trim. The straightening vanes and flow tube shall be plastic. the rotor shall be thermoplastic.

The meter shall be provided with threaded end connections. The register shall be calibrated to indicate in gallons. The meter shall be Model W-160 TURBO-MASTER manufactured by Rockwell, or approved equal.

PART 3: EXECUTION

3-1 HANDLING: The units shall be protected from damage during shipment and storage.

3-2 INSTALLATION: The units shall be installed as shown on the drawings. All manufacturer's instructions and recommendations on installation procedures shall be followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a mixed media filter bed including supporting gravel. The media specified herein shall be utilized to produce high quality water, which in conjunction with the other treatment processes shall provide safe, potable water which will meet or exceed the Drinking Water Quality Standards as established under the Safe Drinking Water Act (PL 93-523). Included in this section will be all materials, equipment, and labor required to install the media by the recommended procedures of the manufacturer.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Filter Underdrain - Section 15252

1-3 QUALITY ASSURANCE: American Water Works Association (AWWA)

The media and support gravel shall meet the requirements of AWWA Standard B100.

1-4 DESIGN CONDITIONS:

Number of filters	2
Surface area, square-feet	31
Flow, gallons per minute	250
Support, gravel depth, inches	7
Stabilizing gravel depth, inches	3
Media depth, inches	30

PART 2: MATERIALS

2-1 SILICA SUPPORTING GRAVEL: Silica gravel shall be furnished and graded in accordance with recommendations of the supplier. Silica supporting gravel shall consist of hard rounded stones with an average specific gravity of not less than 2.5. Not more than 1 percent by weight of the material shall have a specific gravity of 2.25 or less. The gravel shall contain not more than 2 percent by weight of thin, flat, or elongated pieces (pieces in which the largest dimension exceeds 5 times the smallest dimension), as determined by hand picking, and shall be free from shale, mica, clay, sand, loam, and organic impurities of any kind. The porosity of the gravel in any layer shall not be less than 35 nor more than 45 percent. The gravel within each layer shall be uniformly graded. Gravel of 1/4-inch in diameter may be screened through wire screens with square openings or plates with rounded openings. Wire screens shall be used for sizes smaller than 1/4-inch. Not more than 8 percent by weight of any layer shall be finer or coarser than specified for the layer. Sizing to meet the requirements of a vitrified tile filter block underdrain system.

The total depth of the silica supporting gravel shall be 7 inches consisting of the following gradations:

(a) bottom: 3 inches of 1-1/2 to 3/4 inches.

(b) middle: 2 inches of 3/4 to 3/8 inches.

(c) top: 2 inches of 3/8 to 3/16 inches.

2-2 STABILIZING LAYER: The quality and physical characteristics shall meet those requirements of silica support gravel. High density gravel shall be furnished for a depth of 3 inches and properly sized to match the bottom layer of filter media to be graded silica gravel. The gravel shall be designed to act as a barrier to the mixed-media and be supported below by the silica gravel. The high-density gravel shall match the physical characteristics of the silica gravel except that its specific gravity shall not be less than 3.8.

The total depth of the stabilizing layer shall be 3 inches consisting of the following gradation:

(a) 3 inches of 3/16-inch to No. 14

2-3 MEDIA: The filter media shall be provided to produce a decreasing void gradation from 1 mm. at the top to 0.3 mm. at the bottom.

The filter media shall be furnished to a total depth of 30 inches. It shall consist of:

Material	Specific Gravity	Size, mm.	Depth, inches
Coal	1.6	1.0±	18
Silica Sand	2.6	0.5±	9
High-Density Sand	3.8	0.3±	3

The mixed-media shall have a tapering size gradation, from coarse to fine in the direction of flow. Hydrochloric acid solubility of the materials shall be in accordance with the American Water Works Association Standard for Filter Materials B100. Carbonaceous material shall be clean and free from long, thin, scaly pieces, and shall have a hardness of over 2.7 on the MOH scale.

The media shall be approved equal to MF-162 mixed media by Neptune Micro-floc.

PART 3: EXECUTION

3-1 HANDLING: All media bags shall be stored in a protected area to prevent damage or contamination.

3-2 INSTALLATION: The installation of the filter media and supporting gravel shall be done under the direction of the manufacturer's qualified technical representative.

The filter tank and underdrain shall be thoroughly cleaned before starting gravel and media placement. Materials shall be handled to keep them clean during the placement, and any material becoming dirty shall be removed and replaced.

The bottom gravel layer shall be placed carefully by hand to avoid movement to the underdrain system and to assure free passage for water from the orifices. Each layer shall be completed before the next layer above is started. For materials less than 1/2-inch in diameter, the workmen shall not stand or walk directly upon the gravel but shall work upon boards which will sustain the weight of the workmen without displacing the gravel. Any gravel becoming mixed shall be removed and replaced in layers as herein specified. Backwashing of the gravel shall be utilized at the discretion of the media supplier, to remove dirt, dust, or fine accumulations.

The correct thickness for each layer for sizes 1/2-inch or larger shall be obtained as follows: Before the gravel is placed, the top of each layer shall be marked on the side of the filter. The top of each layer shall then be leveled against a water surface held at the appropriate mark. None of the particles shall be less than half submerged and there shall be no places where additional gravel can be placed without the particles extending more than 1/2 their volume above the water surface. For sizes less than 1/2-inch, the gravel shall be leveled to plus or minus 1/4-inch of the water surface.

Media shall be placed in a manner similar to the gravel placement and graded as may be required to achieve the size distribution recommended by the supplier.

3-3 DISINFECTION: The filter media shall be disinfected after all construction work has been completed. The filter basin shall be filled with water and chlorine added in the amount to form a 50 ppm free chlorine residual. The chlorinated solution shall be left in the basin for not less than 24 hours, and after that length of time, the chlorine residual of the solution at any place in the basin shall not be less than 10 ppm.

After approval of the disinfection, the Contractor shall backwash the filter media until the chlorine residual is less than 0.3 ppm.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under the other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a vitrified clay tile block underdrain system for each filter, including all material equipment and labor required to install the system in compliance with the manufacturer's recommendations.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Filter Media - Section 15251.

1-3 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM).

1-4 DESIGN CONDITIONS:

Filter Units	2
Area, square-feet	81
Backwash rate, gpm/sq. ft.	12-18
Head loss at 15 gpm/sq. ft., ft.	2.5

PART 2: MATERIALS

2-1 TILE BLOCKS: The tile blocks shall be of the vitrified-tile type, constructed of fire clay, de-aired and vitrified to provide sanitary, non-absorbent surfaces. The overall block dimensions shall be 10 inches high by 11 inches wide by 2 feet long, except the row of blocks over the flume which shall be 2 feet, 6 inches in length. After the blocks are extruded, cut and perforated, they shall be stored for slow drying in warm moist air. After the blocks are practically dry, they shall be placed in the kiln and burned for several days at a temperature of at least 2000° F. until they are thoroughly vitrified, hard, smooth and straight. The weight of the final block shall average approximately 55 pounds per square foot of filter bed area.

The blocks shall be of the compound duplex type with both primary distribution and secondary equalization laterals provided. Primary laterals shall provide an area approximately equivalent to the area of a circular 6-1/4-inch diameter conduit. Two 5/8-inch diameter metering orifices shall be provided per square foot of filter area to interconnect the primary and secondary laterals. The discharge through the top of the blocks shall be accomplished with 1/4-inch diameter orifices on approximately 1-1/4-inch centers. All filter blocks shall be uniform and smooth in construction with all holes open and smooth.

The blocks shall be approved equal to the Dual-Parallel Lateral Filter Underdrain as manufactured by F.B. Leopold Company, Division of Sybron Corporation.

2-2 END PLATES: The end plates shall be manufactured of PVC.

2-3 BLOCK ANCHOR BOLTS: The block anchor bolts shall meet the requirements of ASTM A-615 No. 4 rebar grade 40.

2-4 CEMENT GROUT:

A. Portland Cement: The Portland Cement shall meet the requirements of ASTM C-150, Type I or II.

B. Sand: The sand shall meet the requirements of ASTM C144-76 for fine aggregate sound, durable, free from deleterious substances, meeting the following gradations:

Passing No.	4 sieve	100 percent
Passing No.	8 sieve	95-100 percent
Passing No.	16 sieve	70-100 percent
Passing No.	30 sieve	40-75 percent
Passing No.	50 sieve	20-40 percent
Passing No.	100 sieve	10-25 percent
Passing No.	200 sieve	0-10 percent

C. Mix: The mix shall be composed of 1 part Portland cement, 2 parts fine aggregate, and clean water to produce a spreadable mixture.

PART 3: EXECUTION

3-1 HANDLING: The filter blocks shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: Prior to placing the filter blocks, the filter shall be cleaned and the floor shall be thoroughly wetted, but no free water shall be applied or allowed to remain on the surface within 30 minutes of the time when the grout is placed.

Filter blocks shall be set level on the filter bottom and placed on a bed of Portland cement grout approximately 1/2-inch thick. After setting, aligning, and joining the tile, all spaces between blocks, rows of blocks, and between blocks and walls, shall be filled with Portland cement grout so that the entire bed is held firmly in place and totally sealed. The Contractor shall exercise extreme care not to allow any grout to enter the channels, openings, or to be deposited in any manner which would interfere with flow.

To prevent the dropping of mortar into the flume, each joint across the gullet shall be protected with a strip of wood, 1/4-inch thick by 3/4-inch width.

After all blocks have been set in a filter and carefully aligned, all space between the rows and ends of blocks and walls up to the top surface of the blocks shall be filled with grout of the same mixture as used on the floor. Following this operation, the underdrain system shall be allowed to set for no less than 3 days, then all orifices shall be carefully cleaned of grout

and other debris and the finished installation tested by backwashing under the manufacturer's supervision. The actual backwashing shall be done in the presence of the Contracting Officer. Cleaning and backwashing shall be repeated until all orifices are cleaned to the satisfaction of the Contracting Officer.

Each underdrain system shall be constructed in accordance with the instructions of the block manufacturer and under its direct supervision.

Immediately following the completion of construction, cleaning, and testing of the underdrain system in each filter box, the entire bottom of the filter box shall be completely covered to protect it from damage and debris until the placement of gravel is to be started.

If required, the manufacturer shall submit test records from an independent hydraulic laboratory demonstrating the equalization of backwash flow under conditions at least equivalent to the layout of this project.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

Nozzles shall be aligned in the following manner:

A. Trailing nozzles, central arm: 15 degrees down and 15 degrees out from center.

B. Leading nozzles, curved arm: 15 degrees down and radial to curve.

All nozzles shall be screwed into tapped busnings that are brazed onto the lateral arm. All nozzles shall be molded nylon with nexagonal wrench flat provided and 1/4-inch male thread end. Nozzles shall be designed to accommodate and retain a snap-on flexible rubber cap provided with a 4-way cross cut opening which shall open under pressure from lateral and close when pressure is turned off.

The nozzles shall be approved equal to the Flexi-Jet nozzle, as manufactured by Leopold-Palmer.

2-4 CENTER BEARING ASSEMBLY: The center bearing assembly shall be cast bronze body with stainless steel thrust bearing and Buna N rubber seals.

The center bearing assembly shall be approved equal to Type No. 2 as manufactured by Leopold-Palmer.

2-5 DIELECTRIC COUPLING: The center bearing assembly shall be connected to the supply piping by means of a brass close nipple and a dielectric coupling. The coupling shall be approved equal to Model EA as manufactured by EPCO Sales, Inc., Cleveland, Ohio.

2-6 DOWNCOMER AND SUPPLY PIPING: The supply piping to the agitator including downcomer and header piping shall be galvanized steel pipe.

2-7 HEADER SUPPORT: The support brackets for the header pipe shall be supplied by the agitator supplier and shall be stainless steel.

PART 3: EXECUTION

3-1 HANDLING: The surface wash units shall be protected from damage during shipment and storage.

3-2 INSTALLATION: The agitator shall be installed according to the manufacturer's recommendations.

The agitator and supply piping shall be installed as indicated on the drawings. All header piping shall be horizontal and firmly secured against any movement. All downcomer piping shall be carefully aligned to the vertical so that the agitator arms swing freely in a horizontal plane.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing 1 filter control console for 2 filters. It shall include controls for valves and pumps, indicating lights, gages and flow meter indicators.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Butterfly Valves - Section 15273
General Electrical Provisions - Section 16010
Controls - Section 16900
Flow Meters - Section 15235
Turbidimeters - Section 15255
Loss of Head Gage - Section 15256

1-3 QUALITY ASSURANCE: National Electric Code (NEC).

PART 2: MATERIALS

2-1 GENERAL: The filter control console shall be approved equal to Model FCH as manufactured by F.B. Leopold Co.

2-2 CABINET: The control console cabinet shall be constructed of molded fiberglass reinforced polyester laminate, having a minimum wall thickness of 1/8- inch. All sections shall be mechanically fastened and chemically bonded to provide a unit structure. The cabinet laminate shall be constructed of 10 ounce fiberglass cloth, fiberglass mat, 24-ounce woven roving and shall contain a minimum of 35 percent by weight fiberglass reinforcement.

The laminate exterior shall be covered with an integrally molded gel-coat, at least 15 mils thick. The surface shall be coated with an epoxy primer and chemically resistant, solvent resistant epoxy enamel. The panel and front shall be light green, and the sides dark green. All corners shall be rounded. The cabinet shall be provided with a flanged base for direct bolting to the floor. The front of the cabinet shall be fitted with removable panels. The operating panel shall be tilted upward toward the back, and the front panel shall be tilted inward toward the bottom. It shall be approximately 3 feet high, 8 feet wide and 2 feet deep. All wiring shall enter the cabinet from the bottom.

2-3 WIRING: The control console shall be completely wired. All wires shall be grouped and taped and shall terminate at terminal blocks conveniently located and identified for field connections.

2-4 NAMEPLATES: Engraved plastic nameplates shall be furnished for each piece of equipment mounted on the control consoles, including indicating lights, valve names and positions, pump names and status, and gage names. Included shall be nameplates for any specific emergency or operating instructions.

2-5 CONTROLS, INDICATING LIGHTS, AND GAGES: The controls, indicating lights, and gages necessary to operate the filters shall be mounted on the cabinet. The Contractor shall closely coordinate his equipment submittals for the items to be mounted in the control console with the submittal for the console itself.

The types of control operators, the description of indicating lights and other items of an electrical nature to be supplied under this Section are further described in Section 16900, Controls.

The description of the remote indicators or gages for the flow meter, loss-of-head gage and turbidimeter are located in the specific sections for those pieces of equipment, found in Division 15 and listed in paragraph 1-2 Part 1 of this Section.

The items required include:

A. Items for Filter No. 1:

(1) Controls for: Filter Influent Valve
Filter Effluent Valve
Filter-to-Waste Valve
Backwash Supply Valve
Surface Wash Valve
Backwash Waste Valve

(2) Indicating lights for the valves above.
(3) Loss-of-head gage
(4) Turbidimeter gage

B. Items for Filter No. 2

(1) Controls for: Filter Influent Valve
Filter Effluent Valve
Filter-to-Waste Valve
Backwash Supply Valve
Surface Wash Valve
Backwash Waste Valve

(2) Indicating lights for the valves above
(3) Loss-of-head gage
(4) Turbidimeter gage

C. Common Items:

(1) Controls for: Treated Water Pump No. 1
Treated Water Pump No. 2
Treated Water Standby Pump
(2) Indicating lights for the pumps above
(3) Treated water flow meter indicator/totalizer
(4) Backwash supply flow meter indicator/totalizer

PART 3: EXECUTION

3-1 HANDLING: Care shall be exercised in the handling of the filter control console to protect it from damage.

3-2 INSTALLATION: The Contractor shall closely coordinate the layout of this panel with the submittals of the equipment that is to be mounted.

No submittal of the filter control console will be approved until the Contractor has submitted and received approval for all of the equipment that is specified elsewhere and is to be mounted in this console.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will consider a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a continuous monitoring turbidimeter with a remote readout and remote alarm for each filter. The meter shall sample filter effluent and display the turbidity on a meter located near the filter. In addition, a remote meter shall be located at the filter control consoles to provide instantaneous readings. An alarm light shall also be provided at the office control panel to alert in case of high turbidity.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Filter Control Consoles - Section 15254; Interior Piping and Plumbing - Section 15203; Controls - Section 16900.

1-3 DESIGN CONDITIONS:

Number of units	2
Flow through unit, gpm	0.13 - 0.40

PART 2: MATERIALS

2-1 GENERAL: The meter shall be designed to measure turbidity by sensing light that has been scattered from a concentrated beam by particles in the water.

The meter shall be calibrated in nephelometric turbidity units with ranges of 0-0.2, 0-1.0, 0-3.0, and 0-30 NTU's.

The meter shall be supplied complete with all control cable, piping for sample supply and drain lines, and all equipment and material needed for initial calibration and maintenance.

The meter shall be supplied with a remote meter mounted at the filter control console. An adjustable set point shall send a signal to an alarm light located at the office control panel. The meter shall have outputs for a recorder.

The meter supplied shall be capable of operation on the gravity filters as shown on the drawings and shall require no extraneous supply or drain piping, booster pumps or supplemental equipment that is not supplied by the manufacturer.

One pint of 4000 NTU Formazin suspension shall be supplied for calibration of the unit.

The turbidimeter shall be approved equal to the HACH 1720-A(Low Range).

2-2 INSTRUMENT BODY: The body shall be made of molded ABS foam with poly-

vinyl-chloride (PVC) fittings or corrosion resistant metal or metal covered by a finish that will resist corrosion.

The body shall be suitable for mounting on the filter tank wall in the gallery level.

The turbidimeter shall be equipped with a bubble trap.

2-3 INDICATOR BODY: The indicator body shall house a meter that shows the instantaneous turbidity and is capable of accurately displaying the readout from 0.0 to 1.0 NTU. The indicator body shall house electrical circuitry and connections for the remote meter and remote alarm signal.

The indicator body material shall meet the requirements of the instrument body and in addition it shall meet the requirements of a NEMA 12 enclosure.

PART 3: EXECUTION

3-1 HANDLING: The meter shall be shipped and stored in a manner that is approved by the manufacturer.

3-2 INSTALLATION: The manufacturer's recommended procedures for installation shall be strictly followed.

The turbidimeters shall be mounted at the locations shown on the drawings, with remote indicators in the filter control console.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a loss of head gage on each of the two filters. Each loss of head gage shall consist of a differential pressure transducer and an indicator. The indicators shall be mounted on the filter control console.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Filter Control Console - Section 15254
Interior Piping and Plumbing - Section 15203
General Electrical - Section 16010
Controls - Section 16900

1-3 QUALITY ASSURANCE: National Electrical Manufacturers Association (NEMA)

1-4 DESIGN CONDITIONS:

Number of units	2
Calibration, feet	0-10
Signal type	4-20 ma

PART 2: MATERIALS

2-1 Pressure Transducer: The pressure transducer shall have a cast aluminum housing. The differential pressure shall be applied to a capsule whose motion is converted to an electrical signal by a linear variable differential transformer. It shall have an internal voltage regulator with polarity reversal protection. It shall have externally accessible zero and span controls.

The pressure tranducers shall be approved equal to Model 152C-P030D as manufactured by Robinson-Halpern.

2-2 Indicator: The indicator shall have an aluminum backplate set in an elastomeric, raised bevel. It shall have a clear plastic cover, a phenolic meter back, and a sealed NEMA V enclosure. The scale shall be approximately 3 inches long. The accuracy shall be ± 2 percent of the span. The meter coil shall have a taut band-type suspension.

The indicators shall be similar and equal to Model 253-01 as manufactured by BIF.

PART 3: EXECUTION

3-1 HANDLING: The units shall be shipped and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The manufacturer's recommended procedures for installation shall be strictly followed.

The pressure transducer shall monitor the differential pressure through the filter. The high pressure shall be transmitted by a 1/2-inch copper pipe from a tap on the filter effluent pipe. The low pressure shall be transmitted by a 1/2-inch copper pipe installed through the filter tank wall at least 6 inches above the top of the filter media. A screen type end cap shall be provided to prevent solids from entering the low pressure line. A sediment trap and strainer shall also be installed on this line.

PART 4: MEASUREMENT AND PAYMENT

No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a dry volumetric chemical feeder and appurtenances for the purpose of feeding lime slurry to the rapid mix tank.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203

1-3 DESIGN CONDITIONS:

Number of Units	1
Capacity, lbs/day	80-500
Capacity, cu. ft./hr.	0.11-0.69
Material to be handled	Hydrated Lime
Material density, lbs/cu.ft.	30
Storage Volume, cu.ft.	36
Mixing ration, lb. lime/gal. water	0.25
Accuracy, percent of full scale	2
Feeder motor, hp	1/4
Mixer motor, hp	1/4
Dust collector motor, hp	3/4

PART 2: MATERIALS:

2-1 GENERAL: The lime feeder shall be approved equal to Series 32-050 as manufactured by Wallace and Tiernan. The vibrator shall be approved equal to Syntron Model V-20 as manufactured by FMC.

2-2 VOLUMETRIC FEEDER: The volumetric feeder shall include a fiberglass hopper with vibrating plates. The agitators shall be sealed behind Buna-N diaphragms, and shall be activated by the feed screw shaft. The feed screw and hopper bottom shall be stainless steel. The discharge spout shall be stainless steel. The feed screw shall be driven by a worm and worm gear with a slip clutch for motor protection. The drive motor shall be suitable for 115-volt, 1-phase, 60-cycle service. Feed rate control shall be with a manual timer with a 1-minute cycle. The timer shall be calibrated for 3 percent to 100 percent of feeder capacity.

2-3 SOLUTION TANK: The solution tank shall be molded fiberglass with a capacity of 35 gallons. It shall be equipped with a mechanical mixer. The mixer motor shall be suitable for 115-volt, 1-phase, 60-cycle service.

2-4 HOPPER: The hopper shall consist of a charging hopper, converging hopper, shut-off gate, and a flexible connection. It shall include a high level bin switch with an alarm light, a low level bin switch with an alarm light, and a mechanical vibrator. The vibrator shall be controlled by an adjustable 0-1-second timer.

2-4 HOPPER: The hopper shall consist of a charging hopper, converging hopper, shut-off gate, and a flexible connection. It shall include a high level bin switch with an alarm light, a low level bin switch with an alarm light, and a mechanical vibrator. The vibrator shall be controlled by an adjustable 60-second timer.

2-5 DUST COLLECTOR: The dust collector shall have a loading hatch with a built-in bag slicing mechanism. It shall have cloth filters having an area of at least 60 square-feet and a blower with a TE motor rated for 460-volt, 3-phase 60-cycle service. The dust collector shall be similar and equal to Model 64 as manufactured by Torit Division, Donaldson Co., Inc.

PART 3: EXECUTION

3-1 HANDLING: The alum feeder shall be transported and stored in a manner which will protect it from damage.

3-2 INSTALLATION: The alum feeder shall be installed at the location shown on the drawings and in accordance with the manufacturer's recommendations.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a dry volumetric chemical feeder and appurtenances for the purpose of feeding powdered activated carbon slurry to the flocculation tank at the tank effluent pipe connection.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203

1-3 DESIGN CONDITIONS:

Number of units	1
Capacity, lbs/day	3-60
Capacity, cu. ft/hr	0.003-0.06
Material to be handled	Powdered activated carbon
Material density, lbs/cu.ft.	40
Storage volume, cu.ft.	0.4
Mixing ration, lbs/gal.	0.2
Accuracy, percent of full scale	2
Feeder motor, hp	1/4
Mixer motor, hp	1/4

PART 2: MATERIALS

2-1 GENERAL: The powdered activated carbon feeder shall be approved equal to Series 32-055 as manufactured by Wallace and Tiernan and suitable for an explosion proof environment.

2-2 VOLUMETRIC FEEDER: The volumetric feeder shall include a fiberglass hopper with vibrating plates. The agitators shall be sealed behind Buna-N diaphragms, and shall be activated by the feed screw shaft. The feed screw and hopper bottom shall be stainless steel. This discharge spout shall be stainless steel. The feed screw shall be driven by a worm and worm gear with a slip clutch for motor protection. The drive motor shall be DC, permanent magnet, explosion proof, with SCR control suitable for 115-volt, 1-phase, 60-cycle service. Feed rate control shall be with a manual SCR variable speed drive control calibrated at 0-100 percent of feed capacity.

The feeder controller shall be a remote wall mounted unit such that this feeder will comply with NEC-502 for Class II Division 1 Group F environment.

The manufacturer of the feeder shall provide a feeder control system that operates from the level of the slurry in the solution tank. The control system will control the addition of water to the solution tank by operating a solenoid valve. the solenoid valve shall meet the requirements of Section

15277. The control system shall provide a rotometer to allow the operator a monitor water flow to the solution tank and a needle valve to adjust the flow rate. The rotometer and needle valve are specified in Section 15203. The control system shall also control the addition of powdered activated carbon to the solution tank. The operation of the mixer in the solution tank shall be continuous and not subject to the level of the solution tank.

2-3 SOLUTION TANK: The solution tank shall be molded fiberglass with a capacity of 35 gallons. It shall be equipped with a carbon-wetting mechanical mixer and a submerged baffle ring. The mixer motor shall be suitable for 115-volt, 1-phase, 60-cycle service. It shall be supplied with a water spray dust arrester, and a brass float valve.

2-4 HOPPER: The hopper shall consist of a converging hopper, shut-off gate, and a one-bag loading hopper with a built-in bag spear. It shall be 16-gage steel. The loading hopper shall be approved equal to Wallace and Tiernan Catalog No. 371-032.

PART 3: EXECUTION

3-1 HANDLING: The powdered activated carbon feeder shall be transported and stored in a manner which will protect it from damage.

3-2 INSTALLATION: The powdered activated carbon feeder shall be installed at the location shown on the drawings and in accordance with the manufacturer's recommendations.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a dry volumetric chemical feeder and appurtenances for the purpose of feeding potassium permanganate solution to the rapid mix tank.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Interior Piping and Plumbing - Section 15203.

1-3 QUALITY ASSURANCE: National Electric Code (NEC)

1-4 DESIGN CONDITIONS:

Number of Units	1
Capacity, lbs/day	4-25
Capacity, cu. ft/hr.	0.0015-0.0100
Material to be handled	Potassium Permanganate
Material density, lbs./cu.ft.	100
Storage Volume, cu.ft.	1.6
Mixing ration, lbs/gal.	0.08
Accuracy, percent of full scale	2
Feeder motor, hp	1/4
Mixer motor, hp	1/4

PART 2: MATERIALS

2-1 GENERAL: The potassium permanganate feeder shall be approved equal to Series 32-055 as manufactured by Wallace and Tiernan.

2-2 VOLUMETRIC FEEDER: The volumetric feeder shall include a fiberglass hopper with vibrating plates. The agitators shall be sealed behind Buna-N diaphragms, and shall be activated by the feed screw shaft. The feed screw and hopper bottom shall be stainless steel. The discharge spout shall be stainless steel. The feed screw shall be driven by a worm and worm gear with a slip clutch for motor protection. The drive motor shall be DC, permanent magnet, with SCR control suitable for 115-volt, 1-phase, 60-cycle service. Feed rate control shall be with a manual SCR variable-speed drive control calibrated 0-100 percent of feeder capacity.

2-3 SOLUTION TANK: The solution tank shall be polyethylene with a capacity of 25 gallons. It shall be equipped with a mechanical mixer. The mixer motor shall be suitable for 115-volt, 1-phase, 60-cycle service. A high level outlet connection shall provide for gravity feed of the solution to the rapid mix tank.

PART 3: EXECUTION

3-1 HANDLING: The potassium permanganate feeder shall be transported and stored in a manner which will protect it from damage.

3-2 INSTALLATION: The potassium permanganate feeder shall be installed at the location shown on the drawings and in accordance with the manufacturer's recommendations.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a dry chemical, volumetric feeder for the polymer feed system.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Polymer Metering Pumps - Section 15225

1-3 QUALITY ASSURANCE: National Electric Code (NEC).

1-4 DESIGN CONDITIONS:

Number of units	1
Maximum design rate, gpn	20
Maximum design rate, lbs/day	10
Dry storage volume, cubic feet	8
Solution tank volume, gallons	50
Solution concentration, percent	0.25
Feeder motor, hp	1/8
Mixer motor, hp	1/2

PART 2: MATERIALS

2-1 GENERAL: The polymer feeder shall be a factory assembled unit of the volumetric type. The unit shall have a self-cleaning rotary feeder and shall be capable of feeding dry polymer over a range of 0 to 60 pounds per day as a 0.25 percent solution. A water spray shall ensure that the individual polymer particles are prewetted as they fall from the feeder into the solution chamber. The feeder, except for the bearings and seals, shall be constructed entirely of Type 316 stainless steel. No leakage of polymer into the solution chamber shall occur when the unit is off. The feeder motor shall be a TENV, 2500 rpm, DC, permanent magnet motor with a full-wave solid state AC to DC converter and speed control potentiometer for adjustable feed rate control. An electrical tachometer shall indicate feed rate.

The polymer shall be loaded through a screen into the hopper. The hopper shall have an adjustable, impact type vibrator and be integrally mounted to the unit by a flexible coupling.

The unit shall have a double compartment solution chamber with a solenoid-actuated valve connecting the two sections. The valve shall automatically isolate the storage chamber from the mixing chamber so that only a pure solution is available to the system. The valve shall open upon completion of the mixing cycle to transfer pure solution to the storage chamber.

The mixing cycle duration shall be adjustable over a range of 0.0 to 999.9 minutes by means of a digital, push button timer. The level in the mixing tank shall be controlled by solution demand. A high level probe shall stop the fill cycle and a low level probe shall start the mixing cycle. Chemical metering pump protection shall be afforded by low level probes in the storage chamber. A mechanical mixer driven by a TENV, 1,800 rpm, permanent magnet DC motor shall provide mixing. Mixer speed shall be adjustable from 0 to 1,800 rpm. Propeller and propeller shaft and level probes shall be of Type 316 stainless steel.

The feeder control panel shall be an integral part of the unit. The controls shall automatically initiate the feeding and mixing cycle and control the duration of mixing. The entire electrical system shall conform to NEC standards and be designed for 120-volt, 1-phase, 60-cycle power. The unit shall be designed to operate with a house water pressure of 25 to 125 psi and be provided with a low pressure switch will stop the feeder and light an alarm light in the event the pressure drops below 25 psi. The unit will automatically resume operation when water pressure is restored.

The polymer feeder shall be approved equal to Chemix Model DA4 as manufactured by Neptune Microfloc.

PART 3: EXECUTION

3-1 INSTALLATION: The feeder shall be located as shown on the drawings. Work shall include all items required to provide a calibrated and functioning unit. Unit shall be installed in accordance with the manufacturer's recommendations.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing the chlorination system and related appurtenances.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203

1-3 DESIGN CONDITIONS:

Number of Units	1
Feed rate, lbs/day	50
Points of Injection (2)	8-inch filter effluent pipe
Injector Backpressure, psi	6

PART 2: MATERIALS

2-1 GENERAL: The chlorination equipment shall be approved equal to Series A-741 Remote Vacuum Chlorinator as manufactured by Wallace and Tiernan.

2-2 CHLORINATOR: The chlorinator shall be of the remote-vacuum type. It shall be wall mounted on a panel provided by the manufacturer. The control module shall consist of an inlet pressure gage, a rotameter, a V-notch type variable control orifice, and a vacuum regulating-vacuum relief valve. The chlorine injector shall be a 1-inch fixed throat type. Control shall be manual set rate.

2-3 CYLINDER UNITS: The two cylinder units shall have chlorine gas pressure- reducing and shut-off valves along with provisions for automatically switching over to a fresh chlorine supply when the on-line supply drops to a pressure below 15 psig. The units shall be cylinder mounted by means of a positive-yoke type, lead gasketed connection. The valve shall close automatically if a minimum operating pressure is not maintained. Chlorine pressure shall be regulated to the optimim for chlorinator operation. All components of the units that come into contact with the gas shall be of plastic or corrosion-resistant alloys.The units shall each have the capacity to supply 100 pounds of chlorine per day to the chlorinating control units. Supply 20 extra lead gaskets.

2-4 TWO-CYLINDER SCALE: A scale that independently and spontaneously weighs the contents of two chlorine cylinders shall be provided. The scale base shall support a steel column which has an adjustable crossarm and a scale head. The crossarm shall have chains for securing two 150-pound chlorine cylinders. The scale head shall have two dials which indicate the net pounds of chlorine remaining in each of the cylinders. The dials shall have 1-pound

graduations and manual adjusting knobs. The accuracy of the scale shall be plus or minus 1-1/2 pounds. The two-cyclinder scale shall be approved equal to Series 50-345 as manufactured by Wallace and Tiernan.

2-5 TUBING AND FITTINGS: All gas-carrying piping shall be 3/16-inch O.D. plastic tubing. All fittings shall be of the compression type.

2-6 PROPORTIONING SOLUTION DISTRIBUTOR: One proportioning solution distributor shall split the flow of chlorine solution to the two injection points. It shall consist of two rotameters, two diaghragm type shut-off valves, and two diaphragm type throttling valves mounted on one panel. It shall be approved equal to Catalog No. 140.046 as manufactured by Wallace and Tiernan.

2-7 WATER MAIN CONNECTIONS: The chlorine solution shall be applied at the two 10-inch filter effluent pipes via a 1-inch corporation cock fitted with a plastic solution pipe.

2-8 SPARE ROTAMETER: One spare rotameter and gaskets shall be provided, including the necessary tools for rotameter replacement.

2-9 GAS MASKS: Two tank type gas masks are required. The gas masks shall meet the requirements of the National Insitute of Occupational Safety and Health (NIOSH). Each tank type unit shall have a 30-minute supply. It shall be furnished with a spare 30-minute tank and a wall-mounted case. One shall be installed in the building. The other shall be installed outside near the door of the chlorinator room.

The tank type mask shall be approved equal to Model MSA 457153 as manufactured by Wallace and Tiernan.

PART 3: EXECUTION

3-1 HANDLING: All components of the chlorinating system shall be kept dry at all times. Dust caps shall be fitted on the connections to the pressure relief valve, the cylinder units, the chlorinators, the chlorine cylinders and all connecting tubing.

The chlorine cylinders shall not be stored on the job site until completion of the rest of the installation and preparation for system checkout. The cylinders shall always be handled and stored in a vertical position. They shall not be exposed to direct sunlight for prolonged periods.

3-2 INSTALLATION: Work shall include the mounting and interconnectin of the chlorinator, injectors and cylinder units. The scale and panel shall be located and secured as shown on the drawings. Other work items shall be:

A. The connection of the injector water supply lines, globe valves, solenoid valves and pressure gages.

B. The connection of the solution discharge lines to the injectors.

C. The fitting of the 1-inch solution discharge corporation cocks, 3/4-inch plastic check valves, bushings and adapters. Allow clearance to withdraw solution tubes from main. Connect to solution discharge line.

D. Route the vent line to the outside and cap the end with a vent screw.

E. Secure the chlorine cylinders onto the scale and connect cylinder units.

F. Check all connections for leaks. Provide a bottle of ammonia for the detection of chlorine gas leaks.

G. All other items required to complete installation.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a modulating float valve as shown on the drawings. The function of this valve is to modulate the flow to maintain a constant water level in the float well. This valve shall be installed on the plant influent pipeline. The valve shall regulate the raw water flow rate to the water treatment plant. This valve shall automatically control the flow by closing the valve in response to a rise in the float well water level, and by opening in repsonse to a drop in the float well water level. The water level in the float well shall not fluctuate more than 0.2 feet. The response of the valve shall be smooth, without overcompensating or "hunting."

The float valve shall be a hydraulically operated, diaphragm actuated, globe pattern valve.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Water Treatment Plant Equipment - Section 15201; Interior Piping and Plumbing - Section 15203; Controls-Section - 16900.

1-3 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM), American National Standard Institute (ANSI).

1-4 DESIGN CONDITIONS:

Valve No. 1	
Number of Units	1
Size, in.	6
Flow, gpm	250 - 500
Float well level, ft.	7901.5 ± 0.1
Valve centerline elevation, ft.	7897.0
Head on valve inlet, ft.	18

PART 2: MATERIALS

2-1 MAIN VALVE: The main valve body and cover shall be cast-iron conforming to the requirements of ASTM standard A48. The connections shall be flanges faced and drilled to a standard ANSI B16.1 125 lb. template. The main valve trim shall be brass and bronze. The diaphragm shall be of nylon fabric bonded with Buna-N rubber. A Buna-N rubber disc shall form a seal with the valve seat when pressure is applied above the diaphragm.

The modulating float valve shall be approved equal to Clayton Model 129-01 Modified as manufactured by Cla-Val Co.

2-2 PILOT CONTROL SYSTEM: The pilot control system shall consist of an ejector, a variable orifice pilot valve, and a float assembly. Direct

linkage from the float shall cause the variable orifice pilot to open or close in response to changes in the water level in the float well. This will increase or decrease the flow in the control line. This variation in flow in the control line shall affect the pressure drop in the ejector, which will in turn control the pressure above the main valve diaphragm. Changes in the valve diaphragm position will regulate flow through the main valve. The ejector shall have a bronze housing with Type 303 stainless steel inserts. The orifice pilot valve and float assembly shall be manufactured of copper, brass and stainless steel.

PART 3: EXECUTION

3-1 HANDLING: The float valve and appurtenances shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The valve shall be installed as shown on the drawings. A dual pilot control water supply system shall be provided and installed. The secondary backup system shall consist of a line tap from the main valve inlet with a flow cleaned strainer, a shut-off cock, a pressure gage, a check valve and a shuttle valve. The primary system shall provide pilot control water supply from the house water system. This shall consist of a shut-off cock, a pressure gage, and a pressure reducing valve. The pressure reducing valve shall be set at approximately 10 psi. In the event that the house water pressure fails the raw waterline pilot system will take over.

All manufacturer's procedures and tolerances for installation shall be strictly followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing a pressure reducing valve as shown on the drawings. The function of this valve is to automatically reduce a higher inlet pressure to a constant lower downstream pressure regardless of variations in flow rate and/or inlet pressure. The response of the valve shall be smooth, without overcompensating or "hunting."

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203
Controls - Section 16900

1-3 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM), American National Standard Institute (ANSI), National Electrical Manufacturer's Association (NEMA).

1-4 SUBMITTALS:

A. In accordance with Section 01300 submit manufacturer's literature and data for all parts and equipment.

B. Provide Operation and Maintenance Manual. Operation procedures should include detailed instructions for winter deactivation of the pressure reducing valves. There should be no possibility of water being left in the pilot or control mechanisms which may freeze with damage to the controls.

1-5 DESIGN CONDITIONS:

Valve No. 38	
Number of Units	1
Size, in.	6
Flow, gpm	800-1300
Upstream Pressure, psi	100 to 20
Downstream Pressure, psi	2

PART 2: MATERIALS

2-1 GENERAL: The valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is approximately twice the area on the underside of the piston. Control shall be by means of pilot valves. The valve opening and closing rates shall be adjustable. This valve shall not require a minimum pressure differential to operate properly. The pressure reducing valve shall be approved equal to model 4500-D as manufactured by G.A. Industries, Inc.

2-2 MAIN VALVE: The main valve body and cover shall be cast-iron conforming to the requirements of ASTM standard A-126 Class B. The connections shall be flanges faced and drilled to a standard ANSI B16.1 125-pound template.

The piston, liner, seat crown, and pilot valve shall be bronze conforming to the requirements of ASTM Standard B-62. The piston cup, liner cup, pilot cups, and O-rings shall be composition leather. The seat washer shall be manufactured of Buna-N rubber. The follower rings, rod, gland, bushings and screws shall be brass. Control piping shall be brass.

The liner shall be cast with V-port openings, and shall provide full pipeline flow when the valve is completely open.

2-3 PILOT CONTROL SYSTEM: The pilot control system shall be manufactured of cast bronze conforming to ASTM Standard B62.

PART 3: EXECUTION

3-1 HANDLING: The pressure reducing valve and appurtenances shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The valve shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall be strictly followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing butterfly valves and valve operators as shown on the drawings. Manually operated valves whose centerlines are located 6 feet or less above floors shall be lever operated for sizes 6 inches and under and handwheel operated for sizes over 6 inches; valves whose centerlines are located over 6 feet above floors shall be chainwheel operated.

Valves shall be wafer type or flanged as indicated on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

750,000 Gallon Storage Tank - Section 15179;
Water Treatment Plant Equipment - Section 15201;
Interior Piping and Plumbing - Section 15203;
Filter Control Console - Section 15254.

1-3 QUALITY ASSURANCE: American Water Works Association (AWWA), American Society for Testing and Materials (ASTM), National Electrical Manufacturers Association (NEMA).

The valves shall conform with AWWA Standard C504 or its latest revision unless otherwise modified herein.

1-4 DESIGN CONDITIONS:

A. WATER TREATMENT PLANT:

Valve No.	Size (inches)	Operator	Rate (gpm)	Open/Close Speed (Seconds)
15	8	Motor Operated	300	15
17	14	Motor Operated*	1500	15
18	4	Motor Operated	300	15
19	4	Lever	300	N/A
22	10	Motor Operated*	1400	30
23	8	Motor Operated	300	15
25	14	Motor Operated*	1500	15
26	4	Motor Operated	300	15
27	4	Lever	300	N/A
30	10	Motor Operated*	1400	30
32	6	Lever	300	N/A
33	6	Lever	300	N/A
36	10	Handwheel	1400	N/A
37	10	Chainwheel	1400	N/A
42	14	Floorstand	2000	N/A
43	14	Floorstand	2000	N/A
47	6	Chainwheel	700	N/A
51	10	Handwheel	700	N/A

* Modulating Service - coordinate motor operator.

B. STORAGE CONTROL VAULT

N/A	6	Lever	N/A	N/A
N/A	12	Handwheel	N/A	N/A

PART 2: MATERIALS

2-1 GENERAL: The butterfly valves shall be approved equal to those manufactured by BIF, Pratt, or Kennedy.

2-2 VALVE BODY: Butterfly valve bodies shall be close grained cast-iron conforming with ASTM A126, class B. Valve bodies shall be flanged. Flanged bodies shall have flanges faced and drilled to an ANSI B16.1 125-pound template. Tapped lugs on a water butterfly valve body are not considered as an equal to flanged body valve.

2-3 VALVE DISC: The valve disc shall be manufactured of Ni-resist cast-iron alloy in accordance with the requirements of ASTM Standard A436, Type I. The disc shall have a seating surface of 18-8 Type 304 stainless steel.

2-4 VALVE SEAT: The body shall have a seat manufactured of natural rubber or Buna-N rubber. It shall be vulcanized to the internal body surface in accordance with the requirements of ASTM Standard D429. The seat shall be designed as Class 150. Other designs meeting AWWA C504 which mechanically retain seals to the body or disc will be allowed.

2-5 VALVE SHAFT: The shaft shall be manufactured of 18-8 Type 304 stainless steel. The disc shall be attached to the shaft with stainless steel pins. The valve bearings shall be woven-oriented Teflon or molybdenum disulphide filled nylon.

2-6 LEVER OPERATORS: Lever operators shall be designed for on-off control and manual throttling service. The lever shall be capable of setting the valve disc in at least 10 degree increments across the 0-90 degree range.

The lever shall be supplied with a means of positively locking the disc into any of the desired settings and holding that position. A means of indicating what position the valve is in shall be provided.

Lever operators shall be constructed of ductile iron castings.

2-7 HANDWHEEL AND CHAIN WHEEL OPERATORS: Handwheel and chain wheel operators shall be of the rack and pinion, lead screw, or worm gear type and designed so that a maximum of 80 pounds on the handwheel will be required to produce an output torque equivalent to the maximum valve shaft torque required to operate the valve.

Position indicators shall be provided with the operators.

Internal gears shall be hardened steel and completely enclosed in a box with permanent lubrication.

2-8 ELECTRIC ACTUATORS: The actuator consists of an electric motor driving a reduction gear box which rotates the outlet shaft.

The actuator shall be in an enclosure designed to meet NEMA 4 requirements.

The electric actuators shall be approved equal to MAR Series as manufactured by Raymond Control Systems, Inc.

The actuator shall be remote-controlled and suitable for operation from 115-volt, single-phase, 60-cycle power supply. It shall be powered by a high torque single-phase reversing motor, capable and of sufficient size to open and close the valve against the maximum valve operating conditions. The reduction gears shall be designed to withstand the actual motor stall torque. The gears shall be hardened steel and permanently lubricated.

The actuator shall have a built-in motor overload protector.

Cam actuated limit swticnes will be provided to prevent overtravel. Limit switches shall be provided for the valve position indicating lights, to be located in the filter control console or office control panel, as required.

The actuator shall be designed for operation in ambient temperature ranging from -40 degrees to +150 degrees F and shall be capable of operation in any mounting position.

The actuator shall have a manual override capability that will enable the valve to be operated in case of power failure. The manual and automatic operations of the valve shall be separate systems and the valve shall not be capable of operations in both modes at the same time.

Actuators shall be sized and selected against valve operating torque values as stated by the valve manufacturer. The sizing shall be based on the maximum torque value encountered during the stroke of the valve when operating under maximum working pressure conditions with a minimum safety factor of 1.50.

2-9 FLOOR STANDS: Floor stands shall be manufactured of cast-iron and shall have a valve position indicator.

PART 3: EXECUTION

3-1 HANDLING: All valves and actuators shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The manufacturer's recommended procedures for installation will be followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this item. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing check valves for piping in vaults as shown on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203

1-3 QUALITY ASSURANCE: American National Standard Institute (ANSI).

PART 2: MATERIALS

2-1 GENERAL: The check valves shall be cast-iron body, with bronze trim and mountings. Connections shall be flanges faced and drilled to an ANSI B16.1 125-pound template. The valve disc hinge pin shall be stainless steel and extend to a spring and lever control outside the body. The spring connection shall allow for tension adjustment.

The check valves shall be approved equal to Model F5340 of Clow Corporation.

PART 3: EXECUTION

3-1 HANDLING: All valves shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The check valves shall be installed as shown on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing plug valves. All sludge pipeline valves shall be plug valves.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203

1-3 QUALITY ASSURANCE: American National Standards Institute (ANSI)

1-4 DESIGN CONDITIONS:

Valve No.	Size (inches)	Operator	Flow (gpm)
4	4	Lever	30
5	4	Lever	30
6	4	Lever	30
7	4	Lever	30
8	4	Lever	30
11	2	Lever	30
12	2	Lever	30
13	2	Lever	30
14	2	Lever	30
44	4	3-way Lever	100
45	4	Lever	100
48	4	3-way Lever	100
49	4	Lever	100
52	4	Chainwheel	100
53	4	Chainwheel	100
57	4	Nut with Wrench Guide	100
57a	4	Nut with Wrench Guide	100
57b	4	Nut with Wrench Guide	100
58	4	Nut with Wrench Guide	100
58a	4	Nut with Wrench Guide	100
58b	4	Nut with Wrench Guide	100

PART 2: MATERIALS

2-1 GENERAL: The valves shall be of the eccentric, non-lubricated type. The valves shall operate from fully open to tight closure in one quarter turn (90 degrees). An indicator shall show the plug position within the valve body. Valve plugs, bearings, and seals shall be accessible for replacement without removing the valve body from the pipeline where it is installed. All valves shall have removable lever or chain operators as shown on the drawings. Valves whose centerlines are located 6 feet or less above floors shall be lever operated. Valves whose centerlines are located higher than 6 feet above floors shall be chainwheel operated. The valves shall be flanged, faced and drilled an ANSI B16.1 125-pound template. All plug valves shall be approved equal to Series 100 as manufactured by DeZurik.

2-2 MATERIALS OF CONSTRUCTION:

Body	Semi-steel
Seat	Ni-resist
Plug	Cast-iron
Plug facing	E.P.T. or RS 16 Chloroprene
Bearings	Stainless Steel
Packing	Buna-V-Flex, or equal

PART 3: EXECUTION

3-1 HANDLING: All valves shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The plug valves shall be installed as shown on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing two motor operated ball valves on the surface wash lines.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203
Filter Control Console - Section 15254
Controls - Section 16900

1-3 QUALITY ASSURANCE: National Electrical Manufacturer's Association (NEMA).

1-4 DESIGN CONDITIONS:

Valve No.	Size (inches)	Operator	Flow (gpm)	Open/Close Speed (Seconds)
16	2	Motor Operated	100	15
24	2	Motor Operated	100	15

PART 2: MATERIALS

2-1 BALL VALVES: The valve body, ball, union nuts, and mounting saddle shall be Type 1, Grade 1 PVC conforming to the requirements of ASTM Specification D1784, Cell Classification 12454-B. The seats shall be TFE, fluorocarbon polymer. The O-ring seals shall be Viton. The shaft coupling shall be cadmium plated steel. The ball valves shall be approved equal to Chemtrol A.M. Series as manufactured by Celanese Piping Systems, Inc.

2-2 ELECTRIC ACTUATORS; The actuator consists of an electric motor driving a reduction gear box which rotates the outlet shaft. The electric actuators shall be approved equal to MAR Series as manufactured by Raymond Control Systems, Inc.

The actuator shall be remote-controlled and suitable for operation from 115-volt, 1-phase, 60-cycle power supply. It shall be powered by a high torque single-phase reversing motor, capable and of sufficient size to open and close the valve against the maximum valve operating conditions. The reduction gears shall be designed to withstand the actual motor stall torque. The gears shall be hardened steel and permanently lubricated.

The actuator shall have a built-in motor overload protector.

Cam actuated limit switches will be provided to prevent overtravel. Limit switches shall be provided for the valve position indicating lights to be located at the filter control console.

The actuator shall be designed for operation in ambient temperature ranging from -40 degrees to +150 degrees F. and shall be capable of operation in any mounting position.

The actuator shall have a manual override capability that will enable the valve to be operated in case of power failure. The manual and automatic operations of the valve shall be separate systems and the valve shall not be capable of operations in both modes at the same time.

Actuator shall be sized and selected against valve operating torque values as stated by the valve manufacturer. The sizing shall be based on the maximum torque value encountered during the stroke of the valve when operating under maximum working pressure conditions with a minimum safety factor of 1.50.

PART 3: EXECUTION

3-1 HANDLING: All valves and actuators shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The manufacturer's recommended procedures for installation will be followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this item. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing solenoid valves in the water treatment plant.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Interior Piping and Plumbing - Section 15203
Controls - Section 16900
General Electrical Provision - Section 16010

1-3 DESIGN CONDITIONS:

Unit Location	Size, Inches
Lime Feeder	3/4
Alum Feeder	3/4
Powdered Activated Carbon Feeder	1/2
Chlorine Feeder	3/4
Potassium Permangenate Feeder	1/2
Powdered Activated Carbon Transport Water	1/2
Polymer Transport Water	1/2

PART 2: MATERIALS

2-1 GENERAL: The solenoid valves shall be suitable for water service as identified below. The valve body shall be bronze. For normally open valves, a stainless steel pilot valve shall have a flexible connection to the magnetic plunger and accurately guided within the main operating piston. For normally closed valves, a stainless steel poppet assembly shall be guided within the main operating piston. The main operating piston shall be bronze. The solenoid assembly shall consist of a malleable iron housing and coils. The coils shall have class A insulation, vacuum impregnated windings and encapsulated with an epoxy resin. The coils shall be designed for continuous service. The valves shall not require any differential pressure to operate. Valves smaller than 1/2-inch shall be direct acting. The valves shall be designed for 115V electric service.

The solenoid valves shall be approved equal to Magnatrol Valve Corp. Models N and NR for valves smaller than 1/2-inch, and Models A and AR for valves 1/2-inch and larger.

Provide special enclosures for solenoid valves in PAC room to meet Class II Division I explosion proof requirements. All other enclosures shall be NEMA 12.

PART 3: EXECUTION

3-1 HANDLING: All valves shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The solenoid valves shall be installed as shown on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this item. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing two shear gates in the water treatment plant.

1-2 DESIGN CONDITIONS:

Valve No.	Size (inches)	Flow (gpm)	Seating Head
2	8	300	4 feet
3	8	300	4 feet

PART 2: MATERIALS

2-1 GENERAL: The gate and frame shall be cast-iron. The wedges that seat the gate shall be bolted on. Trim and mounting shall be bronze. The handles shall be of the length shown on the drawings.

The shear gates shall be approved equal to Model F-3002 as manufactured by Clow Corporation.

PART 3: EXECUTION

3-1 HANDLING: The shear gates shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The valves shall be bolted to flanged wall pieces with tapped holes.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this item. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

Part 1: General

1-1 DESCRIPTION: The work of this section consists of furnishing and installing pump control valves on the discharge lines of the three treated water pumps. These valves shall act to minimize surge by remaining closed until the pump has reached its pumping head condition and to prevent the pump from stopping until the control valve has closed and isolated the pump from the system.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Interior Piping and Plumbing - Section 15203
Controls - Section 16900

1-3 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), National Electrical Manufacturer's Association (NEMA).

1-4 SUBMITTALS:

A. Submit manufacturer's literature and data for all parts and equipment.

B. Provide Operation and Maintenance Manual. Operation procedures should include detailed instructions for winter deactivation of the pump control valves. There should be no possibility of water being left in the pilot or control mechanisms which may freeze with damage to the controls.

1-5 DESIGN CONDITIONS:

Valve Nos. 20, 28, 34	
Number of Units	3
Size, inches	3
Flow, gpm	300
Static Head, ft.	135
Pumping Head, ft.	230

250 gpm will be normal operating condition

PART 2: MATERIALS

2-1 GENERAL: The pump control valves shall be similar and equal to the Model 1730-DC, and the control module shall be approved equal to the Pump Director both as manufactured by G.A. Industries, Inc.

The valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is approximately twice the area on the underside of the piston. Control shall be by means of a control module and a three-way solenoid operated pilot valve. The valve opening and closing rates shall be adjustable. The valve shall have an emergency two-way solenoid operated pilot valve and a built-in stop-check feature which is independent of the solenoid control and will close in the event of a power failure. This valve shall not require a minimum pressure differential to operate properly.

2-2 MAIN VALVE: The main valve body shall be cast-iron conforming to the requirements of ASTM Standard A-126 Class B. The connections shall be flanges faced and drilled to a standard ANSI B16.1 125-pound template.

The piston, liner, seat crown, and pilot valve shall be bronze conforming to the requirements of ASTM Standard B-62. The piston cup, liner cup, pilot cups, and O-rings shall be composition leather. The seat washer shall be manufactured of Buna-N rubber. The follower rings, rod, gland, bushings and screws shall be brass. Control piping shall be brass.

The liner shall be cast with V-port openings, and shall provide full pipeline flow when the valve is completely open.

2-3 PILOT CONTROL SYSTEM: The pilot control system shall be manufactured of cast bronze conforming to ASTM Standard B62.

2-4 DRAINS: Provisions shall be made to permit the draining of the main valve and all pilot valve piping.

PART 3: EXECUTION

3-1 HANDLING: The pressure reducing valve and appurtenances shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The valve shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall be strictly followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing one surge relief valve on the treated water pump discharge header pipe. This valve shall serve to protect the water lines from overpressure. The valve shall open when the line pressure exceeds the pre-determined set point. The valve shall open very quickly and close slowly. The valve shall operate on the differential piston principle such that the piston will expose a greater area to the closing force than to the opening force. Control shall be by means of a spring loaded diaphragm pilot valve.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment	Section 15201
Interior Piping and Plumbing	Section 15203
Controls	Section 16900

1-3 QUALITY ASSURANCE: American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), National Electrical Manufacturer's Association (NEMA).

1-4 SUBMITTALS:

A. Submit manufacturer's literature and data for all parts and equipment.

B. Provide Operation and Maintenance Manual. Operation procedures should include detailed instructions for winter deactivation of the relief valve. There should be no possibility of water being left in the mechanism which may freeze.

PART 2: MATERIALS

2-1 GENERAL: The surge relief valves shall be approved equal to Model 6700-D as manufactured by G.A. Industries, Inc.

2-2 DESIGN CONDITIONS:

	Valve No. 54
Number of Units	1
Size, inches	3
Pipeline Flow, gpm	500
Static Head, ft.	135

2-3 MAIN VALVE: The main valve body shall be cast-iron conforming to the requirements of ASTM standard A-126 Class B. The connections shall be flanges faced and drilled to a standard ANSI B16.1 125-pound template.

The piston, liner, seat crown and pilot valve shall be bronze conforming to the requirements of ASTM Standard B-62. The piston cup, liner cup, pilot cups, and O-rings shall be composition leather. The seat washer shall be manufactured of Buna-N rubber. The follower rings, rod, gland, bushings and screws shall be brass. Control piping shall be brass.

The liner shall be cast with V-port openings, and shall provide full pipeline flow when the valve is completely open.

2-4 PILOT CONTROL SYSTEM. The pilot valve shall be of cast bronze conforming to ASTM specifications B-62. Adjustment of the opening pressure of the main valve shall be accomplished by regulation of a handwheel on the pilot and shall provide a range of 20 psi.

2-5 PILOT CONTROL BYPASS: An additional gate valve shall be provided and installed in parallel to the pilot valve. This valve shall cause the main valve to be opened. This will be required during off-season operation to drain the 8-inch treated water pipeline.

2-6 DRAINS: Provisions shall be made to permit the draining of the main valve and all pilot valve piping.

PART 3: EXECUTION

3-1 HANDLING: The relief valve and appurtenances shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The valve shall be installed as shown on the drawings.

All manufacturer's procedures and tolerances for installation shall be strictly followed.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing globe valves for manual throttling of the treated water pumps and the surface wash supply line.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201;
Interior Piping and Plumbing - Section 15203.

1-3 QUALITY ASSURANCE: American National Standard Institute (ANSI), American Society for Testing and Materials (ASTM).

1-4 DESIGN CONDITIONS:

Valve No.	Size Inches	Operators	Rate (gpm)
21	4	Chainwheel	300
29	4	Chainwheel	300
35	4	Chainwheel	300
50	2	Chainwheel	100

PART 2: MATERIALS

2-1 GENERAL: A 125-pound ferrosteel globe valve such as Crane No. 351 or approved equal shall be provided. The valve will have an iron body, meeting ASTM A-126 Class B standards, with all bronze trim including solid bronze disc and removable bronze seat ring. The threads will be external and easily lubricated. The valve will be equipped with indicators or other device indicating the percent opening of the valve.

2-2 OPERATOR: The valve will be equipped with a chainwheel operator designed so that a maximum of 80 pounds will be required to produce an output torque equivalent to the maximum valve shaft torque required to operate the valve.

PART 3: EXECUTION

3-1 HANDLING: All valves shall be transported and stored in a manner which will protect them from damage.

3-2 INSTALLATION: The check valves shall be installed as shown on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of furnishing and installing one trolley hoist for the purpose of transporting equipment and plant chemicals.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Water Treatment Plant Equipment - Section 15201
Miscellaneous Metalwork - Section 05500

PART 2: MATERIALS

2-1 GENERAL: The trolley hoist shall consist of a hoist built integrally with a trolley. It shall have a design capacity of 1-1/2 tons. The hoist shall have built-in overload protection. It shall have sufficient chain for a lift of 36 feet. A locking type latch hook shall be provided. The trolley shall be geared and chain operated. The trolley shall be a crowned tread and flange track wheels. The hoist shall include a chain container to be mounted on the hoist frame to contain the entire length of chain.

The trolley hoist shall be approved equal to Cyclone Model S, Code No. 4925, as manufactured by CM Hoist, Division, Columbus McKinnon Corporation.

PART 3: EXECUTION

3-1 INSTALLATION: The trolley hoist shall be installed on the S7 x 15.3 overhead rail on the chemical storage level in the Water Treatement Plant.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the Contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section includes the replacement of existing sanitary sewer lines with Ductile Iron Pipe wherever new water lines cross under the sanitary lines.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavating, Trenching and Backfilling - Section 02221
Cast-in-place Concrete - Section 03300

1-3 SUBMITTALS: In accordance with Section 01300 submit manufacturer's literature for couplings and pipe.

PART 2: MATERIALS

2-1 PIPE: Class 52 ductile iron gravity sewer pipe in accordance with ANSI/ASTM A746.

2-2 COUPLING: Calder coupling by Joints, Inc. or approved equal.

PART 3: EXECUTION

3-1 GENERAL: Lay to grades and lines in accordance with pipe manufacturer's recommendation and as directed by Contracting Officer.

3-2 PIPECUTTING: Cutting shall be done neatly by methods which will not damage pipe.

3-3 BACKFILL AND RESTORATION OF SURFACE CONDITIONS AND STRUCTURES: Section 02221. Backfill after approval by Contracting Officer.

PART 4: MEASUREMENT AND PAYMENT

4-1 SEWER CROSSING PIPE: The unit of measurement will be the linear foot. Measurement will be the actual horizontal projected distance along the centerline of the pipe, furnished and installed between connection couplings. Quantities so measured will be paid for at the Contract unit price for each size pipe.

4-2 SEWER PIPE COUPLINGS: The unit of measurement will be each. Measurement will be the number of each size coupling installed including associated concrete placement. Quantities so measured will be paid for at the Contract unit price for each size coupling.

END

PART 1: GENERAL:

1-1 DESCRIPTION: The work of this section consists of furnishing and installing gravity sewer piping and appurtenances.

1-2 DEFINITION: Bedding and backfill material are defined in Section 02221.

1-3 SUBMITTALS: In accordance with Section 01300.

A. Manufacturers' literature and certificates of compliance with the reference standards for pipe, fittings, and couplings.

B. Manufacturers' installation instructions or guide.

C. Written procedure for cleaning sewer lines and disposing of fluidized materials removed.

1-4 PRODUCT HANDLING:

A. Delivery: Handle pipe carefully to insure delivery at the project site in sound, undamaged condition. Contracting Officer will reject damaged pipe on-site. Contractor shall replace damaged pipe at no additional expense to the Government.

B. Storage: Do not store materials directly on the ground. Adequately support piping to prevent warpage. Use protective covers where pipe may be damaged by direct sunlight.

PART 2: MATERIALS

2-1 PIPE, JOINTS, AND BACKFILL MATERIAL:

A. Plastic Pipe:

1. Pipe Material: ANSI/ASTM D3034, polyvinyl chloride (PVC). Minimum wall thickness, SDR 35.

2. Elastomeric Gasket Joint: Manufacturer's standard. Integrally formed bell, push-fit, rubber gasketed joint system.

3. Lubricant: Manufacturer's standards.

2-2 FITTINGS: Size, grade, joint type, and lining to match pipe, and as recommended by the pipe manufacturer.

2-3 COUPLINGS FOR DISSIMILAR PIPES: Transition type couplings shall be factory manufactured to assure tight fit and smooth flow transition at the joint. Poured concrete collar and similar coupling methods will not be accepted.

PART 3: EXECUTION

3-1 GENERAL: Construct the gravity sewer system, complete with appurtenances, to the lines and grades shown or established in the field.

3-2 TRENCHING: Section 02221.

3-3 BEDDING: Section 02221.

3-4 INSTALLATION:

A. Inspection: Inspect pipe for defects before lowering into the trench. Defective, damaged, or unsound pipe will be rejected.

B. Laying: After the trench bottom has been properly prepared for pipe installation in accordance with Section 02221, lay pipe upgrade with the spigot ends pointing in the direction of flow. Lay each length true to line and grade, to form smooth joint transitions and to prevent sudden offsets of the flow line.

C. Cleaning: As work progresses, clear the sewer pipe interior of dirt and other debris by keeping swabs in the pipe and pulling them forward past each completed joint.

D. Pipe Cutting: Cutting for closure or other reasons shall be done neatly by methods recommended by the manufacturer. Sharp edges shall be smoothed to prevent gasket damage.

E. Jointing: Clean gaskets and seats of foreign materials prior to joint assembly. Apply lubricant as recommended by the pipe manufacturer.

1. Push-On Joint: Carefully insert the spigot end into the bell to prevent entry of dirt and incorrect entry angle. With suitable fork tool, crowbar, or by hand, make the joint to the insertion depth recommended by the manufacturer. When the pipe uses joints not designed for full depth insertion, prevent further closure of previously completed joints by restraining movement of the installed line while making succeeding joints.

2. Plain End Jointing: Install factory made couplers in accordance with manufacturer's directions. Center the coupling collar over the joint and tighten bolts or bands evenly.

3-5 BACKFILLING OF SELECT MATERIAL: Section 02221.

3-6 BACKFILLING: Section 02221.

3-7 SEWER LINE MARKING: Section 15058.

3-8 FINAL PIPE CLEANING: Prior to testing, clean all lines to be tested by high pressure water jet or mechanical means. Remove and dispose of fluidized materials as approved.

3-9 TESTING: Section 15042.

3-10 SURFACE FINISH WORK: Section 02221.

PART 4: MEASUREMENT AND PAYMENT

4-1 GRAVITY SEWER PIPE: Measurement will be the actual number of linear feet, in place, measured as horizontal projected distance along the centerline of the pipe, between the following termini, as applicable: Center of manholes; ends of pipe; centerline of adapter, coupling or connection at junctions; or 5 feet from the outside face of all structures, excluding manholes. No deductions will be made for space occupied by manholes or branch fittings. Payment will be made at the Contract unit price.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of the construction and installation of the water line drain manhole.

1-2 RELATED WORK SPECIFIED ELSEWHERE:

Excavating, Trenching, and Backfilling	- Section 02221
Concrete	- Section 03300

1-3 QUALITY ASSURANCE: Standards, American Society for Testing and Materials (ASTM) and Federal Specifications (FS).

PART 2: MATERIALS

2-1 The manhole shall be constructed of precast concrete rings in accordance with the details on the drawings. The concrete rings shall conform to ASTM C478. Joints will be sealed with "Rubber Nek" by K. T. Snyder Co., Houston, Texas or approved equal.

2-2 CONCRETE: Concrete for the manhole basin shall have a compressive strength of not less than 3000 psi after 28 days.

2-3 FRAME AND COVER: The lid shall be embossed with "Potable Water Line Drain". The frame and cover otherwise shall be equal to Neenah R-1649.

2-4 STEPS: Provide aluminum alloy 6005-T5 steps in accordance with ASTM B-221. Neenah R-1982 or approved equal.

2-5 MORTAR AND GROUT: See Section 04100. For finish use waterplug by Standard Dry Wall Inc., or approved equal.

PART 3: EXECUTION

3-1 MANHOLES: construct at locations and to dimensions shown.

3-2 INVERT CHANNELS: Smooth and semi-circular in shape conforming to the inside of the adjacent pipe sections. Make changes in flow direction by a smooth curve or radius as large as permitted by manhole size. Make changes in grade gradually evenly. Form directly in manhole base.

3-3 FLOORS OUTSIDE INVERT CHANNEL: Smooth with slope toward the channel of between 1-inch and 2-inch per foot.

3-4 FRAME AND COVER: Install as shown. Top of cover flush with finished grade or ground surface. Grout frames to the concrete manhole section.

3-5 STEPS: Set as shown coat with asphaltum.

3-6 PRECAST MANHOLES: Set in grout making watertight joints.

PART 4: MEASUREMENT AND PAYMENT

4-1 POTABLE WATER LINE DRAIN MANHOLE: The unit of measurement for payment will be each. Measurement will be the actual number of potable water line drain manholes in place.

END

PART 1: GENERAL:

1-1 DESCRIPTION: The work of this section consists of the construction and installation of sewer mannoles and modifications to connect to existing sewer manholes.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavating, trenching, and backfilling - Section 02221; Concrete - Section 03300.

1-3 QUALITY ASSURANCE: Standards, American Society for Testing and Materials (ASTM) and Federal Specifications (FS).

PART 2: MATERIALS

2-1 The mannoles snall be constructed of pre-cast concrete rings in accordance witn the details on the drawings. The concrete rings shall conform to ASTM C478. Joints will be sealed witn a full mortar joint or "Ramnek" by K.T. Snyder Co., Houston, Texas, or approved equal.

2-2 CONCRETE: Concrete for the mannole basin shall have a compressive strength of not less than 3,000 psi after 28 days.

2-3 FRAME AND COVER: Neenan R-1649 or approved equal.

2-4 STEPS: Provide aluminum alloy 6005-T5 steps, in accordance with ASTM Standard B-221. Neenah R1982 or approved equal.

2-5 MORTAR AND GROUT: See Section 04100. For finisn use Waterplug by Standard Dry Wall Inc., or approved equal.

PART 3: EXECUTION

3-1 MANHOLES: Construct at locations and to dimensions snown.

3-2 INVERT CHANNELS: Smootn and semi-circular in shape conforming to the inside of the adjacent sewer sections. Make changes in flow direction by a smooth curve or radius as large as permitted by manhole size. Make changes in size and grade gradually and evenly. Form as follows:

A. Directly in mannole concrete base.

B. Breaking out top nalf of full sections of sewer tile pipe laid tnrougn the mannole after the surrounding concrete has nardened.

3-3 FLOORS OUTSIDE INVERT CHANNEL: Smootn, with slope toward tne channel of between 1 incn and 2 inches per foot.

3-4 FRAMES AND COVERS: Install as shown. Top of cover, flush with finished grade or ground surface. Grout frames to the concrete manhole section.

3-5 STEPS: Set as shown and coat with asphaltum.

3-6 PRECAST MANHOLES: Set in grout making watertight joints.

3-7 CONNECTION TO EXISTING MANHOLES: As shown on the drawing carefully remove a section of the manhole to allow a minimum 2-inch working space on all sides of the pipe to be inserted. Extend pipe 2 inches inside the manhole and grout in place. Rework the manhole base to form a new influent channel and face with waterplug.

PART 4: MEASUREMENT AND PAYMENT

4-1 SEWER MANHOLES: The unit of measurement for payment will be each. Measurement will be the actual number of manholes in place. Each manhole of four foot depth or less measured to the nearest whole foot, from the invert of the lowest connected pipe to the top of the concrete adjusting rings provided, will be measured as a standard manhole. Quantities so measured will be paid for at the Contract unit price.

4-2 EXTRA DEPTH FOR STANDARD MANHOLES: The unit of measurement for payment will be the vertical foot. Measurement will be the number of vertical feet of manhole in excess of the four foot standard manhole depth. Quantities so measured will be paid for at the Contract unit price.

4-3 SEWER MANHOLE CONNECTION: No measurement will be made for this work. Payment for all work to connect the new sewer line from the water treatment plant to the existing sewer manhole will be at the Contract lump sum price.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of installation of fire hydrants at locations indicated.

1-2 CERTIFICATION: Furnish an affidavit from the manufacturer that the hydrant conforms to AWWA Standard C502.

1-3 SUBMITTALS: Furnish catalog cuts, complete maintenance data and assembly drawings.

1-4 RELATED WORK SPECIFIED ELSEWHERE: Excavating, Trenching and Backfilling for Waterlines - Section 02221; Disinfection - Section 15041; Gate valve with Valve Box - Section 15101.

PART 2: MATERIALS

2-1 HYDRANTS: The fire hydrants shall be Pacific States Model 2 with mechanical joint bottom connection and shall comply with AWWA C502 with optional traffic flange having the following requirements:

A. Valve: 5-inch

B. Inlet: 6-inch

C. Trench Depth: 7 feet cover, minimum

D. Operating Nut: 1-1/2-inch pentagon

E. Open: Left

F. Threads: National Standard

G. Hydrant main valve shall open with the pressure.

H. Hydrants shall be provided with a sidewalk break-off flange.

I. Stem seals shall be of the O-Ring type.

J. Color of the shop-applied, above ground paint shall be red. After installation, the Contractor shall apply two additional coats of compatible paint of a color selected by the Contracting Officer.

K. One hydrant wrench, 1 valve wrench, and 1 set of spare break-off parts, shall be furnished for each 6 hydrants, or any portion of 6 hydrants, installed; i.e., 1 to 6 hydrants - furnish 1 set of wrenches and spare parts; 7 to 12 hydrants - furnish 2 sets of wrenches and spare parts, etc.

2-2 GUARD POSTS: Provide Schedule 40 steel posts as shown on the drawings.

PART 3: EXECUTION

3-1 EXCAVATION AND BACKFILL: Perform in accordance with the applicable provisions of Section 02221.

3-2 HYDRANTS: Where applicable, hydrants shall be installed with pumper outlet facing the adjacent roadway or parking area. Set hydrants at such elevations that the connecting pipe shall drain to the main with a grade of not less than 0.5 percent. Firmly block the back of the hydrant opposite the pipe connection with a concrete thrust block braced against the vertical face of the trench with at least a minimum of 4 cubic-feet in mass and 4 square-feet in area to prevent the hydrant from blowing off the line.

3-3 BRIDLE RODS: If the character of the soil is such that, in the opinion of the Contracting Officer, the hydrant cannot be securely wedged, a connecting piece with integrally cast mechanical joint glands, ductile iron retainer glands, or bridle rods and rod collars shall be used. Bridle rods and rod collars shall be not less than 3/4-inch stock and shall be protected by a coat of acid-resisting paint.

3-4 DRAINAGE AGGREGATE AND BACKFILL: Place not less than 10 cubic-feet of approved broken stone or clean gravel around the base of each hydrant to insure drainage. A layer of 30-pound asphalt-saturated felt paper or heavy vinyl sheet shall be placed over gravel to keep backfill material from sifting into gravel. Thoroughly compact the backfill around hydrants, to the grade line, in an approved manner.

3-5 OPERATIONS CHECK: Clean hydrant interiors of all foreign matter before installation. Stuffing boxes shall be tightened and the hydrant inspected in opened and closed positions to see that all parts are in working condition.

3-6 TESTING AND DISINFECTION: Section 15062. Perform with adjacent pipeline.

PART 4: MEASUREMENT AND PAYMENT

4-1 FIRE HYDRANTS: The unit measurement for payment will be each. Measurement will be the number of fire hydrants in place including the connection fitting in the main, 6-inch gate valve and box, 6-inch spool between the gate valve and fire hydrant, drain material, extensions as needed, operating wrench and spare break-off parts. Also, provide painted guard posts where called for on the plans. Pipe between the tee in the main and the fire hydrant gate valve will be measured and paid for elsewhere. Removal of existing fire hydrants and related cutting and plugging of lines called out on the drawings will be included in the price of the new hydrants. Also, paint any existing green hydrants as part of the related work. Quantities so measured will be paid for at the contract unit price.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of the construction of concrete fire service vaults and the installation of valves and fittings and appurtenances.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavating, Trenching, and Backfilling - Section 02221.

Excavating, Trenching and Backfilling	- Section 02221
Cast-in-Place Concrete	- Section 03300
Insulation	- Section 07216
Painting	- Section 09900
Disinfection of water lines	- Section 15041
Testing	- Section 15042
Ductile-Iron Pipe	- Section 15062
Gates Valves	- Section 15101
Corporation and Curb Stops with Cast-Iron Service Box	- Section 15103
Miscellaneous Metalwork	- Section 05500

1-3 SUBMITTALS: Submit shop drawings for vaults and plumbing layout and manufacturer's literature for valves, couplings, access hatches, restrainment, service clamp, corporation steps and insulation.

PART 2: MATERIALS

2-1 CAST-IN-PLACE CONCRETE: See Section 03300.

2-2 MORTAR: ASTM C270, Type M or 1 part Portland Cement Type II or better and 3 parts sand.

2-3 GROUT: Grout for pipes through walls and other openings shall be "5-STAR" or approved equal non-shrink and non-ferric.

2-4 STEPS: Steps shall be extruded aluminum, Alloy 6005-T5, approved equal to Neenah R-1982.

2-5 ACCESS HATCH: Shall be approved equal to Bilco Type JD. See Section 05500 for general requirements.

2-6 INSULATION: See Section 07216.

2-7 PIPING: See Section 15062.

2-8 COUPLINGS FOR DUCTILE-IRON PIPE: Rockwell Type 912 flanged coupling adaptor or approved equal.

2-9 GATE VALVES, 3-INCH AND LARGER: Iron body, bully bronze mounted, double disc, parallel, seat, outside rising stem and yoke, heavy duty hand wheel flanged conforming to AWWA C 500.

2-10 RESTRAINMENT: All pipe will be restrained from movement, particularly when valves or other fittings are removed. Ductile and iron systems will use tie rods which are 3/4-inch diameter ASTM A36 steel. Tie bolts, nuts and rod couplings shall be STAR or approved equal. All parts will be zinc plated per ASTM A164. Use approved preservative coating on all exterior components.

2-11 CHECK VALVES: See Section 15274.

2-12 PIPE SUPPORTS: Use Clow F-1608 adjustable pipe supports or approved equal.

2-13 FIRE DEPARTMENT CONNECTION: The fire department connection shall be a Sidewalk Siamese 4-inch x 2-1/2 x 2-1/2 cast bronze 90 degree Y pattern double inlet. The connection shall have interior self closing clapper valves in each inlet. The connection shall have raised lettering "AUTOMATIC SPRINKLER". The riser sleeve shall have a breakaway flange. Replacement parts shall be supplied with the connection.

2-14 PAINTING: See Section 09900 for general requirements. The pipe shall be pointed to show the direction of flow and identify where the water is either going or coming from as indicated on the drawings. The wall directly above the wall pipe shall be painted with labels identifying where the water is either going to or coming from as indicated on the drawings.

PART 3: EXECUTION

3-1 INSTALLATION: Install as indicated on the drawings and in accordance with applicable provisions of the related sections. Locations and sizes are indicated on the drawings.

3-2 DISINFECTION: Valve testing and disinfection shall be performed concurrently with the companion water lines.

PART 4: MEASUREMENT AND PAYMENT

4-1 FIRE SERVICE VAULT NO. XX: No measurement of quantities will be made for this work. Each vault shall be identified and payment for all work related to that facility will be at the Contract lump sum price. The costs shall include clearing and grubbing, removal of obstructions, pavements, structures, disconnection and plugging of any related piping, excavation, backfilling, compaction, concrete, insulation, valves, fittings and pipe, restrainment clamps, saddles, corp stops, couplings, access hatch, fire department connection, thrust block, restoration, guard posts and all other work and appurtenances required to complete the facility. The only work not included will be piping 5 feet outside the vault.

4-2 REGISTRATION BUILDING FIRE SERVICE CONNECTION: No measurement of quantities will be made for this work. The fire services connection shall be identified and payment for all work related to the facility will be at the contract lump sum price. The costs include disconnection and plugging of any related piping, excavation, backfilling, compaction, concrete, removal of side walks or structures, fittings and pipe, restrainment, clamps, fire department connection, thrust block, restoration and all other work and appurtenances required to complete the facility. The only work not included are gate valves with valve boxes and post indicator valves.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section is an extension of the General Requirements containing items that pertain to all heating and ventilating work.

1-2 RELATED WORK SPECIFIED ELSEWHERE: General Electrical: Section 16010; Basic Electrical Materials and Methods: Section 16100.

1-3 WORK INCLUDED: The work consists of furnishing all labor, materials, and equipment necessary for a completely finished heating and ventilating system. This work shall include all supplemental and incidental items required for a completely successful operating heating and ventilating system.

1-4 QUALITY ASSURANCE:

A. Codes and Standards: Perform all work in accordance with the following codes:

Air Moving and Conditioning Association (AMCA) Standards
Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) Standards
Uniform Building Code
Uniform Mechanical Code
National Fire Code
American Society of Heating, Refrigeration, Air Conditioning Engineers (ASHRAE) Standards

B. Manufacturers: Install all equipment in accordance with manufacturer's recommendations.

PART 2: MATERIALS

2-1 STANDARD PRODUCTS: All equipment shall conform to the standards specified concerning that particular piece of equipment.

2-2 MISCELLANEOUS METAL: Provide channels, angles, and metal supports where indicated and as required for proper support of equipment. Unless otherwise indicated on the drawings, supports shall be galvanized, cast, or bonderized steel. Use galvanized or cadmium plated fittings, bolts, and nuts. Where welding is necessary, the welds shall be cleaned, given a prime coat of zinc chromate, and finished to match the existing paint in type and color.

PART 3: EXECUTION

3-1 Specific installation instructions are given in the individual sections.

3-2 Maintain a complete set of mechanical drawings at the site with all changes marked neatly thereon in a contrasting color of ink. This set shall not be used for any other purpose. Keep the drawings current at all times, and present to the Contracting Officer upon completion of the work.

3-3 All work shall be done in accordance with best recognized modern practice and shall conform to the latest edition of all applicable codes, and to any revisions to the code by Local Authority. If any conflict occurs between the applicable codes and this Specification, the codes are to govern.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work in this section consists of providing an electric duct heater for Air Handling Units AHU-1 and AHU-2.

1-2 RELATED WORK SPECIFIED ELSEWHERE: General Heating and Ventilating: Section 15801; General Electrical Provisions: Section 16010; Basic Electrical Materials and Methods: Section 16100; Sequence of Operation: Section 15950.

1-3 QUALITY ASSURANCE: General Heating and Ventilating: Section 15801; General Electrical Provisions: Section 16010.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions, and catalog cuts for the following: Electric Duct Heater and Air Flow Switch.

PART 2: MATERIALS

2-1 ELECTRIC DUCT HEATER: Heater shall have 80 percent nickel, 20 percent chromium resistance coils, insulated by floating ceramic bushing and supported in aluminized steel frames. Coils shall be machine crimped in stainless steel terminals which are insulated with high temperature phenolic bushings.

A. Heater shall be furnished with one disk type, pilot duty automatic reset thermal cutout for primary over temperature protection. Heater shall also be furnished with a disk type, load-carrying manual reset thermal cutout factory-wired in series with each heater stage for secondary protection. (Heat limiters or fusible over temperature protection devices shall not be acceptable.)

B. Heater shall be furnished rated for the voltage, phase and number of heating stages indicated. Three phase heater shall have equal, balanced, three phase stages. All internal wiring shall be suitable for 105 degrees Celsius. Heater shall be rated for 480 volt, three-phase operation, control circuit option shall be "Option C."

C. Heater shall be supplied with air flow switch, similar and equal to Indeeco, Model SPD-120B.

D. Heater shall be listed by Underwriter's Laboratories and shall meet the requirements of the National Electrical Code. UL listing shall allow installation with zero clearance to combustible surfaces.

PART 3: EXECUTION

3-1 Heater shall be installed at least 48 inches from any change in duct direction, abrupt change in duct size, and from any air moving equipment. Heater shall be used with horizontal airflow. Install heater, air flow switch, thermostat and controls in accordance with manufacturer's recommendations and as shown.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing exhaust for various sections of the Water Treatment Plant as shown on the drawings.

1-2 RELATED WORK SPECIFIED ELSEWHERE: General Electrical Provisions - Section 16010; Basic Electrical Materials and Methods - Section 16100; General Heating and Ventilating - Section 15801; Ductwork - Section 15840; Special Ductwork - Section 15844; Louvers and Grilles - Section 15879; Sequence of Operation - Section 15950.

1-3 QUALITY ASSURANCE: Section 15801 - General Heating and Ventilating; Section 16010 - General Electrical Provisions.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions and catalog cuts for the following: Exhaust Fans.

PART 2: MATERIALS

2-1 EXHAUST FANS:

A. Furnish with all accessories as indicated on the drawings.

B. Exhaust fans shall have accurately balanced fan wheels, both statically and dynamically, to be free from objectionable vibrations.

C. Bear the AMCA label.

D. Exhaust Fans shall be supplied with vibration isolators.

E. Exhaust Fans shall be as scheduled on the drawings.

PART 3: EXECUTION

3-1 EXHAUST FANS: Exhaust Fans shall be installed in accordance with SMACNA standards. Units shall be free of objectionable noise and vibration.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing Air Handling Units to supply the Water Treatment Plant with make-up air.

1-2 RELATED WORK SPECIFIED ELSEWHERE: General Electrical Provisions - Section 16010; Basic Electrical Materials and Methods - Section 16100; General Heating and Ventilating - Section 15801; Ductwork - Section 15840; Louvers and Grilles - Section 15879; Sequence of Operations - Section 15950.

1-3 QUALITY ASSURANCE: Section 15801 - General Heating and Ventilating; Section 16010 - General Electrical Provisions.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions and catalog cuts for the following: Air Handling Unit, AHU-1 and AHU-2.

PART 2: MATERIALS:

2-1 AIR HANDLING UNIT: Air Handling Unit (AHU-1) shall consist of a fan section and a flat filter section, contained in a complete unit.

A. Unit casing shall be fabricated of heavy-gauge steel reinforced and braced with steel angle framework for maximum rigidity. Sectionalized casing consisting of fan and filter section shall be factory-assembled. Fan section uninsulated.

B. Fan shall be double width, double inlet, multi-blade centrifugal type. All fans statically and dynamically balanced and tested. Fan shall be forward curved with grease lubricated, externally-mounted fan bearing. Motor externally mounted on adjustable bracket.

C. Filter section shall be designed to hold 2-inch throwaway-type filters. Filters shall be of the size required for the particular unit furnished. The unit manufacturer shall provide the contracting officer with a set of filters to allow for one complete filter change after unit has been in operation.

D. Unit shall be furnished complete with motor, drive, belt guard, magnetic starter and on/off switch in starter cover.

E. Air Handling Unit (AHU-1) shall be as scheduled on drawings.

2-2 AIR HANDLING UNIT (AHU-2): Air Handling Unit (AHU-2) shall consist of a fan section and a flat filter section, contained in a complete unit.

A. Unit casing shall be heavy gage steel cabinet, painted with a durable enamel and fully lined with sound absorbing fiberglass. Access panels shall allow service of drive or motor from either side of housing.

B. Fan wheel shall be forward curved.

C. Filter section shall be designed to hold throwaway-type filters, and shall be of the size required for the particular unit furnished. The unit manufacturer shall provide the Contracting Officer with 1 set of filters to allow for one complete filter change after unit has been in operation.

D. Unit shall be furnished complete with motor, drive and on/off switch mounted to housing.

E. Air Handling Unit (AHU-2) shall be as scheduled on drawings.

PART 3: EXECUTION

3-1 Air Handling Unit (AHU-1) and (AHU-2) shall be hung from roof structure with vibration isolators supplied by the unit manufacturer. See plans for location and mounting height.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing ductwork for supply air and exhaust systems in the water treatment plant. This does not include special ductwork (see Section 15844).

1-2 RELATED WORK SPECIFIED ELSEWHERE: Section 15801 - General Heating and Ventilation.

1-3 QUALITY ASSURANCE: Ducts shall be constructed of galvanized mild steel sheets with joints and reinforcing in accordance with the recommended construction as listed in the current edition of the SMACNA standards.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions and catalog cuts for the following: job fabricated turning vanes.

PART 2: MATERIALS

2-1 STANDARD DUCT: Standard duct shall be manufactured of galvanized mild steel metal. Gauge to be determined by SMACNA standards. All ductwork shall be fabricated and installed so that no undue vibration or noise results. All joints shall be airtight with additional caulking provided if necessary. Turning vanes shall be approved equal to Tuttle-Bailey ducturns.

2-2 FLEXIBLE DUCT: Provide rot and fire-proof SMACNA approved flexible duct.

PART 3: EXECUTION

3-1 DUCTWORK:

A. Hang ducts with strap iron attached to bottom of ducts spaced not over five feet center to center and in accordance with SMACNA low velocity duct standards.

B. Curved elbows, if used, shall have a center line radius equal to 1-1/2 times the duct width. Square elbows shall have turning vanes. Job fabricated turning vanes will not be accepted without prior approval by shop drawings.

C. Where vertical ducts pass through floors, supporting angles shall be rigidly attached to ducts and to the floor. Angles shall be galvanized and of approved sizes to properly support the ductwork. The supporting angles shall be placed on at least two sides of the duct.

D. Where horizontal ducts pass through walls and vertical ducts pass through floors, opening shall be tightly sealed off so as to provide a tight seal between duct and opening.

E. Provide flexible connections at inlet and discharge connections of fans to prevent mechanical noises from being transmitted to connecting ductwork. Use flexible connections similar and equal to "Vent-fab."

F. At all places where inside of duct will be visible through return air grilles, louvers, etc., paint normally visible inside portion of duct with flat black paint.

G. Transitions in ductwork, in changing shapes and sizes, shall be made with angles not exceeding 15 degrees.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work in this section consists of providing all special ductwork in the chlorine room as noted on drawings.

1-2 QUALITY ASSURANCE: Section 15801: General Heating and Ventilation.

PART 2: MATERIALS

2-1 ACID RESISTANT DUCT: Acid resistant duct shall be manufactured of galvanized metal. Gauge to be determined by SMACNA standards. Ductwork shall be given two coats of acid resistant coating, inside and out. Duct coating shall be approved equal to Eisen Heis black acid resistant coating. Ducts shall be constructed of galvanized mild steel sheets with joints and reinforcing in accordance with the recommended construction as listed in the current edition of the SMACNA standards.

PART 3: EXECUTION

3-1 DUCTWORK:

A. Hang ducts with strap iron attached to bottom of ducts spaced not over five feet center to center and in accordance with SMACNA guidelines.

B. Where horizontal ducts pass through walls and vertical ducts pass through floors, opening shall be tightly sealed off so as to provide a tight seal between duct and opening.

C. All ductwork shall be fabricated and installed so that no undue vibration or noise results. All joints shall be airtight with additional caulking provided if necessary.

D. Provide flexible connections at inlet and discharge connections of fans and air handling equipment to prevent mechanical noises from being transmitted to connecting ductwork. Use flexible connections similar and equal to "Ventfab."

E. All areas of ductwork that are scratched shall be repainted.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work in this section consists of providing fire damper for the Water Treatment Plant Air System.

1-2 QUALITY ASSURANCE:

A. Section 15801: General Heating and Ventilation.

B. UL Classified.

C. NFPA 90A.

1-3 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions and catalog cuts for the fire damper.

PART 2: MATERIALS

2-1 Fire damper shall be all welded construction having 10 GA. steel frame and 14 GA. steel blades and pivoted one-third off center on 1/2-inch diameter steel shaft stub ends operating in bronze bearings for horizontal air flow. Fusible link (UL approved) 160 degrees. Fire damper shall be approved equal to Louvers and Dampers, Inc., Model FD-B-H.

PART 3: EXECUTION

3-1 Fire damper shall be installed in rated wall at the P.A.C. room as shown on the plan.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing all louvers and grilles for Water Treatment Plant air systems.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Section 15950: Heating and Ventilating Sequence of Operation, Section 08525: Aluminum Windows.

1-3 QUALITY ASSURANCE:

A. All louvers and grilles shall bear the AMCA label.

B. Section 15801: General Heating and Ventilating.

1-3 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions and catalog cuts for the louvers, dampers, grilles and damper motors.

PART 2: MATERIALS

2-1 LOUVERS:

A. Louvers shall be extruded aluminum louver, with 12 gauge thick blades and frames. Heads, sills, and jambs to be one piece extruded structural members with an integral caulking slot. All fastenings to be stainless steel or aluminum. Provide aluminum expanded bird exclusion screen secured in removable extruded aluminum frame on inside of louver. Bird screen shall have a minimum free area of 80 percent of gross area. All louvers shall have anodized bronze finish. Louver shall have 45-degree stormproof blade.

B. Louver shall be similar and equal to Louvers and Dampers, Inc. Model EL-300.

2-2 CONTROL DAMPERS:

A. All welded construction having opposed blades. Damper blades shall be formed 14 gauge steel. Bearings shall be self-lubricating. Air leakage shall be less than 1 percent at 4 inches static pressure.

B. Control damper shall be approved equal to Louvers and Dampers, Inc. Model TSD-400.

2-3 BALANCING DAMPER:

A. All welded construction having opposed blades. Damper blades shall be formed 14 gauge steel. Bearings shall be self-lubricating, operator shall be hand quadrant.

B. Balancing Damper shall be approved equal to Louvers and Dampers, Inc. Model CD-400.

2-4 DAMPER MOTORS:

A. Damper motors shall be line voltage, two position spring return. Unit shall be complete with mount and mechanical linkage.

B. Damper motors shall be approved equal to Louvers and Dampers, Inc. Model T-12.

2-5 GRILLES AND REGISTERS:

A. Grilles and registers shall be as scheduled on drawings, equal to Titus.

PART 3: EXECUTION

3-1 LOUVERS: Install louvers as shown on drawings.

3-2 DAMPERS: Install dampers as shown on drawings.

3-3 DAMPER MOTOR: Install damper motors as shown on drawings. Where control damper is in duct, mount damper motor and mechanical linkage on exterior of duct.

3-4 GRILLES: Install grilles as shown on drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work in this section consists of providing the necessary equipment for the proper and safe operation of the heating and ventilating system for the Water Treatment Plant.

1-2 QUALITY ASSURANCE: Section 15801 - General Heating and Ventilating.

1-3 SUBMITTALS: In accordance with Section 01300, submit shop drawings, manufacturers installation instructions and catalog cuts for the following: Sequence of Operations Diagram with schedule of equipment listing manufacturer and model number.

PART 2: CONTROL SEQUENCE OF OPERATION

2-1 Control Damper D-1 and D-2 (normally closed) shall open when Air Handling Unit (AHU-1) is activated. Air Handling Unit (AHU-1) shall be activated by a wall mounted manual timer.

2-2 Control Damper D-3 and D-4 (normally closed) shall open when Air Handling Unit (AHU-2) is activated. Air Handling Unit (AHU-2) shall be activated by a wall mounted manual timer.

2-3 Electric Duct Heater 1 and 2 shall be controlled by a single stage and two stage remote bulb discharge thermostats (set at 65 degrees F, 63 degrees F, and 61 degrees F) mounted in supply duct as shown on drawings. Supply temperature shall be adjustable, and the controllers accessible. Air flow switch (see Section 15817) shall lock out electric duct heater with no flow condition and lock out when fan switch is off.

2-4 Exhaust Fan (EF-3) shall be activated by a wall mounted switch, interlocked with lights.

2-5 Exhaust Fan (EF-1) shall be activated by a door switch and/or a manual switch mounted near door. See Section 16900 for control.

2-6 Control Damper D-6 (normally closed) shall be activated when Exhaust Fan (EF-1) is activated.

2-7 Exhaust Fan (EF-2) shall be activated when Electric Unit Heater (UH-5) is activated as shown on drawings. Wall mounted manual on/off switch with pilot shall activate Exhaust Fan (EF-2), and activate Electric Unit Heater (UH-5) - Fan only, locking out electric heat.

2-8 Control Damper D-5 (normally closed) shall open when Exhaust Fan (EF-2) is activated and by wall mounted on/off switch with pilot, and when Electric Unit Heater (UH-5) is activated.

2-9 Electric Unit Heater (UH-5) shall be activated by a wall mounted room thermostat with remote bulb sensor as shown on drawings. (See Exhaust Fan EF-2.) Unit Heater scheduled on drawings.

2-10 Electric Unit Heater (UH-1, 3, 4, 2, 6, 7, 8, 9, 10 and 11) shall be activated by an integral thermostat. See schedule on drawings.

2-11 Electric Baseboard A shall be activated by an integral thermostat. See schedule on drawings.

2-12 Electric Convector B and C shall be activated by an integral thermostat. See schedule on drawings.

2-13 Electric Cabinet Heater 1 shall be activated by an integral thermostat. See schedule on drawings.

2-14 ROOM THERMOSTATS: All room thermostats, integral with respective units and/or wall mounted, shall have single setpoint control, 40 degrees - 85 degrees F. Adjustable throttling range 2 degrees - 10 degrees F.

PART 3: EXECUTION

3-1 Installation of equipment shall conform to all applicable codes and standards and as shown on drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. The costs shall be included in the lump sum contract price for the Water Treatment Plant.

END

PART 1: GENERAL

1-1 DESCRIPTION: This section is an extension of the General Requirements and contains items of a common or administrative nature that pertain to all electrical work.

1-2 WORK INCLUDED: The work consists of completely installing an electrical system as specified and indicated on the drawings, including all wiring and connections required for electrical equipment furnished under other sections. It also includes furnishing an empty conduit system for telephone company use, as shown on the drawings. Provide all supplemental and incidental items required for the successful operation of all systems even if such items are not specified or shown.

1-3 JOB CONDITIONS:

A. Electrical installation shall meet the requirements of the local utility company, and the National Electrical Code.

B. Repair of Existing Work: Painted surfaces of existing facilities that are marred, scratched, or damaged shall be refinished to match original condition. Alterations of building surface, required for the proper installation of electrical equipment, shall be restored by skilled mechanics of the trades involved at no additional expense to the Government.

1-4 QUALITY ASSURANCE:

A. Code and Standards: Perform all work in accordance with the National Electrical Code and local codes. The following standards, where applicable, referred to hereafter by abbreviation only, govern the electrical work:

ANSI - American National Standards Institute
IPCEA - Insulated Power Cable Engineers Association
IEE - Institute of Electrical and Electronic Engineers
NEC - National Electrical Code
NEMA - National Electrical Manufacturers Association
NESC - National Electric Safety Code
NFPA - National Fire Protection Association
UL - Underwriters Laboratories

B. Manufacturers: Install material and equipment in accordance with recommendations of the manufacturer unless otherwise directed.

PART 2: MATERIALS

2-1 STANDARD PRODUCTS: All electrical material and equipment shall be listed for the intended application in UL "Electrical Construction Materials List" where UL lists such material or equipment. Provide materials and equipment which are products of manufacturers regularly engaged in the manufacture of the products and are the manufacturer's latest standard design.

2-2 MISCELLANEOUS METAL: Provide channels, angles, and metal supports where indicated or as required for proper support of equipment. Unless otherwise indicated on the drawings, supports shall be stainless steel, cast, or aluminum. Use stainless steel fittings, bolts, and nuts. Where welding is necessary, the welds shall be cleaned, given a prime coat or zinc chromate, and finished to match the existing paint in type and color.

2-3 EQUIPMENT ENCLOSURES: Enclosures in dry locations shall meet NEMA Type 1 requirements and in wet locations NEMA Type 12 requirements unless otherwise indicated.

PART 3: EXECUTION

3-1 Specific installation instructions are given in the individual sections.

3-2 Guarantee all materials, labor, workmanship, and the successful operation of all equipment furnished and installed under this division for a period of one (1) year from the date of final acceptance. Repair or replace, at no expense to the Government, all defects which may arise, during this time due to inferior or defective materials, equipment or workmanship.

3-3 Maintain a complete set of electrical drawings at the site with all changes marked neatly thereon in a contrasting color of ink. This set shall not be used for any other purpose. Keep the drawings current at all times, and present to the Government upon completion of the work.

3-4 Verify telephone company requirements for conduit systems and install per telephone company recommendations as shown on the drawings.

3-5 Hazardous Areas: The P.A.C. room shall be classified as Class II, Division 1 hazardous area. Electrical equipment and installation procedures shall conform to Article 500 of the N.E.C.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of general electrical materials and methods. Electrical materials that are a part of equipment specified under other sections of these specifications shall meet the requirements of this section, unless part of larger factory assembled equipment.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Excavation, Trenching and Backfilling Section 02221: Painting - Section 09900.

1-3 QUALITY ASSURANCE:

A. Section 16010.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings and catalog cuts for the following: Panelboard, transformers, phase protection relays.

PART 2: MATERIALS:

2-1 RACEWAYS AND FITTINGS:

A. Rigid galvanized steel conduit, UL 6.

B. Flexible steel conduit, UL 1.

C. Liquid tight flexible metallic conduit.

D. Galvanized surface metal raceway and fittings, UL 5.

E. Wireways auxiliary gutters and associated fittings, UL 870.

F. PVC conduit and couplings, UL 651.

2-2 RACEWAYS: Provide the following types of raceways for the specific application or location indicated:

Rigid Galvanized Steel:

1. Where required by code or utility company.
2. Hazardous areas.
3. Where required for mechanical protection or where specifically indicated on the drawings.
4. 90° elbows from PVC conduit under slab.
5. Intermediate metal conduit in lieu of rigid galvanized steel where permitted by the National Electrical Code.

Type III, Rigid, Schedule 80 PVC:

1. For all wiring runs in or under the floor slab which is in contact with the ground.
2. For all wiring runs buried underground, unless otherwise indicated.
3. For all wet locations or locations subject to high humidity.

Provide expansion joints in accordance with manufacturer's recommendations.

Flexible Conduit:

1. For final connections to all motors, transformers, and other equipment of this nature.
2. For final connections to recessed fixtures, and where specifically indicated.

Flexible Watertight Conduit:

1. For final connectons to motors and other equipment where exposed to weather or to moisture.

Electrical Metallic Tubing (EMT), Galvanized:

1. The use of EMT is not permitted.

2-3 WIRE AND CABLE: Limited to feeder and branch circuits. The conductor insulation shall be rated 600 volts. Copper conductor size shall meet requirements of NEC or the sizes indicated on the drawings, if larger. Insulation shall be THW, THWN, or THHN, unless indicated otherwise on the drawings. The use of aluminum conductors is not permitted.

Conductors shall be color-coded, consistent throughout. Color-coding shall be factory pigmentation or colored plastic tape at all terminations. All wires on the same leg or phase shall have the same color code, each leg or phase being a different color.

2-4 BOXES: Boxes include outlet, pull, and junction boxes. Install one for each outlet, switch, receptacle, or combination and junction points, sized in accordance with requirements of NEC. Boxes shall be weatherproofed, threaded hub, cast metal, and provided with weatherproof covers. The use of galvanized metal boxes will not be permitted.

2-5 PANELBOARDS:

A. Bolt-on circuit breaker type, number, size, and rating of single and multiple breakers and spaces as indicated in the panel schedule located on the drawings.

The circuit breakers shall be bimetallic thermal magnetic, meeting requirements of NEMA AB-1. Branch circuit breakers shall have a minimum interrupting rating of 10,000 AIC symmetrical at 480 volts AC. Multiple breakers shall be common trip. Tandem breakers are not acceptable. Solid neutrals shall be provided. Lugs shall be suitable for the size and conductor material. Enclosures shall meet requirements of UL 50, surface mounted. Covers shall have doors with flush locks.

B. Ground-fault interrupters shall be furnished where required by NEC or the drawings. SWD listed CB's shall be provided where used for switching lighting circuits.

2-6 WIRING DEVICES:

A. Receptacles: UL 498 and NEMA WD1.

Duplex Receptacles: NEMA 5-15 R configuration. Specification grade with U-shaped grounding pole and a green-colored terminal for connection of a bonding jumper. Receptacles shall be thermosetting ivory colored plastic with screw terminals, sized for No. 10 AWG conductors.

B. Snap Switches: General use quiet type with ivory handles with terminals rated for No. 10 AWG copper conductors. Switches shall be Specification grade, 15 ampere, 120-277 volt, AC rated.

C. Device Plates and Covers: One-piece metallic to suit devices installed. Surface mounted installations shall have covers of type designed for the box. Device plates shall be stainless steel for flush boxes. In wet location, plates shall be gasketed and weatherproof with spring covers for receptacles and lever operators for switches. Junction boxes shall have blank covers. Screws shall have countersunk heads of finish to match plates.

D. Plugmold shall be a two-piece surface mounted electrical raceway with grounding type single 120V receptacles mounted within the raceway at 12 inches on center. Receptacles shall be alternately wired on two circuits.

2-7 MOTOR OVERLOAD PROTECTION: Each motor shall be provided with overload protection. Overload device shall be manual reset type, standard, slow, or quick-trip depending on the application. Overload devices in controllers may be either melting alloy or bimetallic type. Hermetically sealed motors, submersible motors, and other motors with low endurance to locked rotor currents shall be protected as recommended by the equipment manufacturer. Three-phase motors shall be provided with overload protection in each phase to open all phases upon overload in any phase. Protect each winding in multispeed motors. In sizing overload devices, use actual nameplate value of motor current.

2-8 MOTOR OVERCURRENT PROTECTION: Sized in accordance with NEC: circuit breaker. Overcurrents shall open all ungrounded conductors upon tripping of the overcurrent device in any phase.

2-9 MOTOR CONTROL: NEC 430H, NEMA ICS-1970. Control voltages shall not exceed 120 volt AC. Starters shall be automatic and have integral overload protection. Visual indication of overload operation shall be provided. Magnetic starters shall be solenoid operated. Contacts shall be nonwelding and self-cleaning. Seal coils against damage and contaminants. Components shall be front-accessible for ease of maintenance. Overload reset buttons, control operators, and indicating lights shall be cover-mounted. Refer to Section 16900 for required control circuits.

2-10 MOTOR DISCONNECTS: NEC 430H. Provide explosionproof units where shown on the drawings.

2-11 FUSED SWITCHES: Size, rating, and number of poles as shown, quick-make, quick-break, load-break type, horsepower rated, approved for main line service with cover interlock and lockable external operating handle on the door.

Equip switches with fuse reducing clips and/or rejection clips for current limiting fuses as required. Provide fuses as required.

2-12 TRANSFORMERS: Dry type single-phase transformers shall be 480 volt primary and 120/240 volt secondary. Transformers 25 KVA and larger shall have a minimum of two 4-1/2 percent full capacity primary taps.

Transformers 25 KVA and above shall be 150°C temperature rise above 40°C ambient. All insulating materials to be in accordance with NEMA ST 20 standards for a 220°C UL component recognized insulation system.

Transformer coils shall be of the continuous wound construction and shall be impregnated with non-hygroscopic, thermo-setting varnish. Materials used must have a minimum of year of proven field usage.

All cores to be constructed of high grade, non-aging silicon steel with high magnetic permeability, and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point. The core laminations shall be clamped together with steel angles. The completed core and coil shall then be bolted to the base of the enclosure but isolated therefore by means of rubber, vibration-absorbing mounts. There shall be no metal-to-metal contact between the core and coil and the enclosure. The vibration isolating system shall be designed to provide a permanent fastening of the core and coil to the enclosure. Sound isolating systems requiring the complete removal of all fastening devices will not be acceptable.

Transformers 25 KVA and larger shall be in a heavy gauge, sheet steel, ventilated enclosure. The ventilating openings shall be designed to prevent accidental access to live parts in accordance with UL, NEMA, and National Electrical Code standards for ventilated enclosures. Transformers 25 KVA through 75 KVA shall be designed so they can be either floor or wall mounted.

The entire transformer enclosure shall be degreased, cleaned, phosphatized, primed, and finished with a grey, baked enamel.

The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

The core of the transformer shall be grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable NEMA and NEC standards.

Sound levels shall be guaranteed by the manufacturer not to exceed the following when tested per NEMA and ANSI standards:

0 to 9 KVA-40DB; 10 to 50 KVA-45DB; 51 to 150 KVA-50DB; 151 to 300 KVA-55DB; 301 to 500 KVA-60DB.

Transformers shall be listed by Underwriters' Laboratory for the specified temperature rise.

2-13 PHASE PROTECTION RELAY: Control relay shall provide protection from loss of a single phase, low voltage, or reversed phase sequence. Relay shall have adjustable low voltage trip. Unit shall have a minimum 2 second time delay before activation. Unit shall be similar and equal to Time Mark Corp.

PART 3: EXECUTION

3-1 RACEWAY: Penetrations of roof or wall required for electrical installation shall be sealed, weathertight, and permanent. Securely mount raceway using factory manufactured supports, connectors, and securing devices of type designated or in common use by the electrical trade. The use of perforated iron strap for supporting conduits shall not be permitted. Cuts shall be square with sharp edges removed. Joints shall be tight. Make changes in direction with symmetrical bends or metal fittings. Bends shall not kink or reduce the internal diameter. Crushed, deformed, or clogged raceways shall be replaced. Red lead and other such materials shall not be used at joints before the joints are made. Provide expansion joints as necessary for PVC. Install raceways complete, continuous, clean before pulling in conductors. Install pull wire in all runs of conduit and tubing in which no wiring is installed. Allow 12 inches of excess at each end.

Exposed raceways shall run plumb and level. Concealed raceways shall run in a direct line with long sweeping bends and offsets and as required for exposed raceway except for direction of runs. All exposed conduit locations shall be subject to approval of the Engineer. Conduits shall not be run over knock-out panels, other equipment, or thru open spaces except where such location would not detract from visual impact or operations.

Support nonmetallic conduits used above ground with corrosion resistant metal straps and clamps. Follow manufacturer's recommendations for handling, bending, coupling, and installing the conduit. Transitions between nonmetallic conduits and conduits of other materials shall be with manufacturer's standard adapters designed for such purpose.

Electrical equipment subject to vibration shall have flexible electrical raceway, cable, or cord between that equipment and a nonvibrating supply junction or outlet box.

Where underground conduits enter buildings, seal these conduits to prevent circulation of air or moisture. Obtain approval of Contracting Officer before backfilling. Minimum depth to top of underground conduit shall be 18 inches, if not indicated otherwise on the drawings. Underground conduit shall have watertight joints, and steel conduit shall be completely coated with an approved waterproof noncorrosive coating. Allow coating to dry thoroughly before backfilling. Conduit and fittings coated with polyvinyl chloride permanently fused at the factory is preferred to coating conduit in the field.

3-2 WIRE AND CABLE: In accordance with applicable sections of NEC and the following:

A. Taps and splices: Permitted only in junction or outlet boxes using factory-manufactured insulated-wire connectors of bolted and taped connectors. Springs shall be non-corrosive.

B. Homeruns may be combined, providing neutrals are properly sized. Loads shall be balanced such that common neutrals shall not be overloaded. Homeruns for circuits with GFI protection may not be combined.

3-3 BOXES: Sufficient free volume to accommodate, installed devices. Enclose conductors in accordance with requirements of NEC. Mounting heights above the floor or ground shall be 12 inches for indoor receptacles, 42 inches for switches, unless noted otherwise on the drawings. In underground conduit, pull boxes as detailed on the drawings, shall be installed at a maximum of 500 feet on center.

3-4 PANELBOARDS: Insulate subpanel neutrals from the enclosure. Provide neatly typed directory, mounted behind a clear protective covering, correctly identifying each circuit. Install cabinets so distance from the ground or floor to the cabinet top does not exceed 6 feet 6 inches.

3-5 WIRING DEVICES: Firmly attach plates, plumb and level. Mounting and terminal screws shall be tight. Remove fiber washers on mounting screws prior to installing device.

3-6 MOTOR OVERLOAD PROTECTION: Check overload devices for proper size considering nameplate full-load current rating, service factor, and ambient temperature if motor is in different ambient temperature than controller.

3-7 MOTOR OVERCURRENT PROTECTION: Motor overcurrent device ampacities shall be ascertained not to exceed the limitations given in NEC 430-52. If fused, ambient temperature shall be considered in sizing fuses.

3-8 MOTOR CONTROL: Install in accordance with NEC 430G. Where combined with overload or overcurrent protection, the controller shall also meet NEC requirements. Refer to Section 16900 for additional requirements.

3-9 MOTOR DISCONNECTS: Install in accordance with NEC 430H. When combined with the motor controls, the disconnect shall also meet NEC requirements.

3-10 CONTROL DEVICES: Install in accordance with manufacturer's instructions. Refer to Section 16900 for additional requirements.

3-11 FUSED SWITCHES: Installed in motor control center, per manufacturer's instructions.

3-12 MOTOR TESTING: Measure amperage on motors (not to exceed nameplate in running mode). Measure voltage at motor terminals, to be within ± 10 percent of motor nameplate when motor is running fully loaded. Read voltage on submersible pumps at well head. Correct all deficiencies. All testing is to be done in the presence of the Contracting Officer.

3-13 PHASE LOSS PROTECTION: Adjust relay in accordance with manufacturer's recommendations. Refer to Section 16900 for control requirements.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing all service entrance equipment, raceway, and conductors as indicated, from the secondary terminals of power company furnished transformers, to the main disconnect within structure being served.

1-2 WORK FURNISHED BY OTHERS: The Montana Power Company will furnish and install underground primary cable, pad mounted or pole mounted transformers and primary cable trenching and bedding to provide a 277/480V 3-phase 4-wire at the water treatment plant.

1-3 QUALITY ASSURANCE:

A. Standards as established by National Electrical Code (NEC) and Underwriters' Laboratories (UL), as amended, latest edition, govern the work of this section.

PART 2: MATERIALS

2-1 SERVICE RACEWAY: Rigid galvanized steel conduit.

2-2 SERVICE CONDUCTORS: Stranded copper, insulation voltage rating and type meeting or exceeding NEC requirements for the application.

2-3 SERVICE DISCONNECT: Fusible switch type, as shown on the drawings, UL listed as "Service Entrance Equipment." Pressure connectors shall be provided for attachment of service conductors capable of interrupting the maximum symmetrical short circuit current available.

2-4 METERING: Provide metering equipment as required by Montana Power Company and as shown on the drawings. Meter and current transformers will be furnished by utility company. Meter socket and current transformer cabinet will be furnished by Contractor.

PART 3: EXECUTION

3-1 SERVICE RACEWAY: Underground per Section 16100, from transformer to the main disconnect as shown on the drawings.

3-2 SERVICE CONDUCTORS: Without splice, except clamped or bolted connections may be used at meter socket. Make taps to service conductors with split

bolt connectors. For 3-wire systems, color-code line 1, black; line 2, red; neutral, white. Four-wire systems, phase A, black; phase B, blue; phase C, red; neutral, white.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of grounding electrical systems and noncurrent carrying metallic parts of electrical equipment and raceway as indicated.

1-2 QUALITY ASSURANCE: Standards as established by National Electrical Code (NEC 250) as amended, latest edition, govern the work of this section.

PART 2: MATERIALS

2-1 GROUND CONDUCTOR: Nonstranded copper, without splice throughout its length, sized as indicated, bare or insulated; color-coded green.

2-2 MADE ELECTRODES: One-piece galvanized steel rods minimum of 5/8-inch diameter by 8 feet long, or one-piece copper clad rod minimum of 1/2-inch diameter by 8 feet long. Do not use metallic conduit or pipe coated with lacquer or other nonconducting material.

2-3 BONDING JUMPERS: Bare copper. Jumpers for service equipment shall be the size of grounding conductor. Jumpers for interior wiring raceways and enclosures shall be sized according to NEC Table 250-95.

PART 3: EXECUTION

3-1 MADE ELECTRODES: Embed rods into permanent moisture level. Conduct resistance tests to ground. Resistance to ground shall not exceed 25 ohms. Where resistance to ground exceeds 25 ohms, install additional made electrodes, not to exceed three, a minimum of 10 feet apart and bond together. Conduct tests under normal ground conditions using an approved industry recognized method. If satisfactory grounds cannot be obtained, other made electrodes may be used in accordance with NEC 250-83. In impenetrable soils, such as solid rock, subsurface radials may be used if underground metallic water piping is unavailable.

3-2 SERVICE GROUNDING: In accordance with NEC 250, connect neutral of electrical systems to grounding conductor on supply side only of service entrance equipment within service equipment enclosure. Do not connect neutral to ground on load side of service disconnecting means. Bond service equipment enclosures. Provide service conduits with grounding lock-nuts or bushings; provide service enclosures with grounding connectors, lugs, or clamps. Attach grounding conductor to metallic cold water piping system near entrance at

building, ground rod, and other available methods per NEC 250-81. Point of attachment shall be accessible and located in protected area. Attach grounding conductor to piping and electrodes with bolted brass or bronze clamps. Connect conductor to clamp by lugs or pressure connectors. Clamps of sheet metal type are not acceptable. Where grounding electrode is an underground water piping system, assure continuity by providing bonding jumpers across water meters, nonconducting sections, and fittings which can be disconnected.

3-3 EQUIPMENT GROUNDS AND BONDS: Ground metallic raceway systems, enclosures, and noncurrent carrying metallic parts of electrical equipment. All conduits shall contain a separate conductor for grounding. Where raceways connect to enclosures, remove nonconducting coatings. Make raceway connections at enclosures tight to assure continuity or supplement with jumpers. Provide bonding jumpers across expansion joints and telescoping sections of metallic raceway and power cords if not provided with an internal ground wire. Establish continuity between outlet boxes and receptacles by a bonding jumper except where surface mounted boxes or approved ground yokes are utilized. Use service grounding conductor and ground electrode for wiring system as equipment and raceway ground. Do not use red lead or other nonconducting material at metallic conduit joints prior to assembly.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing complete lighting fixtures, with lamps, for each lighting fixture outlet indicated.

1-2 QUALITY ASSURANCE: Standards as established by NEMA, OSHA, UL, and manufacturers' printed recommendations, as amended, latest editions, govern the work of this section.

1-3 PRODUCT HANDLING: Deliver fixtures and lamps in original packing cartons.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings and catalog cuts for the following:

Fixtures and lamps.

PART 2: MATERIALS

2-1 GENERAL LIGHTING FIXTURES: Fixtures shall be as shown in the lighting fixture schedule on the drawings. Fixtures installed in damp and wet locations shall be UL listed and marked "Suitable for Wet Locations."

2-2 BALLASTS: Rated for voltage as shown, 60 hertz, high power factor type. Meeting following requirements; fluorescent lamp ballasts; CBM certified by ETL, Premium Class P, sound rating A, low temperature where exposed to such. Energy efficient where available.

2-3 LAMPS: Provide for each fixture of type, size, color, wattage, and voltage indicated. High efficiency where available.

2-4 LENS AND ENCLOSURES: Fixture lens, acrylic. Housing, fiberglass reinforced plastic, or as noted otherwise.

PART 3: EXECUTION

3-1 GENERAL LIGHTING FIXTURES: Adjust fixture location as needed to avoid space conflicts. Mount at heights indicated, securely supported. Do not use as a raceway for circuit conductors except for single branch circuit supplying the fixtures. Branch circuit wiring shall not pass through an outlet box that is an integral part of an incandescent fixture unless fixture is approved for

the purpose. Wiring within fixtures shall be neatly arranged and protected from physical damage. Protect conductor insulation from abrasion where it passes through metal using chase nipples or equivalent.

3-2 BALLASTS: Generally preinstalled in fixtures.

3-3 LAMPS: Just prior to completion, supply new lamps in fixtures.

3-4 LENS AND ENCLOSURES: Clean, new, unbroken; install just prior to completion.

3-5 CONTROLS: Install as indicated.

3-6 TESTS: Upon completion of lighting fixture installations, test all lighting circuits. Replace noisy or defective fixtures.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. it will be considered a subsidiary obligation of the contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing electric heating equipment at the Water Treatment Plant, Raw Water Pump Station and Storage Control Vault.

1-2 RELATED WORK SPECIFIED ELSEWHERE: Heating and Ventilation Sequence of Operation - Section 15950.

1-3 QUALITY ASSURANCE:

A. Quality assurance standards as established by NEMA, OSHA, UL, and manufacturers' printed recommendation as amended, latest editions, govern the work of this section.

1-4 SUBMITTALS: In accordance with Section 01300, submit shop drawings and catalog cuts of the following: Unit heaters, baseboard heaters, convectors, thermostats, and mounting brackets.

PART 2: MATERIALS

2-1 BASEBOARD HEATERS: Units shall consist of a finned aluminum sheath element in a baseboard style enclosure. Heating element shall be rated at 250 watts per foot at rated voltage. Enclosure shall have baked-on enamel finish. Unit shall be complete with integral thermostat for room temperature control and linear overheat protection. Refer to electric heating schedule on the drawings.

2-2 UNIT HEATERS: Unit heaters shall be horizontal type with metal sheath fin tube heating elements with built-in overheat protection mounted in baked enamel finished heavy gauge steel cabinet. Unit shall be fan forced, with individually adjustable discharge louvers to direct air flow. Unit shall include factory installed integral comfort thermostat with external control knob, heavy duty magnetic control contractors and adjustable wall mounting bracket.

2-3 CONVECTORS: Units shall consist of 16 gauge steel welded one-piece unit, enclosed within a stainless steel sheath with steel fins permanently bonded to the sheath. Heating element shall be rated at 250 watts per foot at rated voltage. Enclosure shall have baked-on enamel finish. Unit shall be complete with integral thermostat for room temperature control and linear overheat protection. See schedule on mechanical drawings.

2-4 CABINET UNIT HEATER: Construction shall be 16 gauge steel, with front panel and control panel for access. Heater resistance wire shall be high grade nickel-chromium alloy, enclosed within steel sheath with steel fins. Unit shall be complete with integral thermostat for room temperature control and linear overheat protection. Motor and blower shall be matched assembly with direct-drive connection, vibration-free performance, built-in automatic reset and overload protection. Blower shall be forward curved double inlet centrifugal type. Air filter shall be located ahead of motor and blower assembly and easily removed for cleaning. An integral fan switch shall be standard to maintain motor operation on the "off" cycle until all residual heat in the elements has been dissipated. See schedule on mechanical drawings.

PART 3: EXECUTION

3-1 Baseboard heaters, unit heaters, convectors and cabinet heaters and thermostats shall be installed per manufacturer's recommendations where shown on the drawings.

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement or payment will be made for this work. It will be considered a subsidiary obligation of the contract under other work to which it relates.

END

PART 1: GENERAL

1-1 DESCRIPTION: The work of this section consists of providing all power and control work for the installation and proper operation of the domestic water supply system including but not limited to control of the water treatment plant and coordination of control signals between the water treatment plant and the existing Yellowstone River pump station, and between the water treatment plant and the existing tank site. Raw water is taken from the Yellowstone River and pumped to a reservoir at the water treatment plant. Pumping is controlled by water level of the reservoir. Water then flows by gravity through the water treatment plant ending in the filters. The finished water is then pumped from the filters to the two existing tanks and the new tank. Pumping of finished water is controlled by the water level of the tanks. Filter backwash water flows by gravity from the filters to the backwash ponds. After settling, the decant is then pumped to the raw water reservoir and the sludge is pumped to the sewage treatment plant.

1-2 TANK LEVEL SENSING: The level of the existing tanks is measured by a pressure sensor connected to the tank outlet line. This pressure is converted to an electrical signal proportional to the tank level. Each signal is then converted to an audio tone signal and transmitted via telephone lines to the water treatment plant. All equipment at the existing tank site is existing and not part of this contract.

1-3 TANK LEVEL INDICATION: The tank level signal is received at the water plant and input to a tank level indicator located in the office control panel. Each tank level indicator has four adjustable limit switches used for storage high and low alarms (refer to "alarms") and the "plant run signal."

1-4 PLANT RUN SIGNAL: The plant run signal is generated by the limit switches on the tank level indicator (refer to "tank level indication"). As water level in the tank falls, the plant is told to turn on and then remains running until the level in the tank rises to a higher level. The plant run signal is used to energize the following equipment. Refer to individual descriptions for further detail.

a. Finished water pumps (3)
b. Rapid mix
c. P.A.C. pump
d. Poly pump
e. Alum solenoid
f. Chlorine solenoid
g. Lime solenoid

h. Poly solenoid
i. P.A.C. solenoid
j. KMnO4 solenoid
k. Alum feeder
l. Lime feeder
m. KMnO4 feeder
n. P.A.C. feeder

1-5 TREATED WATER FLOW: Treated water flow out of the water treatment plant is continuously measured by a differential pressure sensor connected to a Venturi tube with a flow indicator and totalizer located in the filter control console.

1-6 BACKWASH WATER FLOW: Water used for backwash operations is continuously measured by a differential pressure sensor connected to a Venturi tube with a flow indicator and totalizer located in the filter control console.

1-7 PHASE PROTECTION: Electrical power quality is continuously monitored at the water treatment plant motor control center and the intake building. Conditions of low voltage, phase reversal or single phasing will cause the 3-phase motors to stop after a minimal time delay. All motors shall automatically restart upon return of power quality to normal. This protection applies to the following equipment. Refer to individual sections for further details.

a. Finished water pumps (3)
b. Rapid mix
c. Lime dust collector
d. Alum dust collector
e. Settling tank sludge pumps (2)

1-8 FILTER LEVEL: Induction relays connected to probes in each filter provide a high water alarm for each filter (refer to "alarms") and a "run pump permissive" signal for the associated finished water pump (refer to "finished water pumps"). If water level rises in the filter above normal level, the alarm will sound and if water level drops to a low level, the pump removing water from that filter will stop. Water level must regain to a higher level before the pump will restart.

1-9 FINISHED WATER PUMPS: Three finished water pumps remove water from the two filters and pump the water to the existing tanks. The three pumps are called "pump #1" (for filter #1), "pump #2" (for filter #2), and "standby pump" (for either filter #1 or #2). Two selector switches for each filter, located in the filter control console, determine which pump is to be used for each filter. Only two pumps are used at any one time. Two selector switches located in the filter control console determine which pump is to remove water from that filter and provide manual stopping of pumping during backwash. For

filter #1 the first selector switch reads "pump #1/standby" and for filter #2 it reads "standby/pump #2." The second selector switch for both filters reads "run pump/stop pump." Interlocking is provided to prevent more than two pumps running under any circumstance.

The following is typical for all three pumps. The pump has a local hand/off/auto selector switch. In the "hand" position the pump will run. In the "off" position, the pump will not run. In the auto position, the pump will run when signaled by the plant run signal. Pump running is subject to the low water signal from its associated filter (refer to "filter level"), electrical power quality (refer to "phase protection"), position of the selector switches in the filter control console, and that the other two pumps are not both running.

Each pump has an associated electric control valve, consisting of a solenoid and a limit switch. When the pump is told to run, the pump motor is started and the solenoid is energized, causing the valve to open. When the pump is to stop, the solenoid is de-energized allowing the valve to close, but the pump motor continues to run until the limit switch indicates that the valve has closed. The pump motor is then stopped.

To prevent simultaneous starting of the pumps, pump #2 starting is delayed 20 seconds and the standby pump starting is delayed 40 seconds after receiving a signal to start. Each pump has a running time meter located in the office control panel and green running lights located in the office control panel and filter control console.

1-10 RAPID MIX: The rapid mix has a local hand/off/auto selector switch. In the hand position, the unit will run. In the off position, the unit will not run. In the auto position, the unit will run according to the "plant run signal." All running is subject to power quality (refer to "phase protection"). The unit has a running time meter and green running light located in the office control panel.

1-11 SETTLING TANK SLUDGE PUMPS: Each pump has a manual start/stop pushbutton station located at the motor for manual control. Pump running is dependent on good power quality (refer to "phase protection"). A running time meter and pilot light is located in the office control panel for each pump.

1-12 POLYMER SYSTEM: The polymer system consists of a feeder, solenoid, and a pump. The feeder requires only a power supply as all controls are factory prepackaged by the manufacaturer. Power supply is monitored by a green running light located in the office control panel. The solenoid has a local hand/off/auto selector switch. In the hand position, the solenoid is energized. In the off position, the solenoid is de-energized. In the auto position, the solenoid is energized by the plant run system described elsewhere in these specifications. The pump has a local hand/off/auto selector switch. In the hand position, the pump runs. In the off position,

the pump will not run. In the auto position, the pump is controlled by the plant run system. Pump running is monitored by a green pilot light located in the office control panel.

1-13 POWDERED ACTIVATED CARBON (P.A.C.) SYSTEM: Same as polymer system.

1-14 ALUM SYSTEM: The alum system consists of a feeder, solenoid, dust collector and shaker. The feeder has a local hand/off/auto selector switch. In the hand position the feeder runs. In the off position, the unit will not run. In the auto position the unit is controlled by the plant run system. The solenoid is controlled in the same manner as the feeder. The dust collector is controlled by a local start/stop pushbutton station. The shaker is controlled by a 0-60 second manual timer. The feeder operation is monitored by a pilot light located in the office control panel.

1-15 LIME SYSTEM: Same as alum system.

1-16 CHLORINATION (CL2) SYSTEM: This system consists of a solenoid with a local hand/off/auto selector switch. In the hand position, the solenoid is energized. In the off position, the solenoid is de-energized. In the auto position, operation is controlled by the plant run system described elsewhere in these specifications.

1-17 POTASSIUM PERMANGANATE ($KMnO_4$) SYSTEM: This system consists of a feeder and solenoid. The feeder has a local hand/off/auto selector switch. In the hand position the feeder runs. In the off position the unit will not run. In the auto position, the unit is controlled by the plant run signal. The solenoid is controlled in the same way as the feeder. The feeder has a running light located in the office control panel.

1-18 TURBIDIMETERS: Water taken from each filter effluent line will be analyzed by a turbidimeter (one for each filter). A remote indicator for each turbidimeter is located in the filter control console.

1-19 LAMP TEST: A lamp test pushbutton in the filter control console will energize all pilot lights in the console without affecting any operation. A lamp test pushbutton in the office control panel will energize all pilot lights in the panel without affecting any operation.

1-20 ALARMS: The alarm system shall consist of individual red alarm pilot lights, alarm horn and alarm acknowledge switch. Activation of the system will be by signals as outlined in other portions of these specifications. When an alarm signal is received, the appropriate alarm light will be activated in a flashing mode, and the alarm horn will sound. Activation of an alarm acknowledge pushbutton will silence the alarm horn and cause the

flashing alarm light to be constant. The alarm light shall remain lighted until the initiating signal is cleared. Subsequent alarms shall activate the alarm horn and require acknowledgment even though previous alarms have not yet cleared. The alarm horn, alarm acknowledge pushbutton, and all alarm pilot lights are located in the office control panel. The following is a list of all required alarms. Refer to the appropriate portion of these specifications for further detail.

a. Storage high level
b. Storage low level
c. Filter #1 high level
d. Filter #2 high level
e. Backwash pond low level
f. Backwash Pond #2 high level
g. Sludge pump hot
h. Raw water reservoir low level
i. Raw water reservoir high level

Each of the alarms is also input to automatic dialing alarm equipment which transmits a signal unique for each alarm to the park communications center.

1-21 FLOCCULATOR: The flocculators come complete with all controls prewired, requiring only a power feeder. Power supply to the units are monitored by running time meters and green pilot lights, both located in the office control panel.

1-22 FILTER INFLUENT VALVES: Each filter influent valve is operated by a two-position selector switch with positions open and close. Limit switches will stop motor operation when the valve is open or closed. Additional limit switches will activate valve position pilot lights, green for valve fully open and amber for valve fully closed. The selector switch and pilot lights are located in the filter control console.

1-23 BACKWASH VALVES: Each backwash valve is controlled by a spring return to center close/maintain/open selector switch. This valve shall modulate the rate of flow of backwash water. In the maintain position, the valve remains stationary. In the close position, the valve motor is energized to close the valve. A limit switch de-energizes the motor when the valve is fully closed. The opposite occurs in the open position. Limit switches on the valve energize an amber pilot light indicating valve not fully closed and a green pilot light indicating valve fully closed. Pilot lights are located in the filter control console. The valve will close immediately and/or not open if the backwash supply high pressure switch is activated.

1-24 SURFACE WASH VALVES: Each filter surface wash valve is operated by a two-position selector switch with positions open and close. Limit switches will stop motor operation when the valve is open or closed. Additional limit switches will activate valve position pilot lights. Amber for valve fully open and green for valve fully closed. The selector switch and pilot lights are located in the filter control console.

1-25 BACKWASH WASTE VALVES: Each filter backwash waste valve is operated by a spring return to center open/hold/close selector switch. This valve shall modulate the rate of flow of backwash waste water. In the hold position, the valve remains stationary. In the close position, the valve motor is energized to close the valve. The opposite occurs in the open position.
Limit switches will stop motor operation when the valve is open or closed. Additional limit switches will activate valve position pilot lights, amber for valve not fully closed and green for valve fully closed. The selector switch and pilot lights are located in the filter control console.

1-26 FILTER-TO-WASTE VALVES: Each filter-to-waste valve has a two-position selector located in the filter control console. In the close position the valve motor is energized to close the valve. A limit switch de-energizes the motor when the valve is fully closed. In the open position the opposite occurs. When the valve is fully open a limit switch energizes a green pilot light located in the filter control console. When the valve is fully closed a limit switch energizes a blue pilot light located in the filter control console.

1-27 CHLORINE ROOM LIGHTING AND EXHAUST: The lighting and exhaust system consists of the following equipment: Light fixture, exhaust fan, motor operated louver, door activated switch, manual fan switch and manual light switch. The manual fan switch and manual light switch are both spring loaded to return to a neutral position after having been moved to the off position. The door switch is closed by the opening of the door. The motor operated louver is activated (and the louver opens) whenever the exhaust fan is energized. Opening the door will energize both the light fixture and exhaust fan. Both pieces of equipment will remain energized until its associated manual switch is moved to the off position, regardless of door position. Each time the door opens, any equipment not energized will be energized.

1-28 SLUDGE WASTE PUMP: The sludge waste pump is controlled by a hand-off-auto selector switch adjacent to the pump and a start/stop pushbutton station adjacent to the backwash pump house door. In the hand position, the pump runs, in the off position the pump does not run. In the auto position, the start/stop pushbutton station is energized. The pump has automatic shutdown in case of high pump temperature, measured by a sensor on the pump. A gland seal water solenoid is energized whenever the pump runs. Pump running is monitored by a green pilot light and a running time meter, both located in the office control panel.

1-29 DECANT PUMP: The pump is activated by a hand/off/auto selector switch located at the pump and a start/stop pushbutton station located adjacent to the backwash pond pumphouse door. In the hand position the pump will run. In

the off position, the pump will not run. In the auto position, the start/stop pushbutton station is energized. Automatic stop is provided by induction relay connected to probes in a stand pipe within the pumphouse. A temperature sensor on the pump prevents pump operation when activated by high pump temperature.

1-30 BACKWASH POND LEVEL: Backwash pond high water level activates a pressure switch on the sludge line (one for each pond) in the backwash pond pump house. Backwash pond low water level is measured by heat sensors on the housing of the decant and sludge pumps. Each signal will activate an appropriate red pilot light in the office control panel, and activate an alarm horn in the office control panel.

1-31 RAW WATER RESERVOIR LEVEL SENSING: A pressure sensor indicator with pressure sensing line extended into the reservoir measures the level of the raw water reservoir. The 4-20 ma output of the sensor, proportional to reservoir level, is input to current sensitive relays to provide the following discrete level signals:

a.	Reservoir high level	7915.50 Feet
b.	Stop pumps	7915.00 Feet
c.	Start lead pump	7913.00 Feet
d.	Start lag pump	7912.00 Feet
e.	Reservoir low level.	7910.00 Feet

The high and low level signals are used to sound alarms (refer to alarms). The start and stop pump levels are used to create run lead pump and run lag automatic pump signals. Hand/off/automatic selector switches located in the office control panel allow manual control of the lead and lag pumps. The run lead pump and run lag pump signals are input to audio tone transmitting equipment and transmitted to the Yellowstone River pump station.

1-32 RELATED WORK SPECIFIED ELSEWHERE: Refer to sections pertaining to individual pieces of equipment.

1-33 QUALITY ASSURANCE:

A. Refer to Section 16010.

1-34 SUBMITTALS: In accordance with Section 01300, submit shop drawings and catalog cuts for the following:

A. Control Equipment

B. Equipment Enclosures

C. Equipment Interconnection Diagrams

D. Motor Control Center

PART 2: MATERIALS

2-1 CONDUIT AND WIRE: As specified in other parts of these specifications.

2-2 FITTINGS AND JUNCTION BOXES: As specified in other parts of these specifications.

2-3 MOTOR CONTROL CENTER: Motor control center shall be multisection, 277/480 volt, 3-phase, 4-wire, free-standing unit in NEMA 1 gasketed enclosure, with the following features:

A. 600A tin-plated aluminum horizontal bus.

B. 1/4-inch x 1-inch tin-plated aluminum ground bus.

C. Tin-plated aluminum vertical bus of sufficient ampacity to carry loads served.

D. Sections shall contain equipment as shown on the drawings. Actual equipment layout shall be as determined to be most economical, with 10% spare capacity with a minimum of 12" space.

E. Starters shall be NEMA Class 1B with thermal magnetic molded case circuit breaker, magnetic contactor with 120V coil and 2 N.O. and 2 N.C. auxiliary contacts. Circuit breaker size and contactor rating shall be sized for the motor it controls. Unit shall be stab-in type with external operating handle, padlockable in the off position and have cover mounted reset button for bimetallic, isothermic overload relay.

F. Circuit breakers shall be thermal magnetic molded case, sizes as required by N.E.C., with external operating handle.

G. Fused switches shall be 480V, 3P sized as required, quick-make, quick-break type, horsepower rated and shall be approved for main line service. Switches shall have external operating handle, padlockable in the off position, and shall be equipped with fuse reducing clips and/or rejection clips for Class R current limiting fuses as required.

2-4 TELEMETERING TRANSMITTING AND RECEIVING EQUIPMENT:

A. All equipment is existing and shall be very carefully relocated from the maintenance shop to the water treatment plant by the Contractor.

2-5 OFFICE CONTROL PANEL AND CHLORINE ROOM CONTROL PANEL: Panels shall consist of individual control components as described elsewhere in these specifications, mounted in surface mount, NEMA 12, panel enclosure. Terminal strips shall be provided for interconnecting wiring between the panel and external devices and equipment.

2-6 TERMINAL STRIPS: Terminals shall be 300V tubular clamp type rated for current carried. Strip shall be of one-piece construction or individual terminals mounted on a common mounting strip. Terminals shall be numbered corresponding to wiring diagrams.

2-7 LEGEND PLATES: Furnish plastic lamicoid nameplates for all electrical equipment. Nameplates shall have 1/4" high black letters on white background.

2-8 ALARM LIGHT FLASHERS: Provide 120V flashers which cause approximately 1/2 second on 1/2 second off flashing of alarm lights.

2-9 AUTOMATIC TELEPHONE DIALING EQUIPMENT: Provide combination control and communicator Model #1C as manufactured by Franklin Signal Corporation. Provide number of units required for number of signals to be transmitted. No other equipment manufacturer is acceptable as transmitter must communicate with existing receiver at the park communications center. Unit shall be complete with standby battery power. Provide 120/12 volt transformer with unit, and lightning surge protection suitable for electronic equipment.

2-10 CONTROL RELAYS: Standard control relays shall be multi-circuit 300 volt industrial relays with 120V coil and self-cleaning contacts. Timing relays shall be adjustable pneumatic type. All forms shall have compatible design to allow sides of unit to form wiring trough. Types and number of contacts shall be as required (refer to schedule). Contacts shall be rated for 6 amps at 120V. Terminals shall be screwtype, for mounting in control panel. Control relays shall be sealed plug-in type with indicator light, Potter and Brumfield Series KRP-N, or approved equal.

2-11 PILOT LIGHTS: Pilot lights shall be full voltage 120V type. Lens colors and legend plates shall be as described elsewhere in these specifications, and on the drawings. Units shall be approved equal to Allen-Bradley Bulletin 800T.

RELAY CHART

RELAY NO.	CONTACTS N.O.	USED N.C.	PAGE NUMBER CONTACTS	PAGE NUMBER COIL	FUNCTION
1	2	1	PE-6, PE-8	PE-6	STORAGE HIGH WATER
2	1	0	PE-6	PE-6	PLANT OFF
3	1	0	PE-6	PE-6	PLANT ON
4	2	0	PE-8	PE-6	STORAGE LOW WATER
5	8	0	PE-6, PE-7	PE-6	PLANT RUN
6	8	0	PE-7, PE-9	PE-6	PLANT RUN
7	0	8	PE-6, PE-7	PE-6	PHASE PROTECTION
8	2	0	PE-8	PE-6	FILTER #1 HIGH LEVEL
9	2	0	PE-6	PE-6	FILTER #1 RUN PUMP
10	2	0	PE-8	PE-6	FILTER #2 HIGH LEVEL
11	2	0	PE-6	PE-6	FILTER #2 RUN PUMP
12	1	0	PE-6	PE-6	RUN STANDBY PUMP
13	1	0	PE-6	PE-6	RUN PUMP #1
14	1	0	PE-6	PE-6	RUN PUMP #2
15	1	0	PE-6	PE-6	RUN STANDBY PUMP
16	0	3	PE-6	PE-6	TWO PUMPS RUNNING
17	3	0	PE-6	PE-6	RUN PUMP #1
18	2	0	PE-6	PE-6	PUMP #1 VALVE OPEN
19	2	0	PE-6	PE-6	PUMP #1 AUX.
20	3	0	PE-6	PE-6	RUN PUMP #2
21	2	0	PE-6	PE-6	PUMP #2 VALVE OPEN
22	2	0	PE-6	PE-6	PUMP #2 AUX.
23	3	0	PE-6, PE-7	PE-6	RUN STANDBY PUMP

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RELAY CHART

RELAY NO.	CONTACTS N.O.	USED N.C.	PAGE NUMBER CONTACTS	PAGE NUMBER COIL	FUNCTION
24	2	0	PE-7	PE-7	STANDBY PUMP VALVE OPEN
25	2	0	PE-6	PE-7	STANDBY PUMP AUX.
26	2	1	PE-7, PE-8	PE-7	BACKWASH POND LOW LEVEL
27	2	1	PE-8	PE-7	BACKWASH POND #1 HIGH LEVEL
28	2	1	PE-8	PE-7	BACKWASH POND #2 HIGH LEVEL
29	2	1	PE-7, PE-8	PE-7	SLUDGE PUMP HOT
32	8	0	PE-8	PE-8	ALARM ACKNOWLEDGE
33	4	0	PE-8	PE-8	ALARM ACKNOWLEDGE
34	2	1	PE-8	PE-8	STORAGE HIGH LEVEL
35	2	1	PE-8	PE-8	STORAGE LOW LEVEL
36	2	1	PE-8	PE-8	FILTER #1 HIGH LEVEL
37	2	1	PE-8	PE-8	FILTER #2 HIGH LEVEL
38	2	1	PE-8	PE-8	BACKWASH POND LOW LEVEL
39	2	1	PE-8	PE-8	BACKWASH POND #1 HIGH LEVEL
40	2	1	PE-8	PE-8	BACKWASH POND #2 HIGH LEVEL
41	2	1	PE-8	PE-8	SLUDGE PUMP HOT
44	2	1	PE-8	PE-8	RAW WATER RESERVOIR LOW LEVEL

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RELAY CHART

RELAY NO.	CONTACTS N.O.	USED N.C.	PAGE NUMBER CONTACTS	PAGE NUMBER COIL	FUNCTION
45	2	1	PE-8	PE-8	RAW WATER RESERVOIR HIGH LEVEL
46	1	0	PE-9	PE-9	START INTAKE LAG PUMP
47	1	0	PE-9	PE-9	START INTAKE LEAD PUMP
48	2	0	PE-9	PE-9	STOP INTAKE PUMPS
49	2	0	PE-9	PE-9	RUN LAG PUMP
50	2	0	PE-9	PE-9	RUN LEAD PUMP
51	2	0	PE-8	PE-9	RAW WATER RESERVOIR HIGH LEVEL
52	6	6	PE-6, PE-7, PE-10	PE-8	LAMP TEST
53	5	5	PE-10	PE-8	LAMP TEST
54	6	6	PE-10	PE-8	LAMP TEST
55	5	5	PE-10	PE-8	LAMP TEST
56	6	6	PE-6, PE-7	PE-8	LAMP TEST
57	6	6	PE-7, PE-8	PE-8	LAMP TEST
58	6	6	PE-8	PE-8	LAMP TEST
59	4	4	PE-8, PE-9	PE-8	LAMP TEST
60	5	5	PE-9	PE-8	LAMP TEST
61	2	0	PE-8	PE-9	RAW WATER RESERVOIR LOW LEVEL
62	0	1	PE-7	PE-7	CL_2 DOOR OPEN
63	2	0	PE-7	PE-7	CL_2 PULSE
64	1	0	PE-7	PE-7	FAN ON/OFF
65	1	0	PE-7	PE-7	LIGHT ON/OFF
66	1	0	PE-9	PE-6	PLANT RUN

2-12 SELECTOR SWITCHES: Selector switches shall be standard operator type with white color insert. Number of positions and contacts shall be as required for function. Provide spring return where required. Contacts shall be rated for currents carried. Legend plates shall be as described elsewhere in these specifications and on the drawings. Units shall be approved equal to Allen-Bradley Bulletin 800T.

2-13 PUSHBUTTONS: Pushbutton operator shall be flush head type with black operator for all pushbuttons. Contacts shall be rated for current carried and of number required for operation. Legend plates shall be as described elsewhere in these specifications and on the drawings. Units shall be approved equal to Allen-Bradley Bulletin 800T.

2-14 TANK LEVEL SENSOR/FLOW SENSOR: Differential pressure sensor responds to pressure changes caused by changes in tank water level. The unit converts these pressure changes to a time-pulse signal directly proportional to the level or flow. Unit shall be accurate within 1 percent of full range. Unit shall operate at 120V, 1 phase, 60 Hz. All equipment shall be mounted in a NEMA 4 enclosure, suitable for wall mounting. Unit shall include an integral level or flow indicator. Unit shall be approved equal to Model 251 as manufactured by B.I.F. Range for each unit shall be as follows:

a.	Plant treated water flow	0 - 750 GPM
b.	Backwash flow	0 -1500 GPM
c.	Raw water reservoir level	0 - 10 Feet

2-15 FLOW INDICATORS: The flow indicator shall have a steel dustproof case with an enamel finish. The door shall be clear plastic with a magnetic latch. The unit shall consist of a solid-state positioner. The power pack shall consist of printed circuit board assemblies with 120V 1-phase power supply, spray coated with a moisture-and-fungusproof coating. All connectors and connector fingers shall be nickel-gold plated on contact areas. The positioner shall have a 12-volt d-c reversible servo motor and a servo motor mounted position potentiometer. Shafts and gears shall be stainless steel or nickel-plated brass. The positioner module plates shall be aluminum. The indicator shall have an accuracy of $\pm$0.5 percent of the full scale. The indicator shall have a nominal 6-inch diameter with a single pointer and a 270-degree dial calibrated as specified under the individual units. It shall be provided with adjustable auxiliary contacts for control, as required. Unit shall be approved equal to Model 233 as manufactured by B.I.F. Range for each unit shall be as follows:

a.	Plant treated water flow	0 - 750 GPM
b.	Backwash flow	0 - 1500 GPM

2-16 RUNNING TIME METER: Timers shall have a synchronous motor which drives six digit readout wheels to indicate the total time the unit is energized. Range shall be 99999.9 hours. Unit shall operate at 120V, 60 Hz over a temperature range of 0°-140°F. Unit shall be nonresettable. Meters shall be approved equal to series HK as manufactured by "Eagle Signal."

2-17 INDUCTION RELAYS: Primary coil shall be rated 115V, 60 Hz. Contacts shall be double-break, made of silver alloy and rated for load to be carried. Insulation blocks shall be made of a thermosetting plastic that has high arc resistance, dielectric strength and dimensional stability. Secondary coil shall be of voltage for use in treated or untreated water. Relay contact arrangement shall be as required for function. Unit shall be approved equal to equipment as manufactured by B & W.

2-18 PROBES: Probes shall consist of a 4-inch long stainless steel electrode assembled in a molded plastic insulating shield suspended on a single conductor, 18 gauge, 41 strand copper, vinyl-insulated cable. Units shall be approved equal to equipment as manufactured by B & W. Probes shall be suspended from a fitting designed for the purpose.

2-19 MANUAL 60 SECOND TIMER: Timer shall be manually-operated, spring-powered, suitable for mounting in single gang box. Contacts shall be rated 15A, 120V.

2-20 PRESSURE SWITCH: Pressure switch shall have 4-1/2 inch dial mounted in back flanged cast iron housing. Dial, calibrated 1-100 lbs., shall be visible through acrylic window. Entire unit shall be waterproof. Switches (two required) shall be single-pole, double-throw, adjustable from rear, rated at 10A-125/250VAC with a minimum 5 percent switching differential. Connection shall be 1/4-inch ANPT. Accuracy shall be 0.5 percent of indicator span, with 2 percent repeatability. Unit shall be approved equal to No. 3050 as manufactured by U.S. Gauge.

2-21 ALARM HORNS: Horns shall be interior type flush-mount with enamel-coated grill. Horn shall be die-cast aluminum with stainless steel diaphragm, polyvinyl-acetal insulated magnet wire and nonhygroscopic coils. All accessories shall be electroplated and finished with a heavy enamel coating. Units shall be volume adjustable, sustained tone. For operation at 120V, 60 Hz. Horn shall be rated minimum 90 db at 10 feet. Unit shall be approved equal to "vibratone" horn as manufactured by "Federal Electric."

2-22 DOOR SWITCH: The door switch shall have one normally closed switch with contacts rated 3 amps at 120 volts. Units shall be plunger operated and suitable for flush mounting in door jamb on hinge side so as to be operated by a closing door.

2-23 3-HOUR TIMER: Timer shall be manually adjustable in 1-minute increments on a range of 1 minute to 5 hours. Contacts shall be rated 15 amps at 120V. Unit shall start timing with application of power with the contact closing at the end of the timing period. Timer shall reset and contact open with removal of power, ready for the next timing cycle. Unit shall be approved equal to Eagle "Microflex" Series HA.

2-24 CURRENT SENSITIVE RELAYS: Relays shall be dual units with two independent spdt output switches. Input shall be 4-20 ma. Each switch shall be individually adjustable across the full range of input. Output contacts shall be rated minimum 2A at 110V. Switch deadband shall be minimum 0.5% of full range with +0.1% repeatability accuracy. Unit shall be approved equal to Acromag Series 373.

2-25 TEMPERATURE SENSORS: Unit shall be a surface mounting non-indicating temperature controller operating on the principle of the differential expansion of metals. Unit shall be adjustable from 85° to 250°F with 3° setting accuracy. Contacts shall be rated 10A at 120V.

2-26 FILTER CONTROL CONSOLE: Refer to section 15254.

2-27 RAW WATER RESERVOIR REMOTE LEVEL INDICATOR: Unit shall be panel mounted digital LED indicator with 1/2" high numerals. Input shall be 4-20 ma over a range of 0 - 10 feet. Unit shall be approved equal to 4100 Series of Electro-Numerics, Inc.

PART 3: EXECUTION

3-1 CONTROL WIRING: Provide control wiring and conduit as shown on the drawings.

3-2 WIRE TERMINATION: Terminate all wires in manner required and shown in manufacturer's wiring diagrams. Provide jumpers as required for the designed operation of all equipment. Terminations of stranded wire will be by crimped spade lugs. Number and/or color code wiring as shown on manufacturers schematic/interconnection diagrams. Label all relays and other control equipment as to function as shown.

3-3 EQUIPMENT: Mounting for all electrical equipment is covered by other parts of these specifications.

3-4 PROBES: Probe mounting elevations shall be as follows:

A. FILTER #1

Mounting flange	7903.00	Feet
High level alarm	7902.00	Feet
Pump reset	7894.50	Feet

Pump stop	7893.50	Feet
Ground	7893.25	Feet

B. FILTER #2

Mounting flange	7903.00	Feet
High level alarm	7902.00	Feet
Pump reset	7894.50	Feet
Pump stop	7893.50	Feet
Ground	7893.25	Feet

C. BACKWASH POND

Mounting flange	7895.33	Feet
Reset pump	7891.00	Feet
Stop pump	7890.00	Feet
Ground	7889.50	Feet

3-5 CURRENT SENSITIVE RELAYS: Individual switches shall be set at the levels as follows:

Raw water reservoir high level	7915.50	Feet
Stop intake pumps	7915.00	Feet
Start intake lead pump	7913.00	Feet
Start intake lag pump	7914.00	Feet
Raw water reservoir low level	7910.00	Feet

3-6 PANEL WIRING: All pilot lights, running time meters, pushbuttons and selector switches shall be door mounted. All incoming wires shall be terminated at a master terminal strip. All wiring from panel interior to door mounted devices shall be extra flexible and bundled across hinge. All wiring shall be bundled.

3-7 CONTROL CABLE MARKING: All control wiring shall be marked corresponding to numbering system used on shop drawings at all conductor terminations and splices. Either conductor markers or marked terminal blocks are acceptable. Further identification using colored insulation is recommended.

3-8 OPERATION AND MAINTENANCE MANUAL: Furnish six copies of a manual including system operating description, shop drawings, catalog cuts, installation instructions, maintenance instructions and replacement parts-list for all control systems and equipment. Provide address and telephone number of local source for parts and maintenance.

3-9 SYSTEM TEST AND DEMONSTRATION: Upon completion of entire control system, contractor shall perform tests of all control systems in the presence of the Contracting Officer to demonstrate proper operation of all systems.

Arrange with Contracting Officer to provide demonstration of all system operations for all persons of his choosing. Deliver copies of the operation and maintenance manuals to the Contracting Officer at this demonstration.

3-10 TELEPHONE TELEMETERING LINES: Verify all requirements of the telephone company for connection of equipment to telephone company lines. Install all equipment per telephone company recommendations.

3-11 LEGEND PLATES: Install all equipment legend plates with a minimum of two brass screws.

3-12 AUTOMATIC TELEPHONE ALARM DIALING EQUIPMENT: Install per recommendations of equipment manufacturer and telephone company. Location codes and alarm codes shall be as shown on the drawings. Alarm telephone number is 344-7300.

3-13 EXISTING EQUIPMENT: The following equipment is existing and being relocated under this contract. Provide new mounting equipment and associated equipment as required.

A. Run lag pump and run lead pump audio tone transmitters (provide mounting rack and power supply), being relocated from the maintenance building.

B. One automatic dialing alarm reporting unit being relocated from the maintenance building.

C. Audio tone receiving equipment and tank level indicator being relocated from the maintenance building.

3-14 TANK CONTROL EQUIPMENT: All equipment at the existing tank site is existing and is not part of this contract. New tank level signal receiving equipment at the water treatment plant shall be coordinated with this existing equipment to produce the desired operation.

3-15 TANK LEVEL INDICATOR: Adjustable limit switches shall be set at the levels as follows:

Storage high level	8090.67	Feet
Plant off	8090.33	Feet
Plant on	8085.00	Feet
Storage Low Level	8080.00	Feet

PART 4: MEASUREMENT AND PAYMENT

4-1 No separate measurement and payment will be made for this work. It will be considered a subsidiary obligation of the contract under other work to which it relates.

END